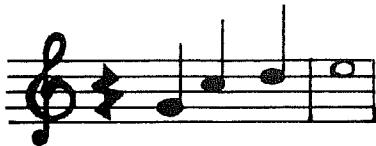
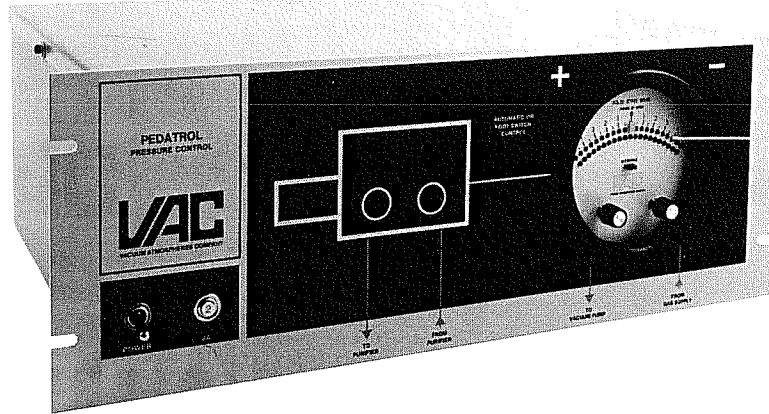




PEDATROL

TECHNICAL MANUAL

MODELS HE-63-P & PC-1



PEDATROL-5/91

VACUUM/ATMOSPHERES COMPANY

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Contents

List of Figures	iv
List of Tables	iv
INTRODUCTION	v
1. OVERVIEW	1-1
Application	. . . . .	1-1
Functional Description	. . . . .	1-4
Photohelic	. . . . .	1-4
SSG	. . . . .	1-4
Foot Switch	. . . . .	1-6
Nomenclature	. . . . .	1-7
2. INSTALLATION	. . . . .	2-1
General	. . . . .	2-1
Customer-Furnished Items	. . . . .	2-1
Utility Requirements	. . . . .	2-1
Electrical	. . . . .	2-1
Gas	. . . . .	2-2
Vacuum	. . . . .	2-2
Setting Up the Pedatrol	. . . . .	2-2
Installing Rack Mounting (PC-1)	. . . . .	2-2
Installing HE-63-P Enclosure	. . . . .	2-3
Line Connections	. . . . .	2-4
Installing Sensing Line	. . . . .	2-4
Installing Vacuum Line	. . . . .	2-4
Installing Inert Gas Line	. . . . .	2-4
Installing Pressure Control Line	. . . . .	2-4
Electrical Connections	. . . . .	2-5
Electrical Check	. . . . .	2-5
Photohelic	. . . . .	2-5
Foot Switch/SSG	. . . . .	2-6
Foot Switch/Photohelic	. . . . .	2-6
Foot Switch/Manual Operation - Photohelic.	. . . . .	2-7
Leak Check	. . . . .	2-7

Contents (Cont'd)

	Pressure Bubble Test	2-8
	Static Leak Test	2-8
3.	OPERATIONS	3-1
	General	3-1
	Establishing an Inert Atmosphere	3-1
	Providing Pressure Control	3-2
	Photohelic	3-3
	SSG	3-4
	Foot Switch	3-4
	Items to Remember During Operation	3-5
4.	MAINTENANCE AND TROUBLESHOOTING	4-1
	General	4-1
	Periodic Maintenance	4-1
	Troubleshooting	4-1
	Solenoid Valves	4-1
	Pressure Problems	4-5
	Removing/Installing Photohelic	4-5
	HE-63-P	4-5
	PC-1	4-7
5.	PARTS AND ACCESSORIES	5-1
	Spare Parts	5-1
	Replacement Policy	5-1

APPENDIXES

A.	Specifications and Dimensions	A-1
B.	Electrical Diagrams	B-1
C.	Wiring Installation for SSG	C-1
D.	Spare Parts Listing	D-1
E.	Warranty	E-1

INDEX		Index-1
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Contents (Cont'd)

List of Figures

<u>Figure</u>	<u>Page</u>
1a. HE-63-P Pedatrol with SSG - Front View.....	1-2
1b. HE-63-P Pedatrol with SSG - Front View with Side Panel off.....	1-2a
1bb. HE-63-P Pedatrol with SSG - Rear View with Side Panel off.....	1-2aa
1-1. Photohelic - Front.....	1-2b
1-2. Photohelic - Rear.....	1-2b
2a. PC-1 Pedatrol with SSG - Front View.....	1-3
2b. PC-1 Pedatrol with SSG - Back View.....	1-3a
2-1. SSG - Front.....	1-3b
2-2. SSG - Rear.....	1-3b
3. System Flow Diagram.....	1-5
4. Photohelic Mounting Hardware.....	4-6
4-1. SSG Mounting Hardware.....	4-6a
5. Pedatrol Wiring Diagram in 120V System - Photohelic..	B-1
5a. SSG Wiring Diagram.....	B-1a
6. Foot Switch.....	B-2
6a. Foot Switch Wiring Diagram.....	B-2a
7. Pedatrol Photohelic Wiring in Systems with SAFE-TROL/ Normal Photohelic Wiring.....	B-3
8. Schematic Diagram.....	B-4
9. SSG Jumper Configuration.....	B-5
9a. SSG Standard Jumper Configuration.....	B-5a
9b. SSG Dry - Contact Jumper Configuration.....	B-5b
9c. SSG Zero and Gain Adjustment.....	B-5c
9d. SSG Δ P Version.....	B-5d

List of Tables

<u>Table</u>	
1. Pedatrol Nomenclature.....	1-8
2. Troubleshooting Pedatrol.....	4-2
3. Spare Parts and Accessories List.....	D-1

INTRODUCTION

This manual provides information necessary to install, operate, and maintain Vacuum/Atmospheres HE-63-P and PC-1 Pedatrol automatic, pressure control systems.

Additional information relative to any Vacuum/Atmospheres Company (VAC) system may be obtained from:

Vacuum/Atmospheres Company
4652 West Rosecrans Avenue
Hawthorne, CA 90250-6896
Telephone: (310) 644-0255
FAX: (310) 970-0980

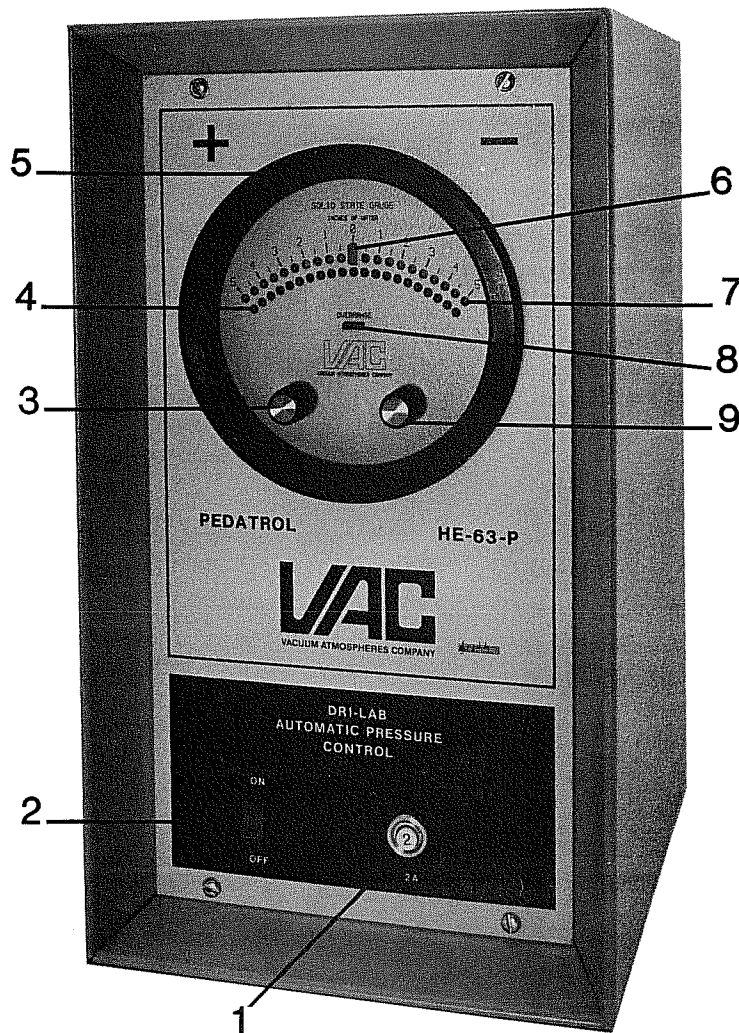
Section 1**OVERVIEW****APPLICATION**

The purpose of the HE-63-P or PC-1 Pedatrol* is to provide automatic pressure control of a Dri-Lab or Vac-Lab** glove box. Because a Dri-Lab is a hermetically sealed system, slight changes in pressure, caused by volume or temperature changes, will readily affect the gloves by forcing them out or drawing them in. To compensate for these changes, the Pedatrol will automatically either exhaust excessive gas via a vacuum pump or pressurize the glove box from an inert gas source. This automatic pressure control protects the gloves from excessive swings in pressure, as well as protects materials within the glove box while an operator is away from the workstation. The Pedatrol also allows the operator to focus attention on the work at hand without distraction by pressure changes within the Dri-Lab.

The HE-63-P Pedatrol also provides for manual pressure control. Manually operating this pressure control system is performed with the use of a foot switch (Figures 1 and 2). The foot switch permits the user to increase or decrease the pressure inside the Dri-Lab within and beyond automatic pressure settings. This could be useful for applications where the user's hands are occupied within the glove box and can not be withdrawn to make changes to the internal pressure.

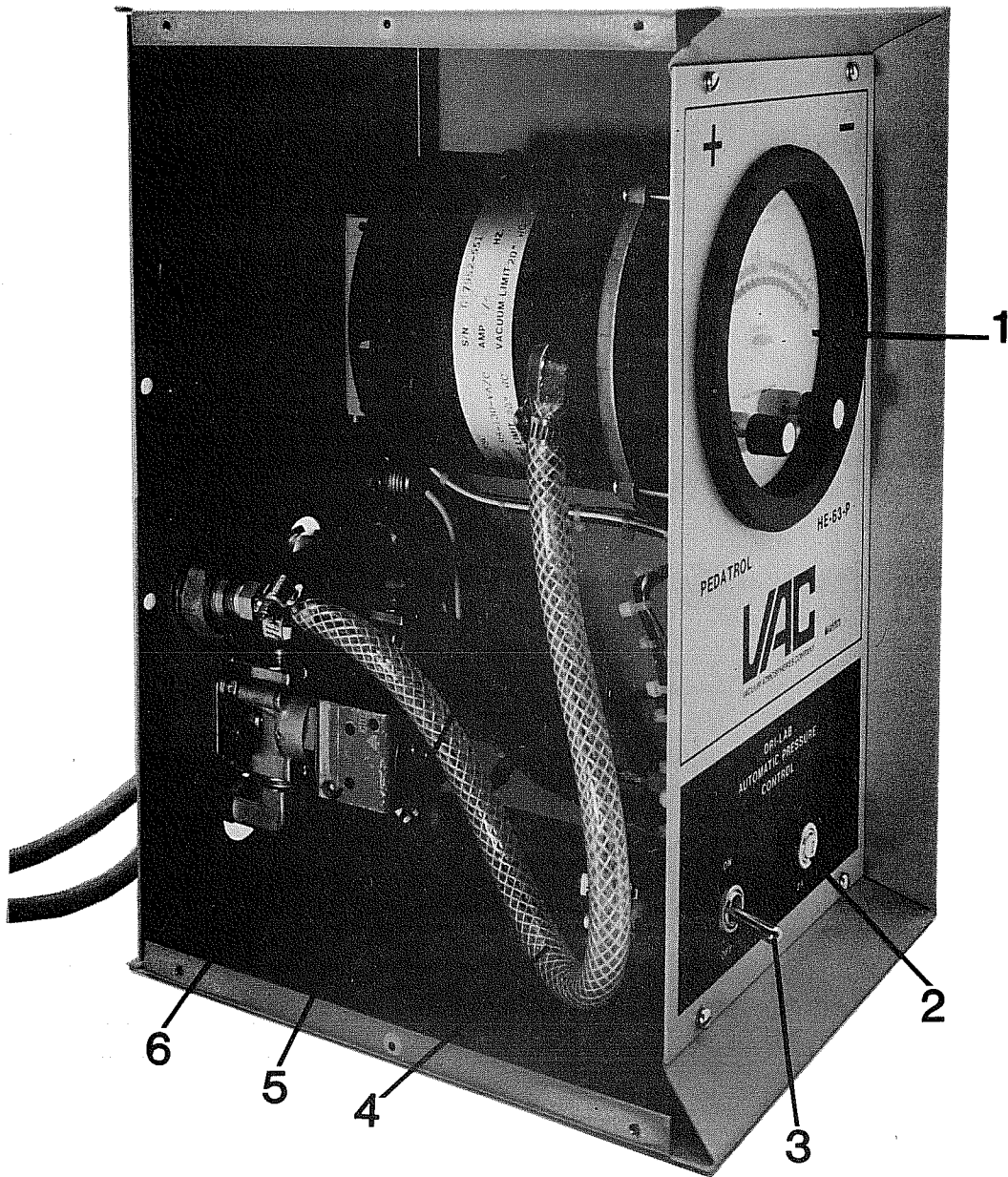
* VAC manufactures the PC-1 and the HE-63-P Pedatrol models. For simplicity, this manual will refer to the HE-63-P Pedatrol unless otherwise noted. Both units perform the same functions. The PC-1 is for mounting in a 19-in. NEMA rack while the HE-63-P is contained in its own enclosure for attachment to a Lab panel.

** For simplicity, this manual will refer to the Dri-Lab system though all functions herein apply to both systems.



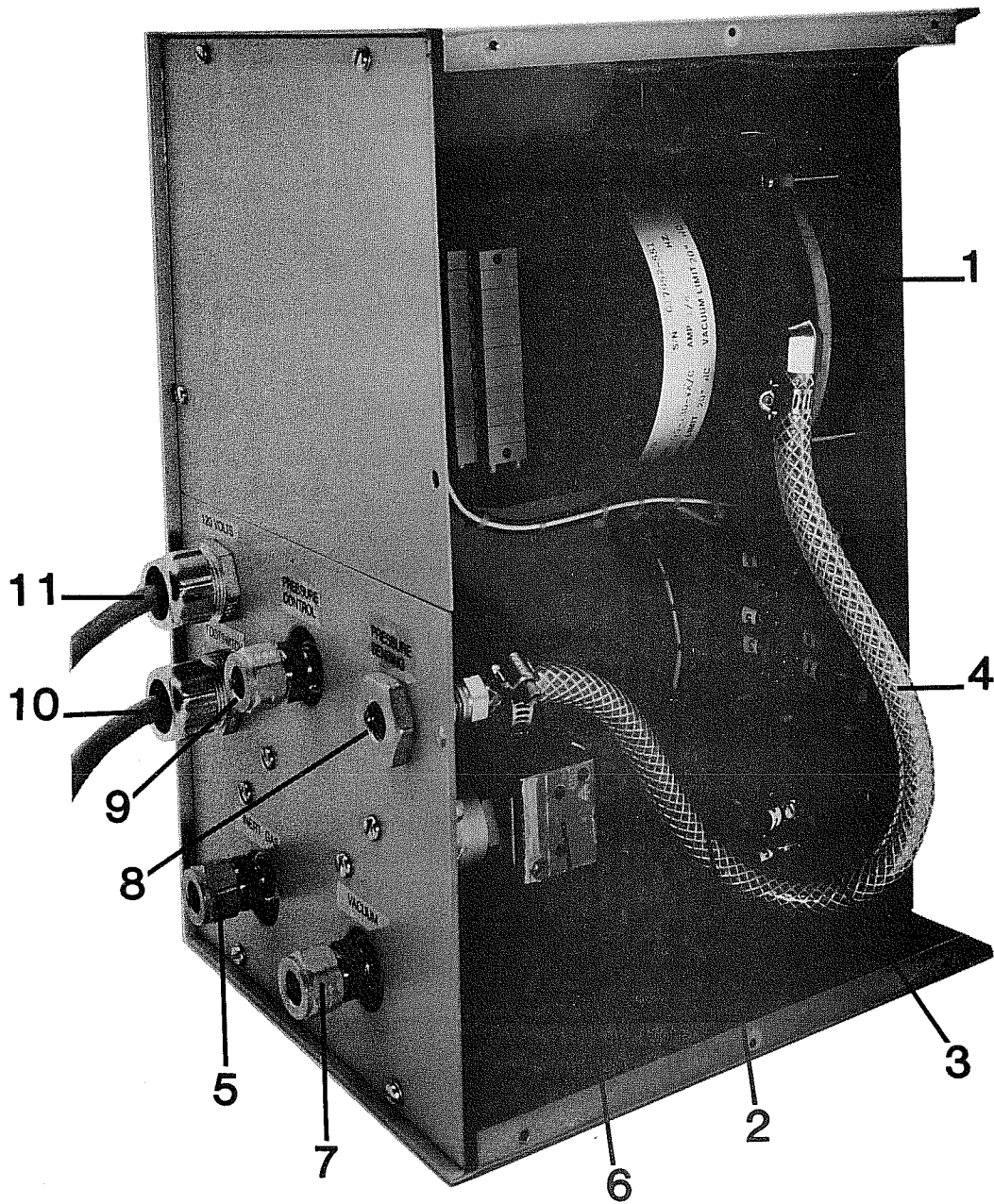
- | | |
|--------------------------------------|----------------------------|
| 1. Circuit Breaker | 5. SSG (Solid State Guage) |
| 2. Automatic Pressure Control Switch | 6. Green 'ON' Light |
| 3. Window Size Knob | 7. Amber Indicator LEDs |
| 4. Red Setpoint LEDs | 8. Red Overrange Indicator |
| | 9. Window Position Knob |

Figure 1a: HE-63-P Pedatrol with SSG - Front View



- | | |
|----------------------|--------------------------|
| 1. SSG or Photohelic | 4. Pressure Sensing Line |
| 2. Circuit Breaker | 5. Inert Gas |
| 3. Power Switch | 6. Vacuum Valve |

Figure 1b: HE-63P Pedatrol with SSG - Front View with Side Panel Off



- | | |
|--------------------------|---------------------|
| 1. SSG or Photohelic | 7. Vacuum Port |
| 2. Circuit Breaker | 8. Pressure Sensing |
| 3. Power Switch | 9. Pressure Control |
| 4. Pressure Sensing Line | 10. Footswitch Cord |
| 5. Inert Gas | 11. Power Cord |
| 6. Vacuum Valve | |

Figure 1bb: HE-63P Pedatrol with SSG - Rear View with Side Panel Off

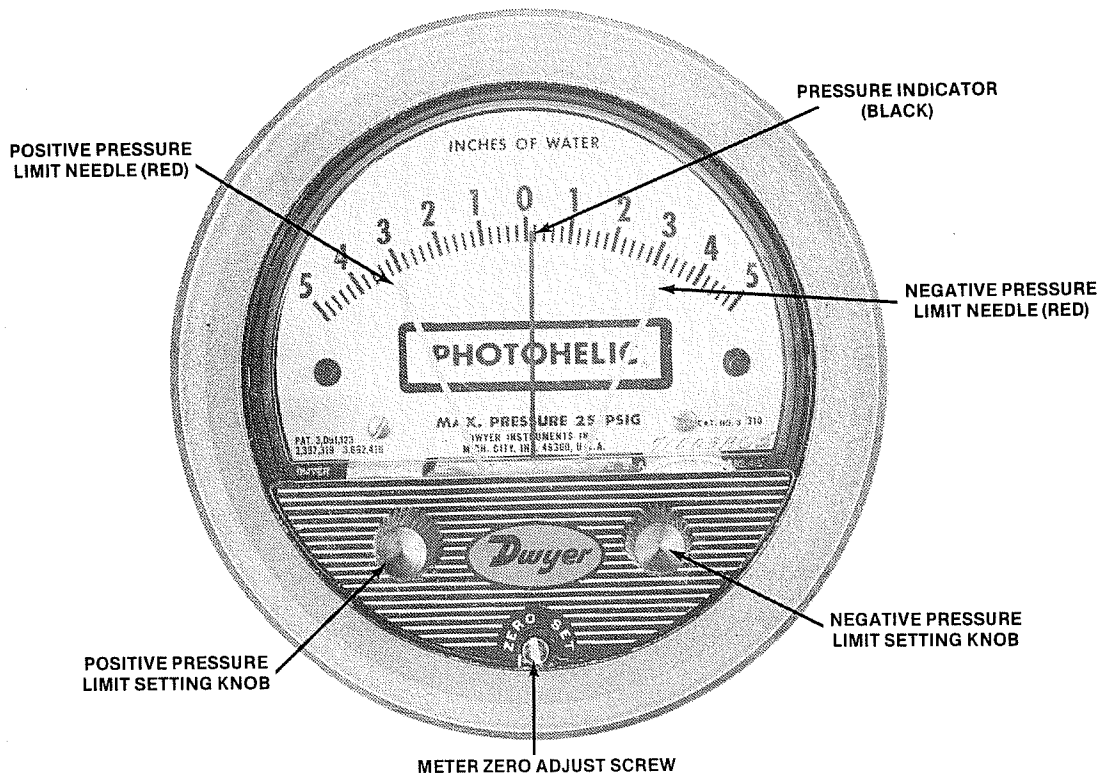


Figure 1-1: Photohelic - Front

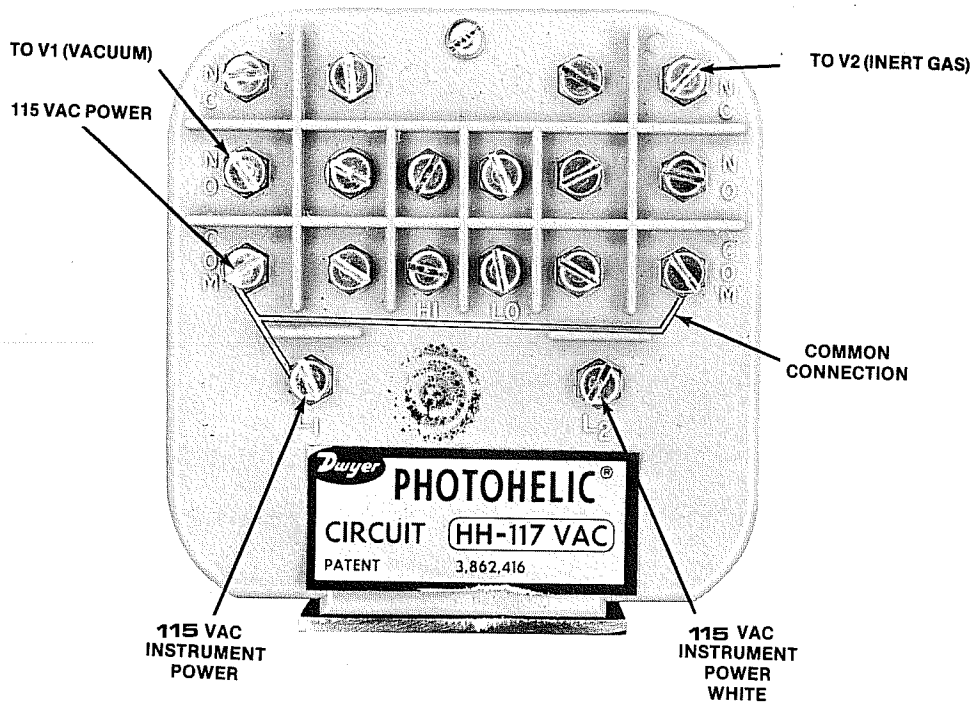
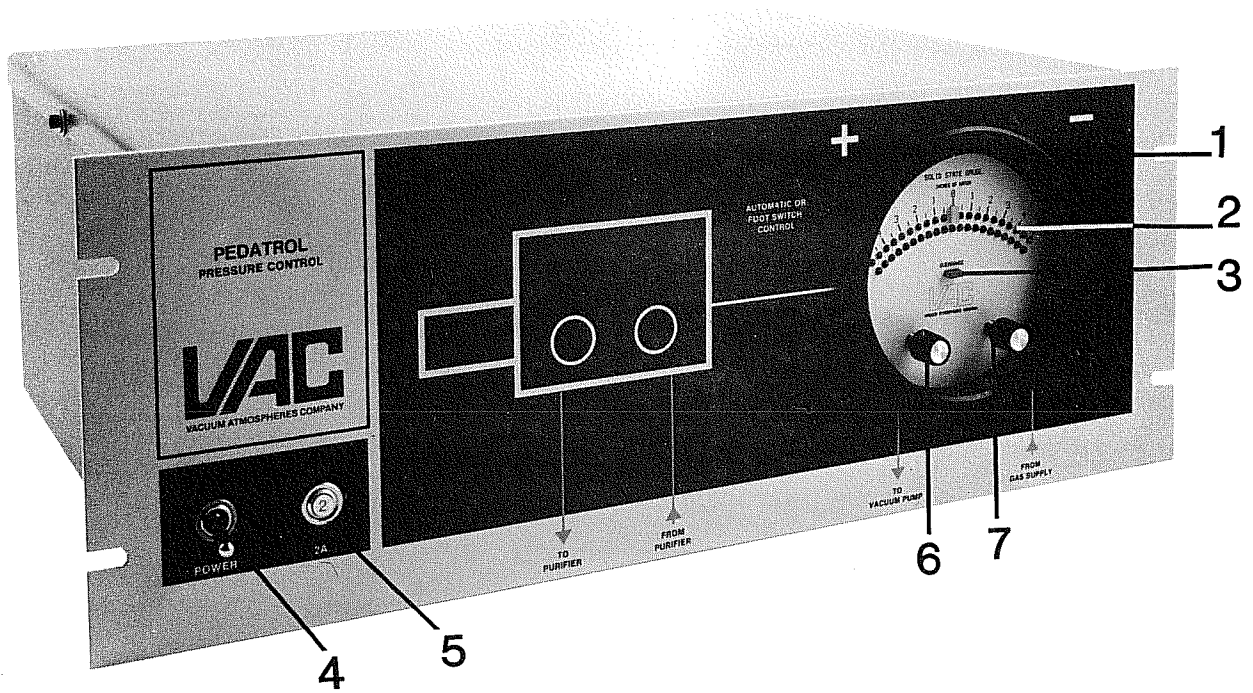
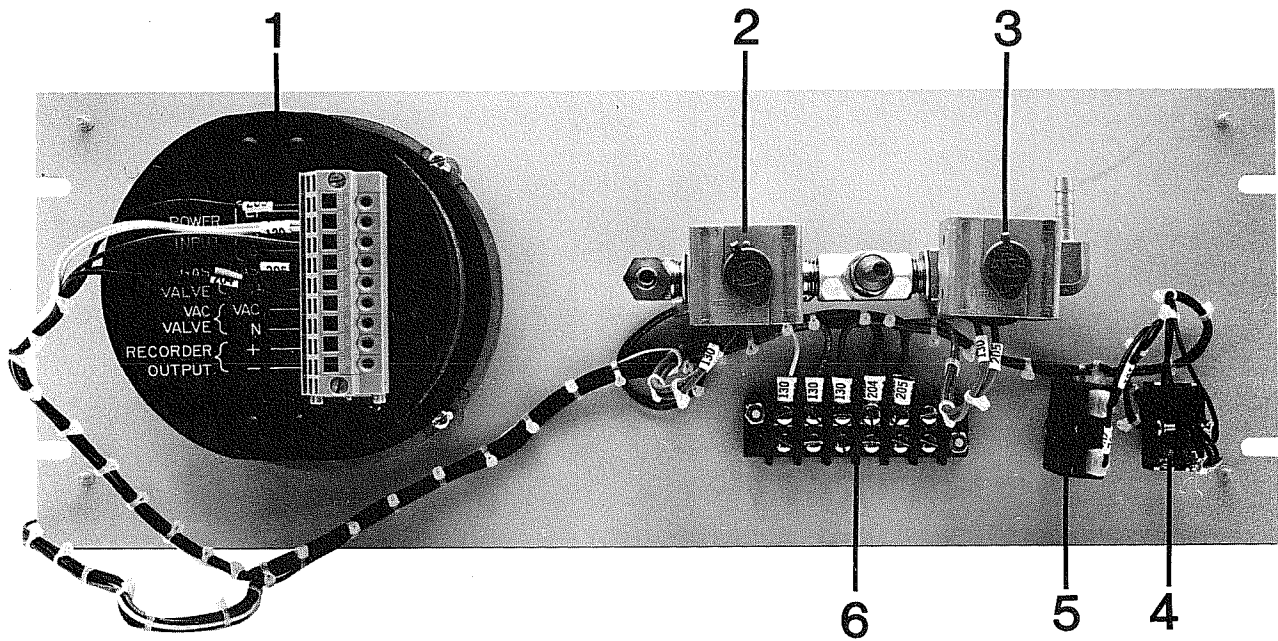


Figure 1-2: Photohelic - Rear



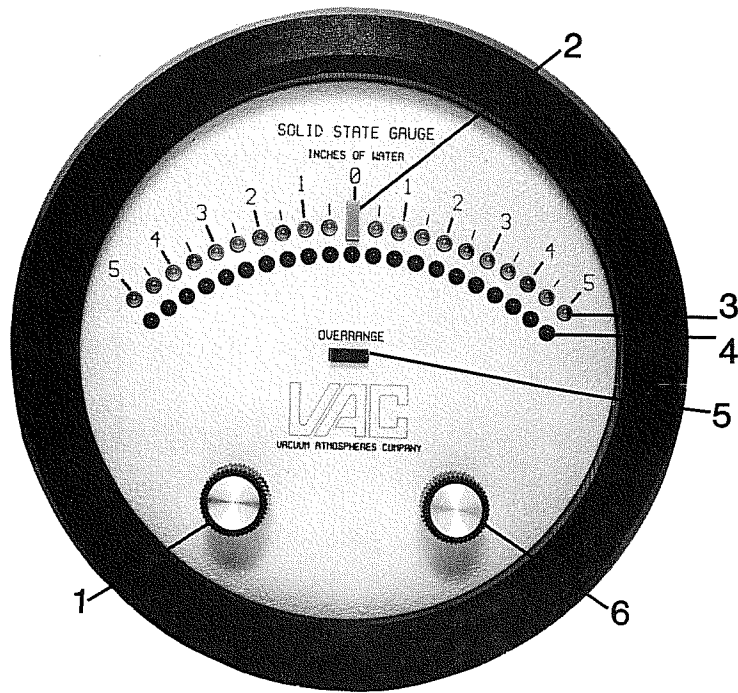
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|--------------------------------------|-------------------------|
| 1. SSG (Solid State Gauge) | 5. Circuit Breaker |
| 2. Green 'ON' Light | 6. Window Size Knob |
| 3. Overage Indicator | 7. Window Position Knob |
| 4. Automatic Pressure Control Switch | |

Figure 2a: PC-1 Pedatrol with SSG - Front View



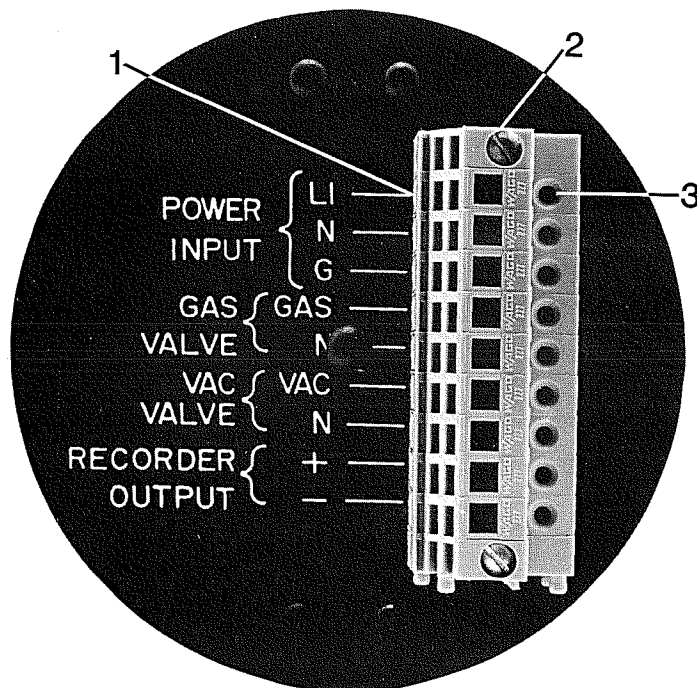
- | | |
|----------------------------------|--------------------|
| 1. SSG | 4. Power Switch |
| 2. Solenoid Valve V1
(Vacuum) | 5. Circuit Breaker |
| 3. Solenoid Valve V2
(Gas) | 6. Terminal Strip |

Figure 2b: PC-1 Pedatrol with SSG - Back View



- | | |
|----------------------------|-----------------------|
| 1. Window Size (Setpoints) | 4. Red Setpoints LEDs |
| 2. Green ON LED | 5. Red Overrange LED |
| 3. Amber Indicators LEDs | 6. Window Position |

Figure 2-1: SSG - Front



- | | |
|---------------------|----------------|
| 1. Wire Connections | 3. Test Points |
| 2. Terminal Strip | |

Figure 2-2: SSG - Rear

FUNCTIONAL DESCRIPTION

The Pedatrol functions around two solenoid valves: one to admit inert gas into the Dri-Lab and one to evacuate gas via a vacuum exhaust system. The valves, depicted in Figure 3, are contained within the Pedatrol mainframe along with a combination pressure gauge/differential pressure switch (either a Photohelic analog gauge or an SSG gauge (Solid State Gauge)). The gauges display both the pressure within the Dri-Lab and the two pressure settings that limit the Dri-Lab pressure range. In the automatic mode, the gauges control the solenoid valves. The foot switch also controls the solenoid valves but under differing conditions (to be reviewed later in this Section).

Photohelic

The Photohelic is the key to automatic control. Two adjustment knobs on the Photohelic faceplate (see Figure 1) control two "set points" that limit the Dri-Lab range of pressures: one set for a high limit and one for a low limit. Whenever the Pedatrol automatic pressure control is switched On, the Photohelic pressure gauge senses the pressure* inside the Dri-Lab and adjusts the pressure to bring it within the set point limits.

When the pressure is too high, the Photohelic cycles power On/Off to a solenoid valve between the Dri-Lab and an accessory vacuum pump. When the pressure is too low, the Photohelic cycles power On/Off to a solenoid valve between the Dri-Lab and an inert gas source.

SSG

The SSG solid state gauge performs the same functions as the Photohelic except the SSG has more features and is more sensitive to pressure changes than the Photohelic. The SSG has increased stability over the Photohelic and provides a chart recorder output of +/-5 Vdc at 1/10 V accuracy [1 V = 1 in. w.c.].

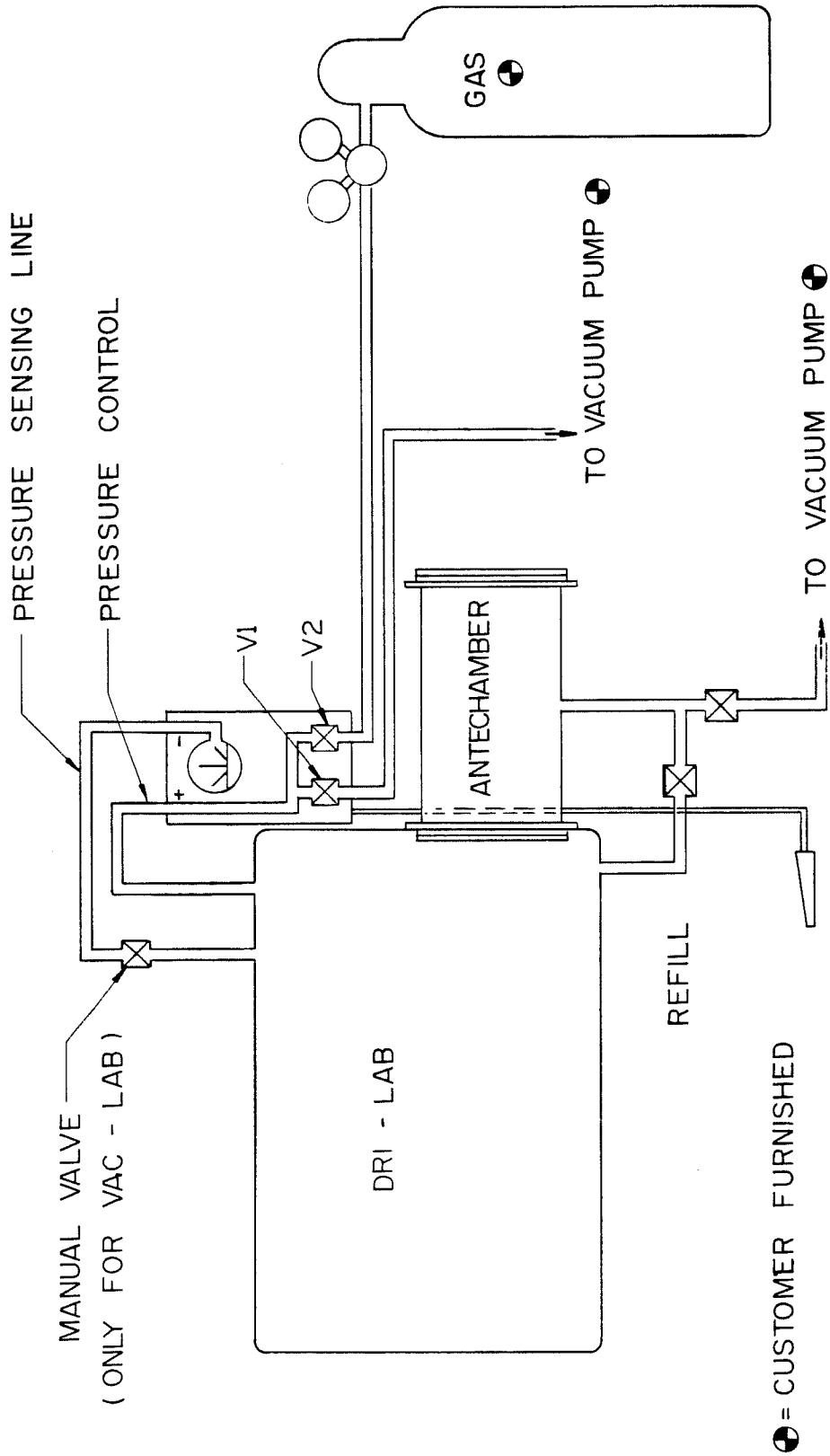


Figure 3: System Flow Diagram

Like the Photohelic, the SSG has a 'window' of atmospheric pressure that is controlled automatically when the unit is switched on. However, when switched off, no pressure indication is given as the SSG requires ac power for its operation. Additional information on the operation and maintenance of the SSG will be presented in later sections of this manual.

Foot Switch

The Pedatrol foot switch is provided for manual, independent adjustment of Dri-Lab pressure. As long as the power cord for the Pedatrol is plugged in and ac power is provided, the foot switch will open or close the two solenoid valves to change Dri-Lab pressure.

- In the automatic pressure control mode, the foot switch can adjust pressures in the Dri-Lab up or down within the range of pressures marked by the Photohelic red needle set points. If, by depressing the foot switch, the pressure reaches the Photohelic set points, the automatic pressure function will take over and cycle the respective solenoid valve to maintain the set point pressure. In sum, the foot switch can vary pressures in the Dri-Lab up or down only within the Photohelic set points when the automatic pressure control is switched On. The same applies to the SSG as well, allowing pressure changes within the 'window' of pressures.
- In the manual mode (automatic pressure control switched Off), the Pedatrol foot switch can adjust pressures in the Dri-Lab up or down outside the range of pressure marked by the Photohelic set points. By stepping on one side of

* The black, pressure sensing needle will display Dri-Lab pressure regardless of whether ac power is on or off.

the foot switch, a solenoid valve will open and stay open until the foot switch pressure is removed. The switch then returns to a neutral position.

If the Pedatrol is wired into a workstation containing a VAC Safe-Trol safety shutoff system, continuously holding a valve open may eventually bring pressure within the Dri-Lab to the Safe-Trol settings, resulting in system shutdown. The SSG has an overrange protector in this instance and will also shut off the evacuation and refill valves to safeguard the system, but the SSG must be on to enable this feature.

VAC recommends that Dri-Lab users should not leave the system unattended in the manual mode.

NOMENCLATURE

The following table of reference terms, symbols, and descriptions has been assembled here to help familiarize the user with Pedatrol functions and terms. Understanding these aspects will make for easier installation and operation of the Pedatrol/Dri-Lab covered later in this manual.

A complete list of Pedatrol specifications may be found in Appendix A in the back of this manual.

Table 1
Pedatrol Nomenclature

Term	Symbol	Description
Photohelic	1PH	A pressure control gauge that allows pressure limits to be preset; when switched On it provides automatic pressure control. Gauge enables the pressure to be read and limited to within 0.1-in. water column. Reads positive (left) or negative (right) pressure inside Dri-Lab.
Foot Switch	1FS	Foot-operated switch that permits user to raise or lower the system pressure while leaving the hands free.
Positive "+" Knob	---	Sets positive pressure limit for Dri-Lab by using the red needle on the left side of the photohelic.
Negative "-" Knob	---	Sets negative pressure limit for Dri-Lab by using the red needle on the right side of the photohelic.
Black Needle	---	Indicates current pressure within Dri-Lab; pressure gauge works without electrical power.
Auto. Pres. Control Switch	S1	On/Off switch supplies power for automatic pressure control via photohelic. Light inside must illuminate when switch is in On position.
"L" Foot Switch Position	---	<u>L</u> owers pressure in Dri-Lab by applying vacuum pressure (suction).
"R" Foot Switch Position	---	<u>R</u> aises pressure in Dri-Lab by admitting inert gas under pressure.
Vacuum Solenoid Valve	V1	Operated by photohelic or foot switch to apply vacuum pressure (suction) to the system. Valve contained within mainframe.
Inert Gas Solenoid Valve	V2	Operated by photohelic or foot switch to admit inert gas into the system. Valve contained within mainframe.

Section 2

INSTALLATION

GENERAL

Before starting the installation, read all instructions completely. Instructions are standard and some may not apply to custom systems. (Refer to envelope in back of manual for special drawings or schematics for custom systems.)

- A. Remove components from crate (if used).
- B. Remove all packing, tape, and shipping blocks or bands.

Note

If the Pedatrol is delivered as part of a Dri-Lab, do not use the Pedatrol as a handle. Plumbing damage may result.

WARNING

Do not plug into electrical power until the unit is ready for electrical check, as described herein.

CUSTOMER-FURNISHED ITEMS

Before complete installation is possible, the customer must furnish the following items:

- A. 3/8-in. (minimum) copper or stainless steel tubing for inert gas.
- B. Utilities, as noted.

UTILITY REQUIREMENTS

Electrical

Supply Pedatrol with 115 V ac, 50/60 Hz, 1.5 A (see Appendix B for electrical diagrams).

Gas

Supply Pedatrol with inert atmospheres as argon, helium, or nitrogen at 20 to 40 psig (maximum) for connection to the gas valve inlet. VAC recommends customer use as pure a gas as is economically or conveniently practical. For air boxes (not inert), use compressed air regulated to provide the same 40 psig (maximum) as for inert gas.

Vacuum

Supply Pedatrol with a vacuum source capable of providing between 3 (minimum) and 5 cfm of vacuum.

SETTING UP THE PEDATROL

This section assumes a Dri-Lab is being retrofitted with a Pedatrol. This means that the Dri-Lab atmosphere will be contaminated and that inert gas will be used to verify the Pedatrol is operating properly.

Installing Rack Mounting (PC-1)

The PC-1 Pedatrol is built for mounting in a 19-in. rack enclosure but may be set on any flat surface. Special racks may be purchased from VAC that provide for mounting a PC-1 onto the antechamber of a Dri-Lab or into the stand supporting the Dri-Lab.

Use the following procedure to install racks onto the antechamber:

- A. Remove the following nuts and washers from the antechamber bolts that connect the antechamber to the glove box:
 1. Facing the antechamber side of the glove box, identify the highest nut on the antechamber. Do not remove this nut.
 2. Remove the next two lowest nuts and washers to the left and right of the top center nut. Put nuts and washers aside.

- B. Place left-hand panel onto exposed bolts and fasten washers and nuts onto bolts.
- C. Place right-hand panel onto opposite side of antechamber frame. Align panel to identical bolt pattern of left-hand panel. With the 1-in.-long bolts, cap nuts, and washers (provided), fasten right-hand panel to the antechamber with the bolts pointing towards the glove box.
- D. Fasten blank-off panels to the top, bottom, and top rear locations of the rack with the 10-32 Phillip screws and nylon washers (provided).

If a rack enclosure can not be located on the antechamber, VAC manufactures racks that fit under the Dri-Lab in the supporting stand. Contact VAC for information on retrofitting racks into the Dri-Lab stand.

Installing HE-63-P Enclosure

The HE-63-P Pedatrol is built for mounting onto the right-hand side of the Dri-Lab glove box, positioned above the antechamber. Use the following procedure to retrofit the Pedatrol to the glove box:

- A. Drill out (No. 7) and tap (1/4 x 20) four holes to match bolt pattern on HE-63-P. Using 1-1/2-in.-long, 1/4 x 20 bolts (provided), thread bolts into holes from inside glove box. Half way into panel, apply epoxy (provided) to threads to seal threads and head. Screw bolts in all the way. Allow epoxy to dry 24 hr. Also, drill out, tap, and epoxy two (2) 1/4-in. FPT bulkheads: one for pressure sensing and one for make-up gas (Note: brass bulkheads require a 3/4-in. hole).
- B. Thread one set of nuts and washers onto bolts.
- C. Remove top rear panel of Pedatrol and place unit onto bolts via holes drilled in side of unit. Fasten washers and nuts onto bolts such that fastened nuts leave 1/4-in. of extra threads exposed inside the cabinet.

- D. Tighten nuts on outside of cabinet flush against the cabinet panel.
- E. Reinstall back panel of Pedatrol.

For installations other than for the right-side Dri-Lab position, contact VAC for additional installation information.

LINE CONNECTIONS

Fittings for connecting tubing to ports in the back of the Dri-Lab will have been provided by VAC for completing the connections described below.

Installing Sensing Line

Connect Nylobrade tubing from line barb in back of Pedatrol to an available port in the back of the Dri-Lab.

Installing Vacuum Line

Connect 3/8-in. (minimum) O.D. tubing from a vacuum pump to the vacuum, 3/8-in., compression tube fitting in the back of the Pedatrol.

Installing Inert Gas Line

Connect 3/8-in. O.D. tubing from an inert gas bottle (via 2-stage regulator) to the inert gas, 3/8-in. compression tube fitting in the back of the Pedatrol.

Installing Pressure Control Line

Connect 3/8-in. O.D. tubing from the pressure control, 3/8-in., compression tube fitting on the back of the Pedatrol to any convenient port in the back of the Dri-Lab.

ELECTRICAL CONNECTIONS

The Pedatrol power will be On when the power cord is plugged in (do not plug in at this time).

ELECTRICAL CHECK

The electrical check consists of verifying whether or not the Pedatrol correctly controls Dri-Lab pressures. The checkout will be conducted using gas regulated to 20 psi.

Photohelic

- A. Turn gas source On.
- B. Turn vacuum pump On.
- C. With Pedatrol automatic pressure control switched Off, plug ac power cord into ac receptacle. Since the Photohelic is Off, do not be concerned with the needle settings.
- D. Step on "L" side of foot switch. The vacuum valve will open and the pump will labor. The gloves will also be drawn into the glove box. Notice that black needle will move with the change in pressure.
- E. Release the foot switch. The switch will return back to a neutral position and the vacuum valve will close. The gloves will also stop moving.
- F. Step on "R" side of foot switch. The gas valve will open and gas will enter the Dri-lab. The gloves will also be forced out.
- G. Release foot switch. The gas valve will close and the switch will return back to a neutral position. The gloves will also stop moving.
- H. Move Photohelic red needle settings to - and +1-in. water column. Step on "R" side of foot switch until pressure reading is +1.5-in. water column. Release foot switch. Turn automatic pressure control On. Vacuum pump valve will open and the pump will labor. When the black needle crosses the red needle, the vacuum pump valve will close and the pressure setting will stop just within the +1-in. water column setting.
- I. Turn the right (negative) red needle to the left momentarily across the black needle. The gas valve will open and the gloves will be forced out. Return the red needle to the -1-in. water column setting.

Foot Switch/SSG

Foot switch operation is independent of the pressure control power switch. Shutting off power does not stop the capability of varying pressure inside the system up or down.

- A. Step on L side of foot switch. The vacuum valve will open and the pump will labor. The gloves will also be drawn into the glove box.
- B. Release foot switch and vacuum valve will stop Neutral position on switch disengages solenoid valves.
- C. Step on R side of foot switch. The inert gas valve will open and pressurize the glove box. Gloves will be forced out.
- D. Release foot switch and pressurizing will stop.
- E. To return to automatic pressure control, press pressure control switch to the right (on). The SSG should light up and automatic pressure control should adjust pressure to the previous set points on the SSG. The red light next to the switch should come on as well.

Foot Switch/Photohelic

- A. Step on the "L" side of the foot switch and hold it down. The pressure as read on the Photohelic gauge should decrease until it reaches the pressure that was set on the right-hand red needle. The gas valve will begin to cycle and admit gas into the system to make up for the gas being removed by the vacuum pump through the vacuum valve. The pressure will hold at around the preset point. Release foot switch.

B.

CAUTION

When the "R" side of the foot switch is depressed, the pressure in the glove box is limited only by the regulator setting of the inert gas supply. The vacuum solenoid will open when the pressure exceeds the

set point, but the pump will not be able to remove gas as fast as it enters the system. Therefore, the gas supply should be kept at 20 psi to balance this condition.

Step on the "R" side of the foot switch and hold it. Pressure will increase as long as the foot switch is depressed. Release foot switch.

Foot Switch/Manual Operation - Photohelic

- A. Turn automatic pressure control Off.
- B. Step on "L" side of foot switch until pressure exceeds red, negative pressure set point (-1-in. water column). Release foot switch. Pressure should hold steady.
- C. Step on "R" side of foot switch until pressure exceeds red, positive pressure set point (+1-in. water column). Release foot switch. Pressure should hold steady. Step on "L" side to return pressure back within set point limits.

When all of the previous indications check out correctly, the system will operate normally. If any indications do not check out, refer to Section 4, Maintenance and Troubleshooting.

LEAK CHECK

Perform a gas leak check at the tubing connections using helium gas and helium leak detection equipment (if practical) or other inert gas and SNOOP bubble solution. Be sure there are no leaks in the Dri-Lab system before continuing with Section 3, Operations.

CAUTION

Do not use halogen leak detection equipment for leak testing. Halogens are harmful to seals, copper, and other materials used in the

construction of VAC equipment. VAC will not assume responsibility for systems tested by methods other than defined in this manual.

Pressure Bubble Test

Maintain as constant a room/Dri-Lab temperature as possible for this test to be accurate.

- A. Depress "R" side of foot switch. Gloves will be forced out.
- B. Release foot switch when Photohelic shows +5-in. water column.
- C. Coat all connections made during installation with bubble solution (SNOOP) and watch for gas bubbles. Be sure all connections are leak-free before proceeding to the next test.

Static Leak Test

- A. With automatic pressure control switched Off, bring Dri-Lab pressure to +4-in. water column. Allow Dri-Lab to stabilize. Note exact pressure reading to nearest tenth of an inch.
- B. Wait 30 min and check reading again. There should be no drop in pressure for this period. If a drop in pressure is detected, see Section 4, Maintenance and Troubleshooting for assistance.

Section 3

OPERATIONS

GENERAL

The instructions that follow are for the basic operation of the Pedatrol. To make the total Dri-Lab system operational, a good purge of contaminated gas is required to establish a viable inert atmosphere. The following are instructions to establish an inert atmosphere, followed by procedures on operating the Pedatrol.

Note that the positive pressure indication is on the left and the negative pressure indication is on the right of the SSG and Photohelic faceplates. Large + and - decals are affixed to the panel near the faceplates to eliminate ambiguity.

ESTABLISHING AN INERT ATMOSPHERE

The purge described herein requires 200 to 250 ft³ of gas for a 25-ft³ box (this equals about 10 volume changes or one cylinder of inert gas). For best results, use as pure a gas as is available.

After the electrical check, leak testing, and pressure control check described in Section 2 have been performed satisfactorily, the following procedure is suggested:

- A. Set left red needle of Photohelic to approximately +5-in. and right red needle to approximately +4-in. water column (for SSG users, set window to the same settings).
- B. Turn automatic pressure control On and remove one of the service port plugs from the glove box. Raise the pressure regulator setting of the reserve gas from 20 to 40 or 50 psi to speed the process.
- C. Adjust flow and port opening so that pressure is balanced above +1 to +2-in. water column. As the gas cylinder nears empty, plug the port so that gloves will not drop completely.

After purge, replace service port plug and reset needles as desired. Return gas regulator setting to 20 psi.

WARNING

For Vac-Labs, install a manual valve in the pressure sensing line. Turn this valve Off when evacuating the glove box. This is to prevent possible damage to the Photohelic diaphragm. The automatic pressure control must also be turned Off when this manual valve is closed!

PROVIDING PRESSURE CONTROL

System pressure is controlled in two ways: automatically or manually. The first, automatic control, holds pressures within preset limits by the action of the Photohelic or SSG. These limits will be maintained within 0.1-in. water column of the set point at all times. The second method, manual operation, is by use of a foot switch. This switch is used to manually position the gloves in a glove box or to make other fine changes in the system pressure for any reason. The foot switch permits either increasing or decreasing the system pressure.

When the pressure inside the Dri-Lab exceeds the limit set on the red, left-side Photohelic needle (see Figure 1), the Photohelic will close a set of internal contacts. Ac power (120 V ac) will then be applied through these contacts to the solenoid of the vacuum valve (V1). This valve will open and apply negative pressure from the vacuum manifold to the main circulation system.

Conversely, when the system pressure falls below the limit set on the red, right-side needle, another internal contact closure will occur and apply 120 V ac to the solenoid of the inert gas valve (V2). This will open the valve and cause makeup gas to be admitted to the gas system. This input of gas will continue

until the system gas pressure returns to the allowed operating range.

The inert gas and vacuum valves can also be operated manually by depressing the proper side of the foot switch. The foot switch can vary pressure in the Dri-Lab up or down within the SSG set points when automatic pressure control is switched on. It can also vary the pressures outside the range of the preset limits when automatic pressure control is switched off.

CAUTION

The R-side of the foot switch pressurizes the lab faster than a 4 cfm vacuum pump can evacuate it. Overriding automatic control can result in unsafe pressures and glove or window breakage!

Photohelic

The Photohelic device functions as a pressure gauge (black needle) and as a differential pressure switch (red needles). The Photohelic senses pressure via the pressure sensing line that is connected to the Dri-Lab. It is the Photohelic pressure gauge that is used to determine where the system pressure is at any given time relative to the setting of the two, red, pressure limit needles on the face of the gauge.

Note

- VAC replaces normal silicone Photohelic diaphragms with a neoprene diaphragm to prevent moisture/oxygen diffusion, via the diaphragm, into the system. Should the diaphragm become defective, replace only with VAC neoprene diaphragms.
- The Photohelic controls system pressure only when the automatic pressure control switch is turned On.

- All pressure readings are referenced to the ambient room pressure.

SSG

The SSG performs the same functions as the Photohelic except the SSG can also provide digital signals to an outside data recorder for logging pressure readings (0.1 in. w.c. accuracy). The hookup is located in the back of the SSG inside the mainframe cabinet. The SSG also shuts down the relays driving the vacuum and refill valves should pressures reach + or - 10 in. w.c. (automatic control must be switched on for this feature to work).

The left knob on the SSG adjusts window size (narrow to wide range of pressures allowed within the system before automatic valves are actuated). The right knob adjusts the window up or down.

Foot Switch

Raising the pressure by stepping on the "R" side of the foot switch will force the gloves outward from the box. Lowering the pressure in the system by stepping on the "L" side of the foot switch will cause the gloves to be drawn (retracted) into the glove box. Foot switch operation is independent of the automatic pressure control. When this control is turned Off, the foot switch can vary system pressure above or below the limits set on the Photohelic or SSG.

WARNING

If no Safe-Trol or pressure relief system (bubbler: DPRB or PR-1) is within the Dri-Lab system, it is up to the user to keep the Dri-Lab within the safe, operating pressure limits while in the Pedatrol manual mode. Failure to maintain safe pressures can result in glove or window breakage (+/-15 in. water column for 15 mil gloves in glass window).

ITEMS TO REMEMBER DURING OPERATION

- During normal operations, leave the Pedatrol automatic pressure control switched On.
- Let vacuum pump run continuously.
- Keep a spare bottle of inert gas near the Pedatrol for quick changeover.

Section 4

MAINTENANCE AND TROUBLESHOOTING

GENERAL

Maintenance of the Pedatrol is uncomplicated due to relative simplicity of the unit's design and component selection. However, standard safe practices should always be observed during maintenance.

PERIODIC MAINTENANCE

- A. Visually inspect all valves, fittings, lines, tubing, and electrical connections for mechanical, pneumatic, electrical, and structural integrity on a quarterly basis.
- B. Mix mild soap and water onto a clean towel to clean the outside painted surfaces. Dry with clean cotton towel.

TROUBLESHOOTING

Failures in operating the Pedatrol may occur in either the Photohelic, SSG, solenoid valves, or the foot switch. Check these areas first. Table 2 provides additional information in locating and correcting problems.

Solenoid Valves

The solenoid valves inside the Pedatrol can be checked for electrically energized or de-energized modes by placing a small magnet near the red cap on the solenoid. The modes are as follows:

- A. Energized Valve: Magnet will be strongly attracted to the center core; 60 Hz "hum" will be felt in the magnet.
- B. De-energized Valve: Magnet will exhibit normal steady pull. No 60 Hz hum will be present.

Dirt can often times make valves stick open without electrical energy applied. Clean or replace all stuck valves if encountered.

Table 2
Troubleshooting Pedatrol

Problem	Test	Solutions
I. Power: No power to Pedatrol, foot switch does not actuate solenoid valves. <p style="text-align: center;"><u>or</u></p> Photohelic light is out.	<ul style="list-style-type: none"> ● Incoming power from main power source is OFF. ● Loose wires at line connection. ● Circuit breaker has popped out. ● Ac cord not plugged into ac. ● Indicates gauge is inoperative. 	<ul style="list-style-type: none"> ● Switch main power ON. ● Tighten loose connections. ● Reset circuit breaker or replace. ● Plug cord into ac. ● Replace photohelic.

II. Pressure: System leaks. Doesn't maintain static reading; gradual constant decrease.	<p style="text-align: center;"><u>Lines</u></p> <ul style="list-style-type: none"> ● With switch S1 Off, depress R-side of foot switch till +4-in. w.c. Let box stabilize. Readjust for temperature changes. Wait 30 min. There should be no drop in pressure after this period. If not - Dri-Lab leaks. <p style="text-align: center;"><u>Photohelic</u></p> <ul style="list-style-type: none"> ● Turn auto. Off. While maintaining +4-in. w.c. in photohelic, plug opening inside of Dri-Lab at pressure sensing line. If leak continues = bad diaphragm. 	<ul style="list-style-type: none"> ● Tighten loose connection on pressure sensing line. ● Tighten loose connection on pressure control line. ● See Dri-Lab manual for leak testing. ● Defective diaphragm in photohelic-contact VAC.

Table 2
Troubleshooting Pedatrol (Cont'd)

Problem	Test	Solutions
Uncontrollable pressure in Dri-Lab (+ or -).	<ul style="list-style-type: none"> ● Turn switch S1 Off. If pressure stabilizes = bad photohelic. ● Solenoid valves are either worn out or debris stuck in valve seat. ● Incoming gas pressure is too high. ● Unplug Pedatrol. Power to valves via foot switch will shut off and valves should close = faulty switch. 	<ul style="list-style-type: none"> ● Electrical fault in photohelic - contact VAC. ● Clean or replace valves. ● Verify there is regulated 20 psi or less. ● Check foot switch for continuity. Replace if defective. ● Clean or replace valves.
<ul style="list-style-type: none"> ● High Pressure 	<p align="center"><u>Foot Switch</u></p> <ul style="list-style-type: none"> ● Leave switch S1 Off. Check valve V2 with magnet to see if energized. If so = bad foot switch or debris stuck in the valve seat. 	<ul style="list-style-type: none"> ● Clean or replace foot switch. Check for debris in valve.
<ul style="list-style-type: none"> ● Low Pressure (gloves retracted inward) 	<ul style="list-style-type: none"> ● Check valve V1 with magnet to see if energized. If so = bad foot switch or debris stuck in valve seat. 	<ul style="list-style-type: none"> ● (Same as above.)
Intermittent uncontrollable pressure in Dri-Lab.	<ul style="list-style-type: none"> ● Turn switch S1 On. Energize solenoids momentarily by crossing adjust. set points (one at a time) across black needle and back. If solenoids stick energized or do not energize at all = bad photohelic or debris in valve seat. 	<ul style="list-style-type: none"> ● Photohelic malfunction - contact VAC; or clean or replace valves.
<u>or</u>		
Above tests do not reveal problem.		

Table 2
Troubleshooting Pedatrol (Cont'd)

Problem	Test	Solutions
<p>Pressure in Dri-Lab can't be raised by use of foot switch or photohelic needles.</p>	<ul style="list-style-type: none"> ● Ensure adequate supply of inert gas. With switch S1 On, depress R-side of foot switch. If V2 opens and pressure increases = o.k.; If V2 doesn't open and no pressure increase = defective foot switch or V2. ● Cross negative set point over black needle in photohelic. If pres. increase = prob. likely in foot switch. If no increase = problem likely in V2. If V2 works with foot switch but not photohelic = photohelic faulty. 	<ul style="list-style-type: none"> ● Clean or replace foot switch or gas solenoid. ● Clean or replace foot switch. ● Replace V2 coil or whole valve. ● Photohelic defective - Contact VAC.
<p>Pressure in Dri-Lab can't be lowered by use of foot switch or photohelic.</p>	<ul style="list-style-type: none"> ● Switch S1 On. Ensure vacuum pump is connected and working. Depress L-side of foot switch. V1 should lower pressure in Dri-Lab. If not = problem likely in foot switch or V1. ● Cross positive set point over black needle in photohelic. If pressure decreases = problem likely in foot switch. If not = problem likely in V1. If V1 works with foot switch but not by photohelic = problem likely with photohelic. 	<ul style="list-style-type: none"> ● Clean or replace foot switch or V1. ● (Same as above.) ● Check for loose wires between valves. ● Photohelic defective - contact VAC.

Removing/Installing Photohelic

Some pressure problems are the result of defective Photohelic components. Send the gauge to VAC for inspection and/or repair. The following instructions will assist removing the Photohelic without disassembling entire systems. Have a 1/4 in. plug or rod ready to close off Nylobrade tubing during removal.

I. HE-63-P Pedatrol

- A. With positive pressure in the Dri-Lab, remove power to the Pedatrol (pull plug or shut down system).
- B. Open HE-63-P front panel by removing the four retaining screws located in the corners of the panel. Connections to the panel inside the cabinet will allow for extension: lay the panel down from top to bottom and carefully allow to hang free.
- C. Attach labels to each wire on the Photohelic noting terminal location. Remove all wires from Photohelic.
- D. Using a screw driver, unscrew retaining clamp on Nylobrade hose and remove hose from line barb (Figure 4). Plug hose immediately to prevent contamination. Positive pressure in Dri-Lab will purge small amount of inert gas through hose during this process.
- E. Note that four screws touch the front panel when the Photohelic is fastened to the panel. Using a screw driver, unscrew these four screws half way away from the panel. The heavy metal ring holding the screws will retract with the screws towards the front of the panel.
- F. The retaining means, a thin metal snap-ring, is located just behind the metal ring in a concentric groove in the Photohelic body. Locate the space between the ends of the ring and, with a screw driver, deflect one side out of the groove. The snap-ring will be easy to remove by hand after one end is out. Remove the clip and the Photohelic will slide out.

After Photohelic is outside the cabinet, reinstall snap-ring onto gauge body. Ship Photohelic with snap-ring attached.

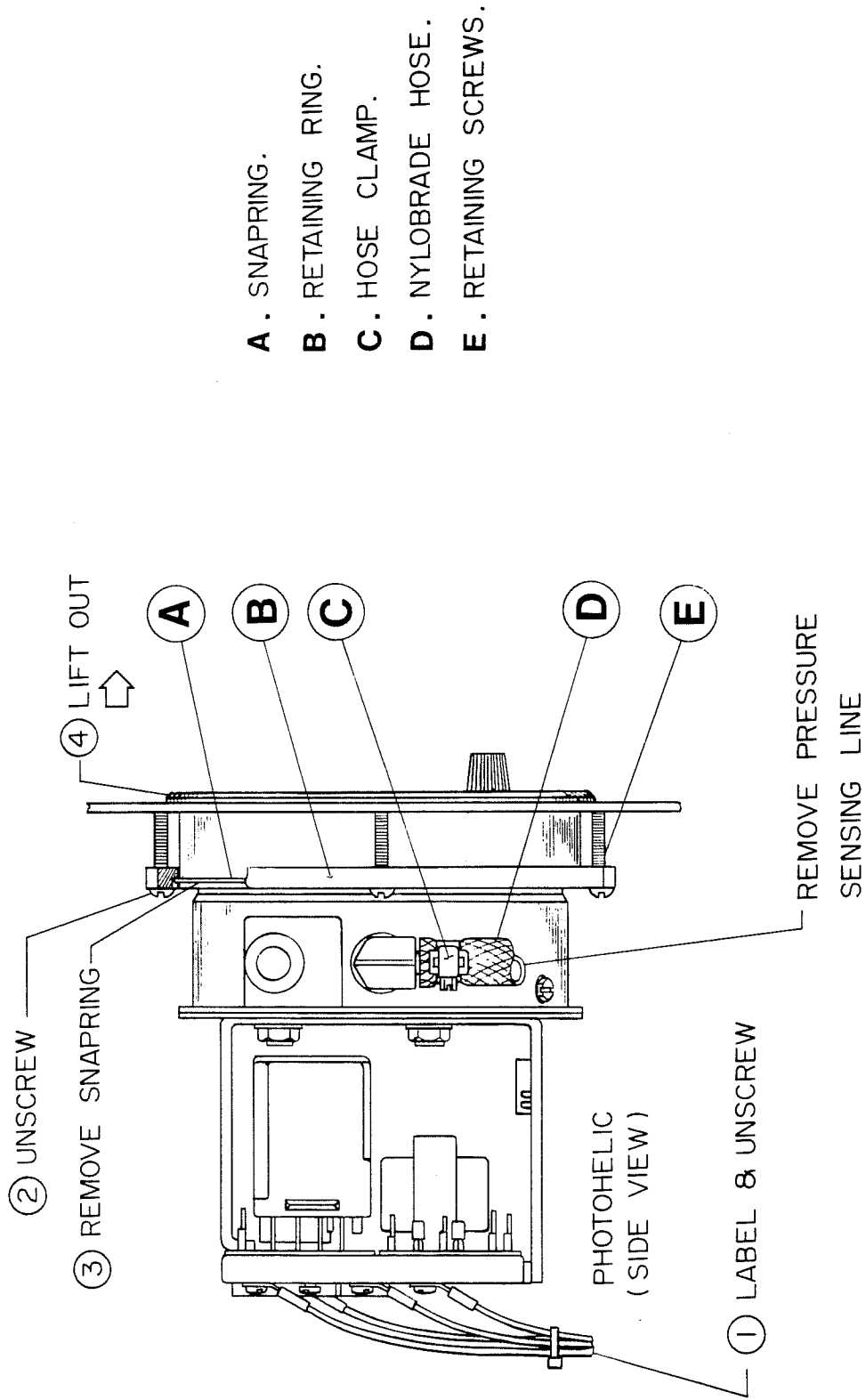


Figure 4: Photohelic Mounting Hardware

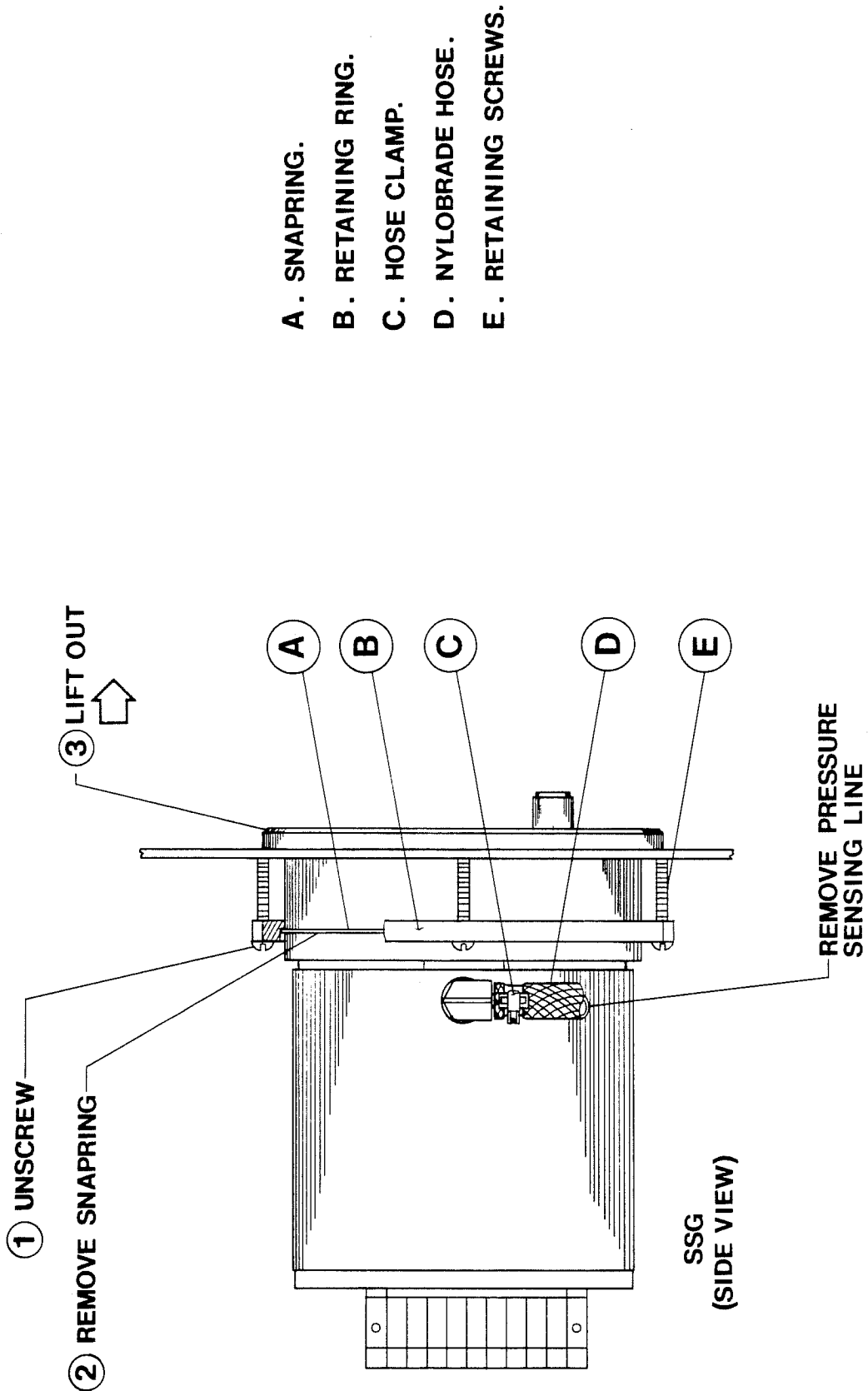


Figure 4-1: SSG Mounting Hardware

To install the Photohelic, simply reverse the order of the above steps. Be sure the gauge is in the upright position before final tightening of retaining screws. The same procedure applies to the SSG (see Appendix C for further illustrations on wiring connections for the SSG).

II. PC-1

To remove the Photohelic from the PC-1, follow the same steps as those for the HE-63-P except the top cover is removed instead of the front panel. The user must remove the retaining screws and wires from the inside of the cabinet. Install Photohelic following the same instructions for the HE-63-P except in reverse order.

Section 5**PARTS AND ACCESSORIES****SPARE PARTS**

VAC spare part numbers are listed in Table 3 in Appendix D. To order spare, replacement, or accessory parts, contact Vacuum/Atmospheres Company direct at the address and telephone number listed in the front of this manual.

The Photohelic, SSG, and foot switch are also covered by an exchange policy through Vacuum/Atmospheres. Contact VAC directly for further information on this policy.

REPLACEMENT POLICY

Vacuum/Atmospheres Company warrants all parts in the HE-63-P and PC-1 Pedatrol system. All parts or assemblies installed in this system, whether or not they are built by VAC, are warranted under the Warranty in Appendix E.

APPENDIXES

Appendix A

Specifications and Dimensions

Specifications and dimensions are as outlined below. These details are standard and some may not apply to custom systems.

Material: Mild steel with textured, light brown baked enamel on outside.

Power

Requirements: 115 V, 50/60 Hz, 1.5 A.
Six-foot power cord provided.

Power Switch: None. Unit is On when plugged in.

Automatic Pressure

Control Switch: On/Off toggle switch in front panel. Shuts off automatic control when switched Off.

Circuit Breaker: Set to cut off at 2 A. Resettable.

Size: HE-63-P: 7-1/2-in. W, 13-in. H, 9-in. D.
PC-1: 19-in. W, 7-in. H, 12-in. D.

Configuration: HE-63-P: designed for mounting on right side Dri-Lab panel.
PC-1: designed for 19-in. NEMA rack enclosure.

Pressure Gauge

Range: Photohelic: +/-5.0 in. w.c. in 0.2 in. div.
SSG: +/-5.0 in. w.c. in 0.5 in. div.

Photohelic & SSG

Sensitivity: 0.1-in. water column.

Appendix A (Cont'd)

Pressure Sensing

Connection: One 1/4-in. O.D. tube for tubing from Pedatrol back panel to Dri-Lab glove box.

Pressure Control,
Inert Gas, Vacuum

Connections: Three 3/8-in. O.D. tubes: from Pedatrol to glove box, gas source, and vacuum pump, respectively.

Vacuum Source: Continuous-duty vacuum pump (user provided); 3 to 5 cfm recommended.

Inert Gas Source: 1 to 30 psi; regulated 20 psi recommended.

Valves Controlled: Vacuum source and make-up gas solenoid valves.

Override: 3-position manual foot switch. Operational as long as ac power is provided to Pedatrol.

Status Light: Light inside photohelic illuminates upon switching toggle switch On.

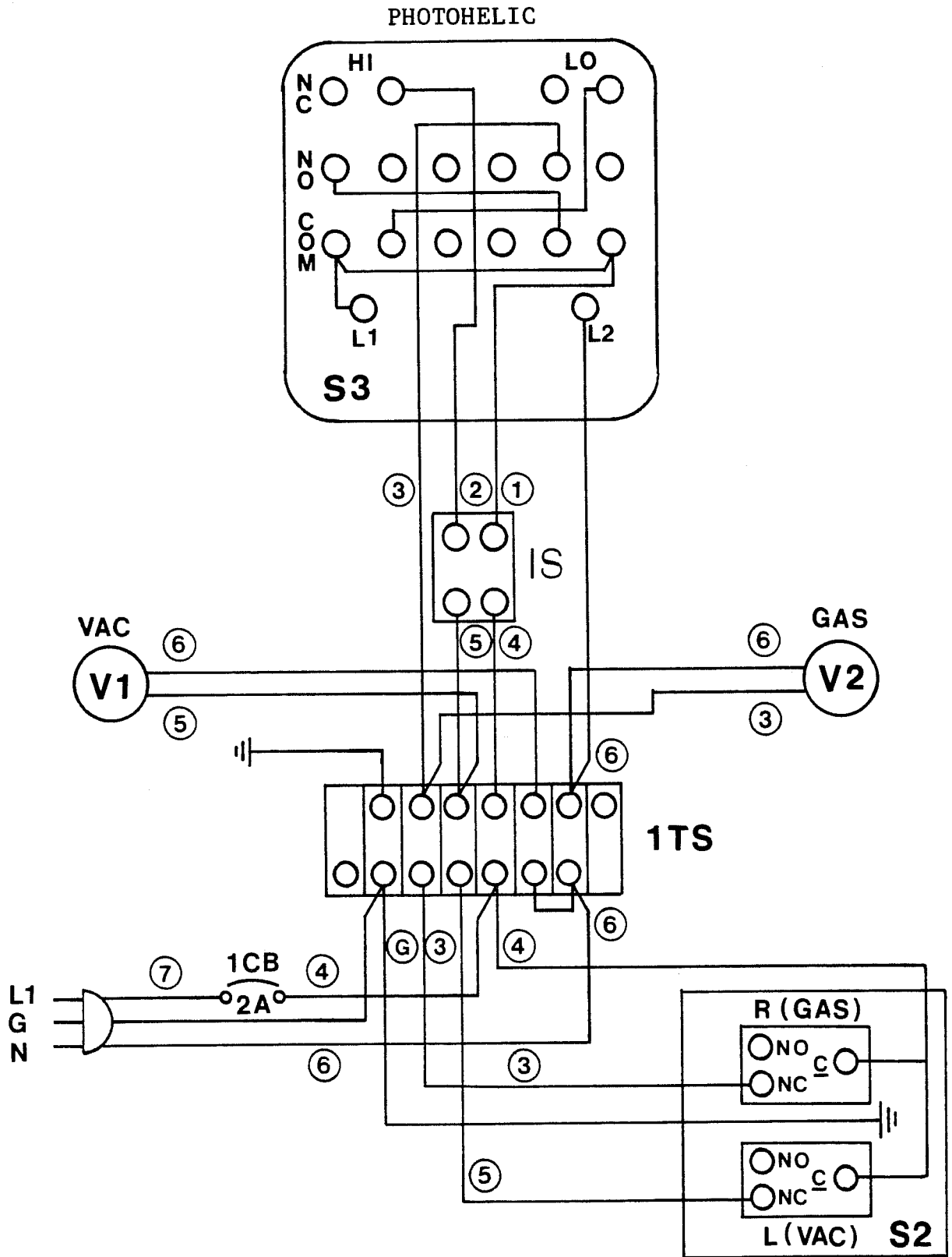
SSG: 1 red overrange LED, 20 yellow LEDs to display pressure, 1 green LED to display power On and zero, 20 red LEDs to display setpoints.

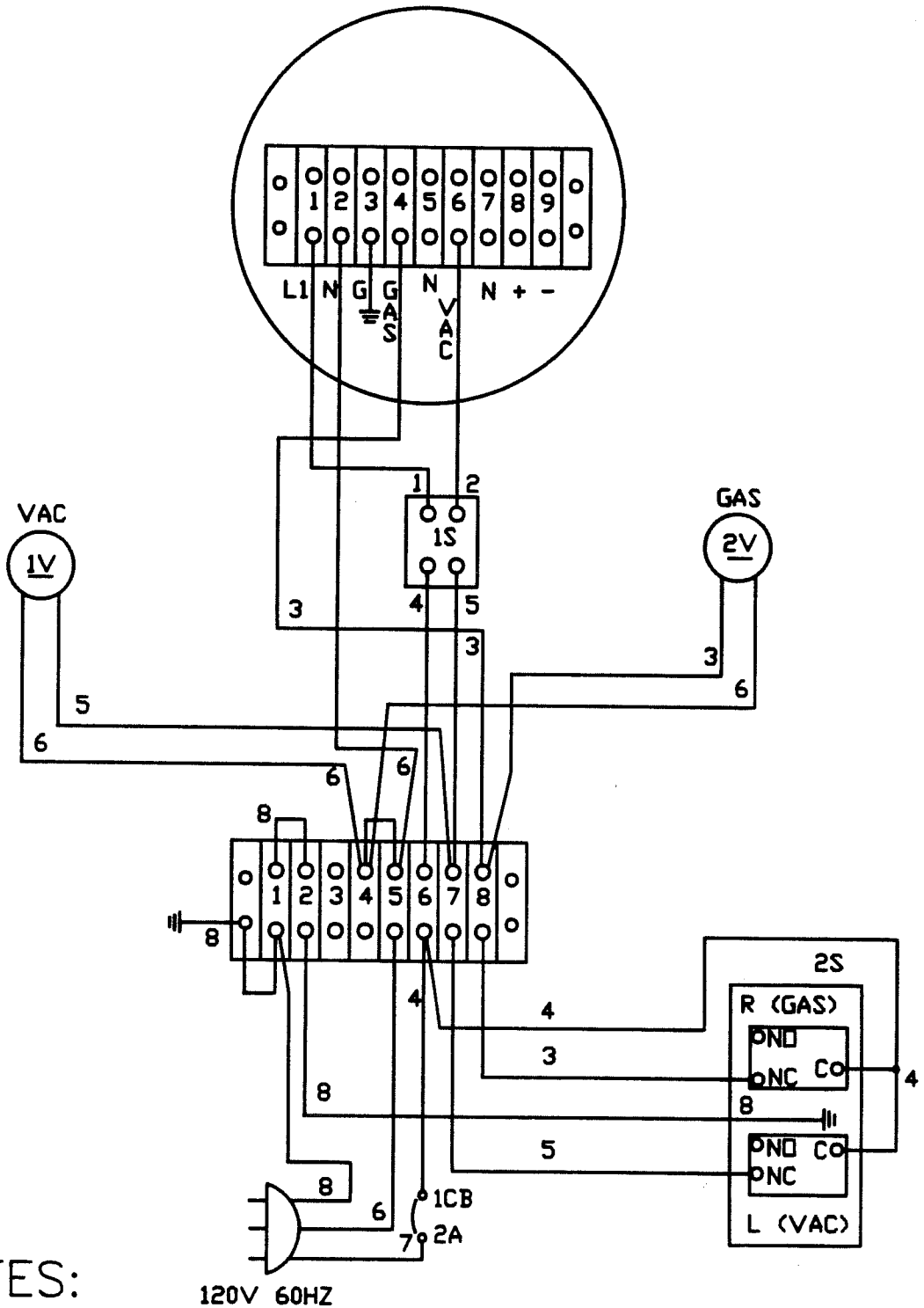
Rear Electrical

Connections: Power cord to ac; power cord to foot switch. Built-in meter test ports provided in SSG.

FIGURE - 5

PEDATROL WIRING DIAGRAM IN 120V SYSTEM.





NOTES:

1. ALL WIRES ARE 18 GA. BLACK EXCEPT GROUND (8) IS GREEN AND NEUTRAL (6) IS WHITE.

Figure 5a: SSG Wiring Diagram



Figure 6: Foot Switch

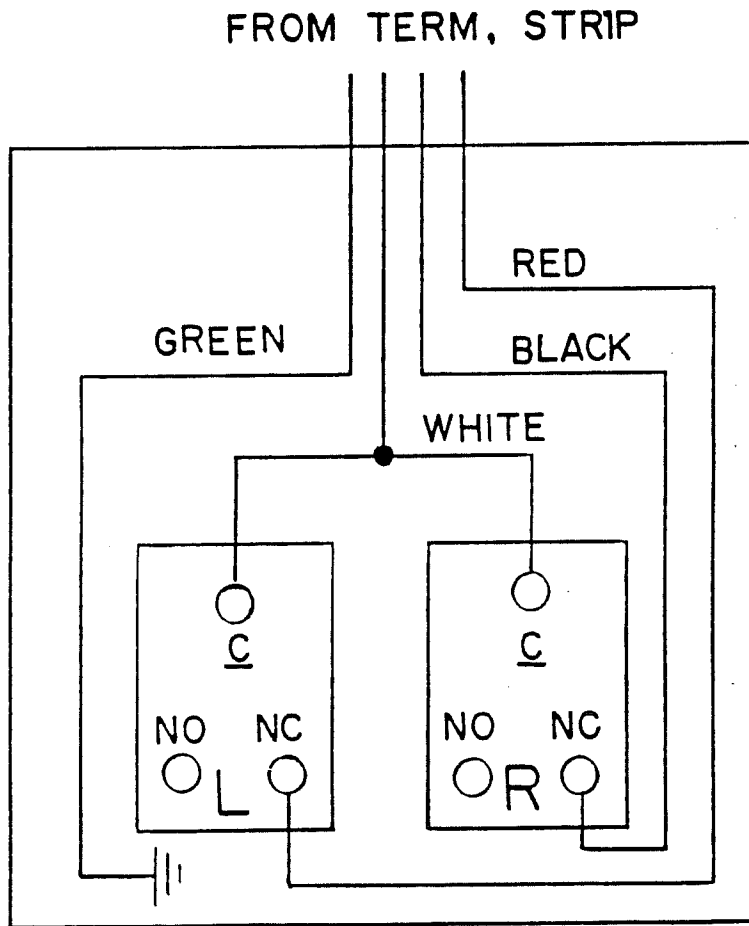
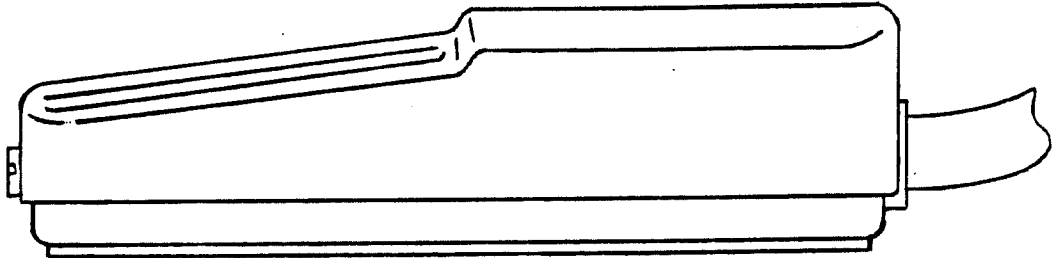


Figure 6a: Foot Switch Wiring Diagram

MANUFACTURER'S BULLETIN PHOTOHELIC WIRING FOR ALL PEDATROLS

The following is an alternate method for wiring the Photohelic Gauge in the VAC Pedatrol.

WARNING

This alternate method does not apply to VAC Safe-Trol Models ST-110, ST-208, or ST-220.

Diagrams A and B of this sheet show only wires requiring changes.

Diagram A

Photohelic wired in this configuration will electrically energize (physically open) both the gas and vacuum solenoids in the Pedatrol if the light in the photocell burns out.

Diagram B

Photohelic wired in this configuration will not allow either the gas or vacuum solenoids in the Pedatrol to electrically energize (physically open) if the light in the photocell burns out.

Diagram A

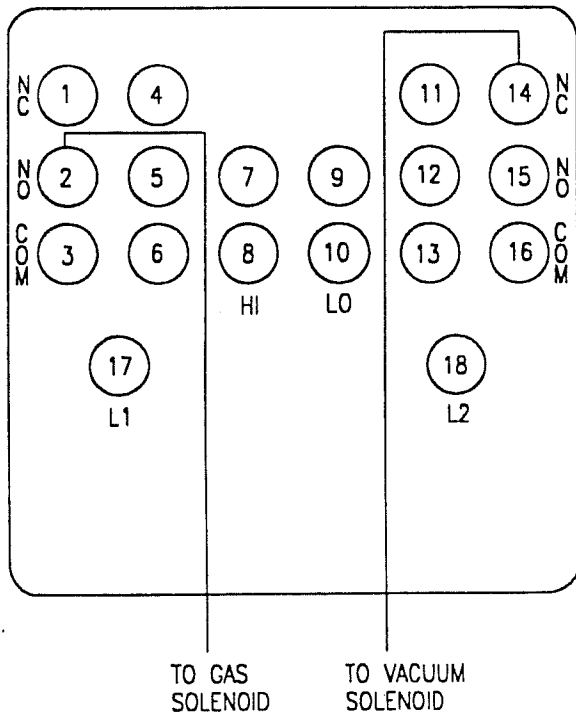


Diagram B

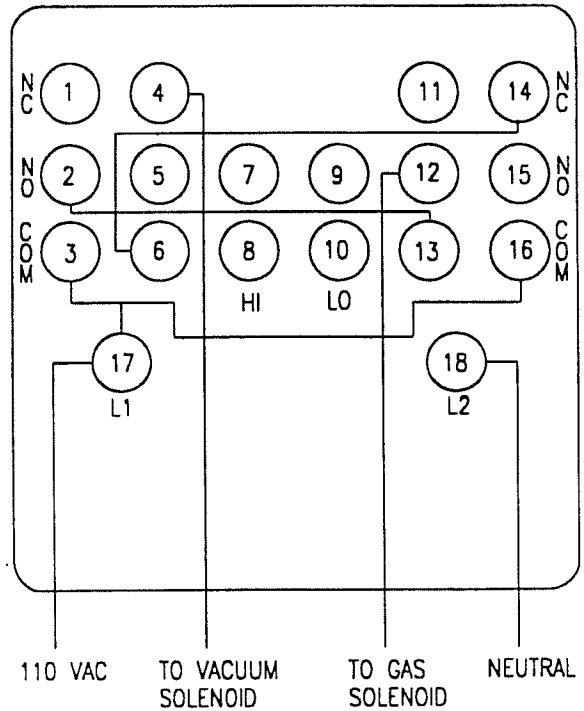
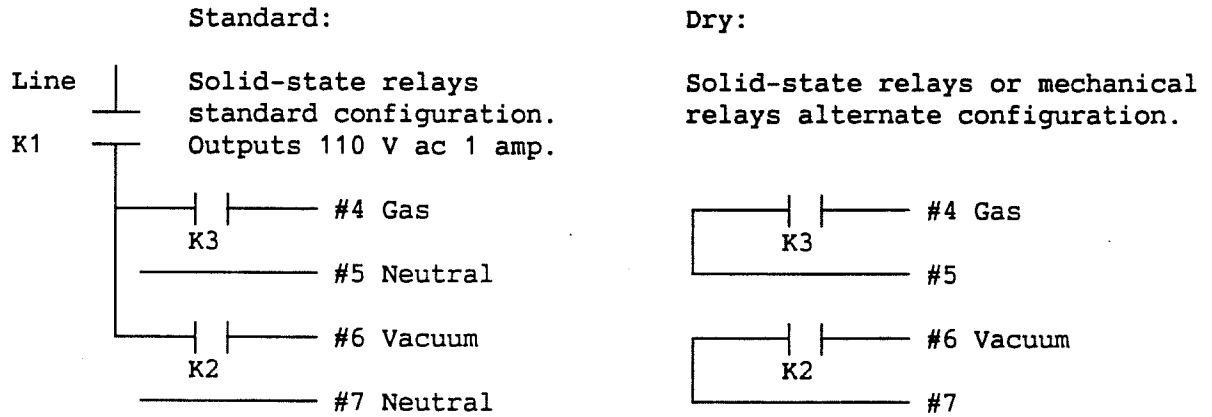


Figure 7
B-3

Figure 8
Schematic Diagram

SSG Jumper Configuration



	STD	DRY
J3	IN	OUT
J4	OUT	IN
J5	IN	OUT
J6	OUT	IN
J7	IN	OUT
J8	IN	OUT

Figure 9

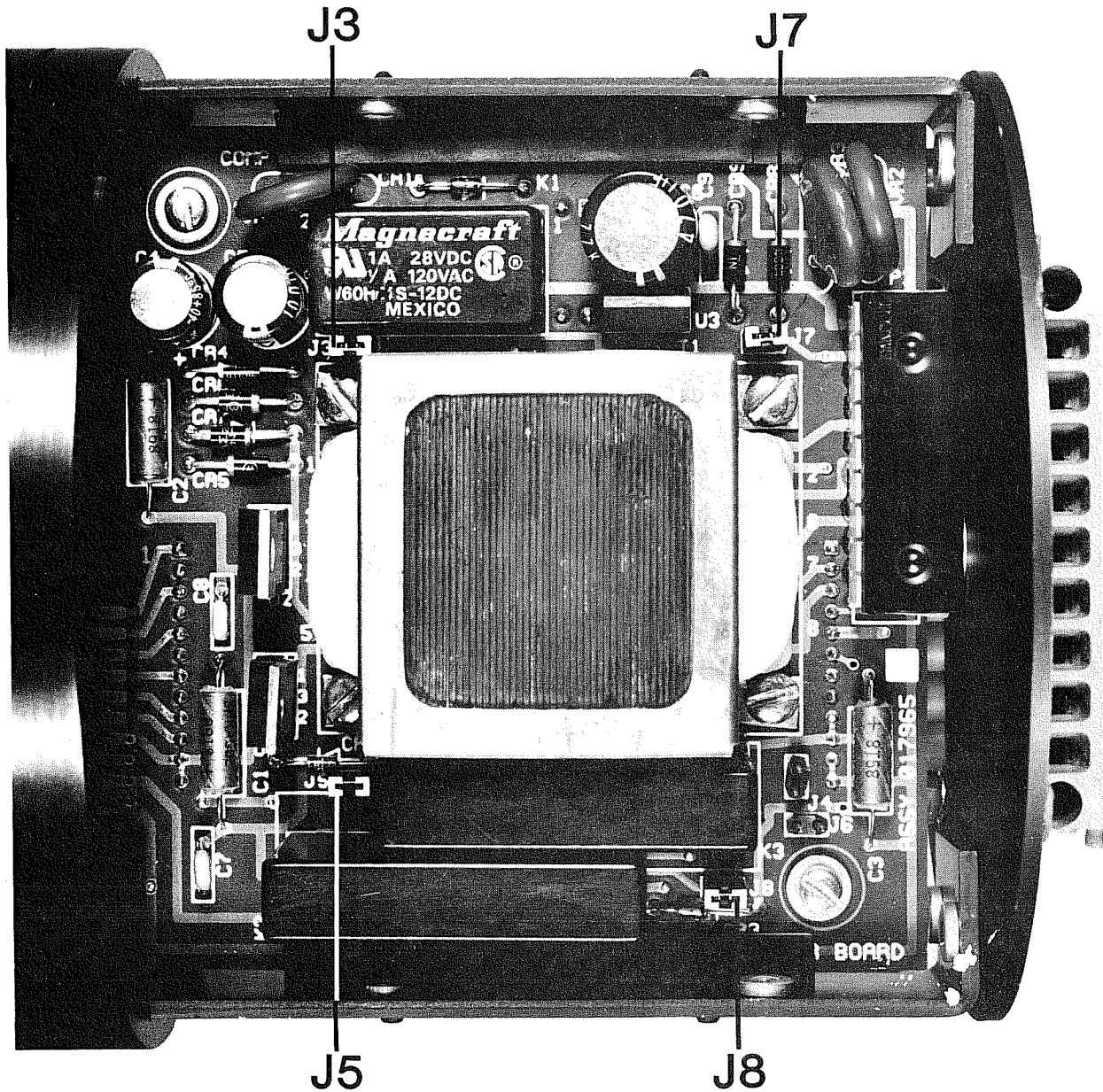


Figure 9a: SSG Standard Jumper Configuration

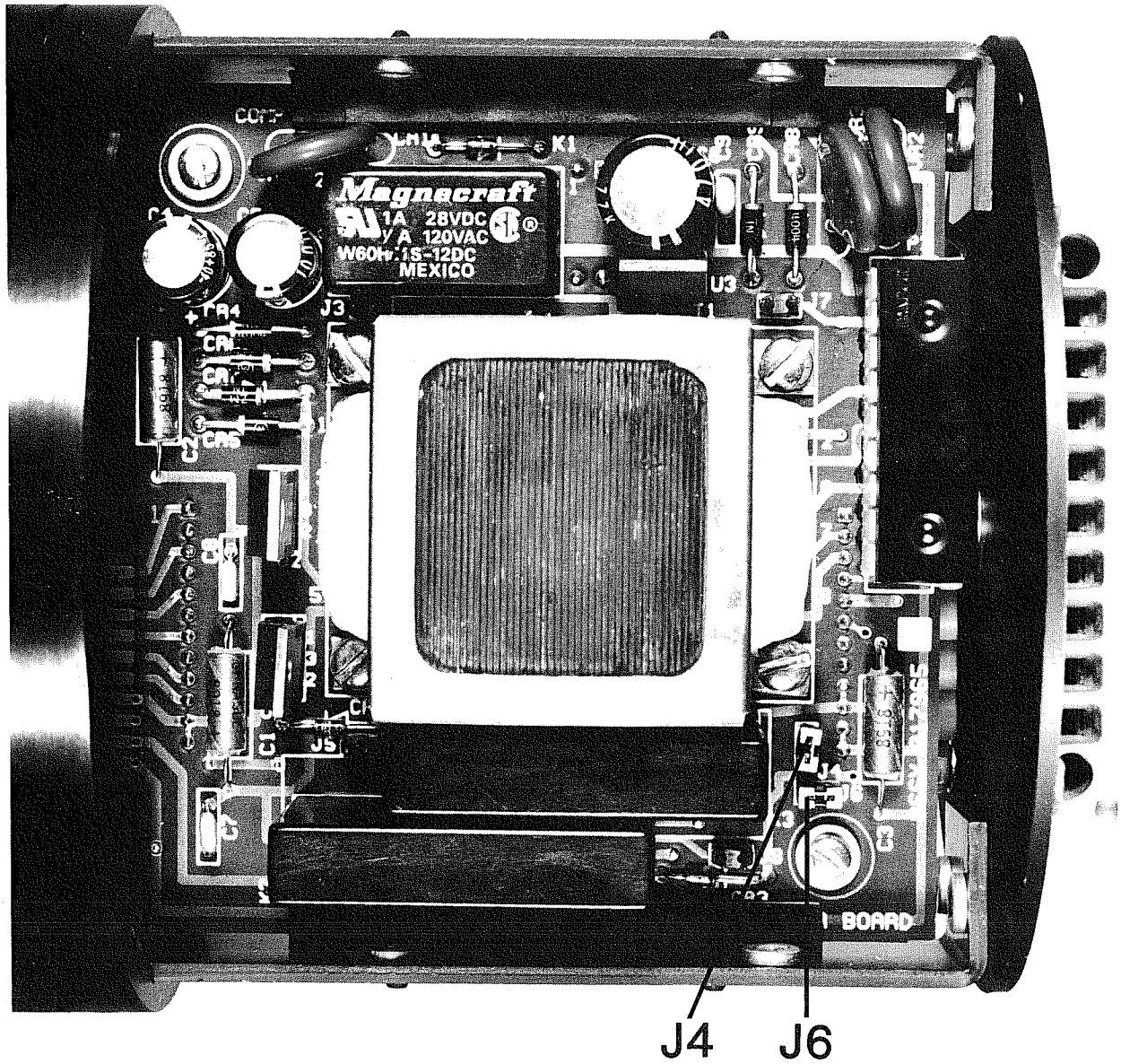
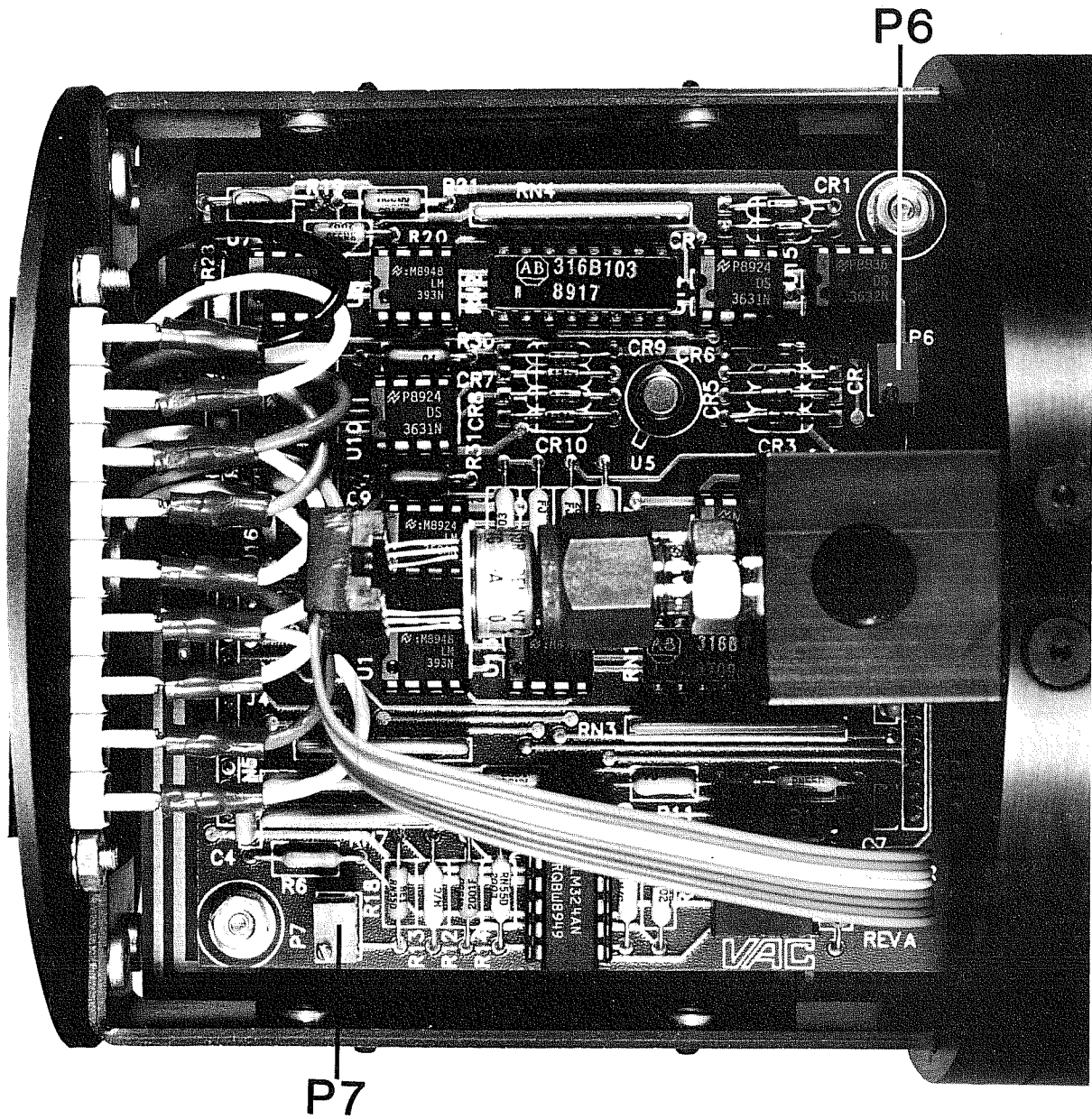


Figure 9b: SSG Dry - Contact Jumper Configuration



P6. Zero Adjustment

P7. Gain Adjustment

Figure 9c: SSG Zero and Gain Adjustment

PRESSURE PORT SENSOR PRESSURE PORT

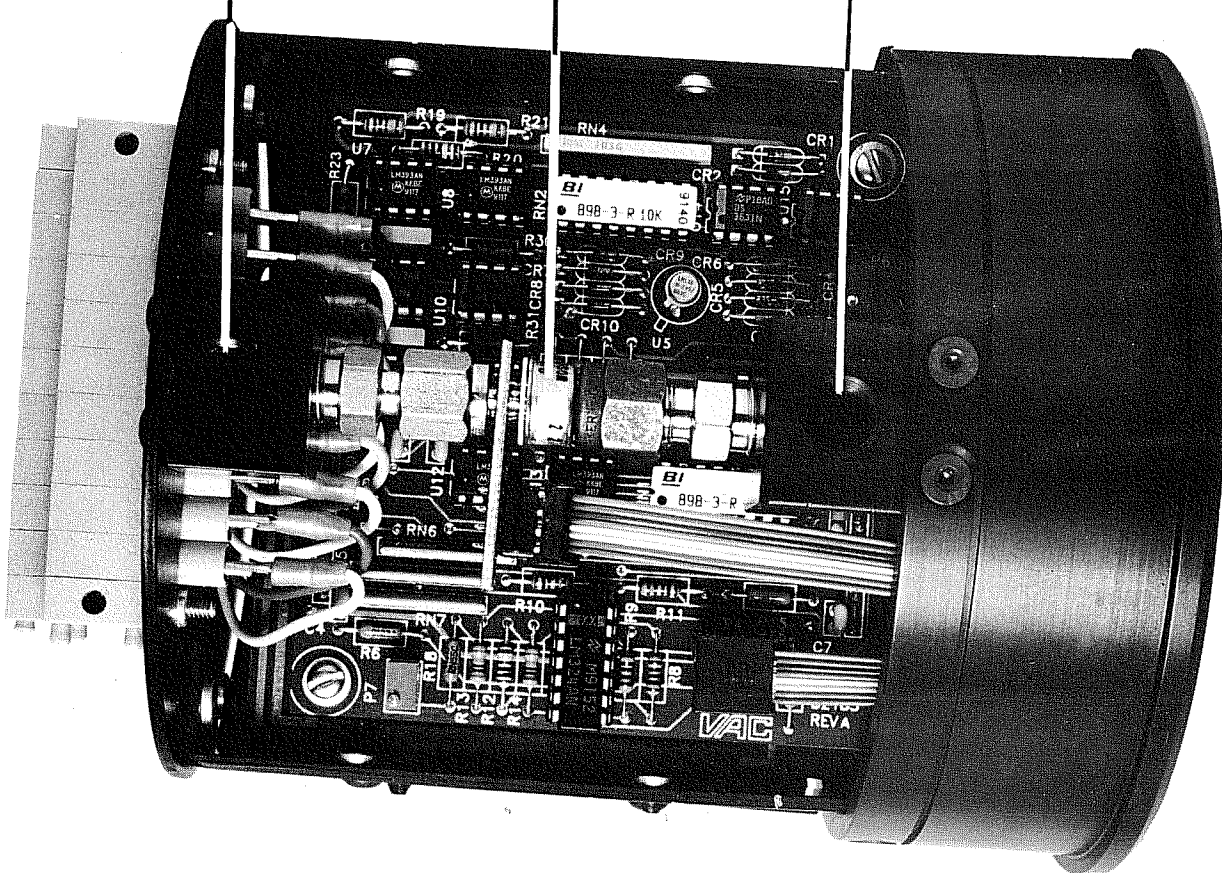


Figure 9b: SSG ΔP Version

APPENDIX C

MANUFACTURER'S BULLETIN

SSG SOLID STATE GAUGE RETROFIT WIRING

The following instructions should be used in retrofitting the VAC equipment listed below with an SSG Solid State Gauge.

ST-110 Safe-Trol	MO-40 Dri-Train
PC-1 Pedatrol	MO-120 Dri-Train
HE-63-P Pedatrol	HS-PC-1 High Speed Pedatrol

Read all instructions completely before beginning this retrofit procedure. Wiring matrices have been provided on the back of this bulletin for each of the above-listed devices. The wires within each device are labeled to help identify all wires involved. With the unit(s) turned Off and Power supply turned Off:

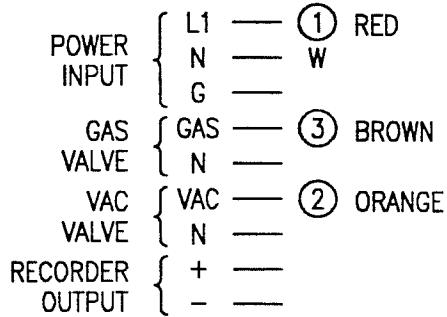
1. Remove service panels.
2. Identify wires to the Photohelic according to wire number inside unit. Cut wires with diagonal wire cutters at Photohelic lugs.
3. Disconnect 1/8 in. NPT sensing connection from back of Photohelic.
4. Loosen retaining ring screws on inside face of Photohelic*, and then remove snap ring located in Photohelic body.
5. Pull out Photohelic. Place SSG in its place.
6. Hold SSG and install snap ring onto body. Tighten retaining ring screws so the SSG is flush with front panel.
7. Connect 1/8 in. sensing connection using teflon tape on the threads. Make a tight connection.
8. Strip connection wires 1/4 in. for insertion into terminal strip. Insert wires accordingly, as depicted in the respective diagram on the back of this bulletin.
9. Reinstall service panel. Installation should now be complete.

* Photohelic is a trademark of Dwyer Instrument Inc.

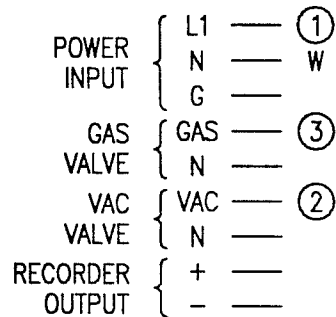
APPENDIX C

WIRE SSG PER DIAGRAM PERTAINING TO SPECIFIC DEVICE BEING USED.

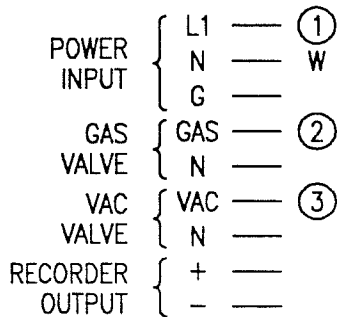
HE-63-P



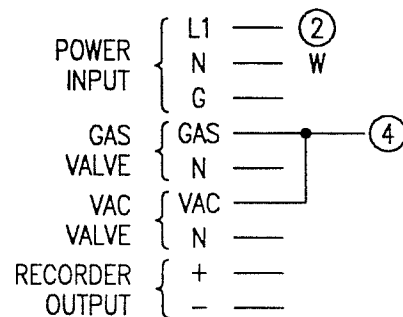
PC-1



HS-PC-1

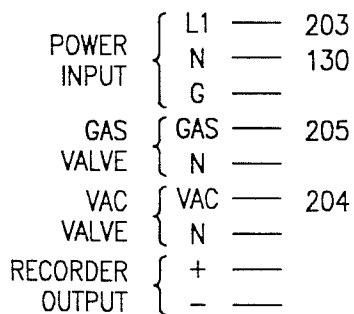


ST-110



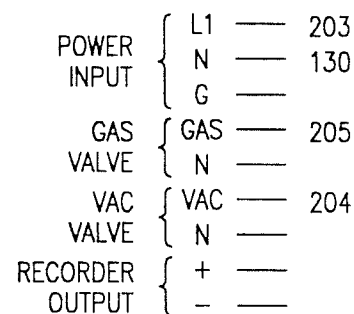
NOTE: SPLICE WIRE #3 TOGETHER

MO-40



NOTE: SPLICE WIRE #206 TOGETHER

MO-120



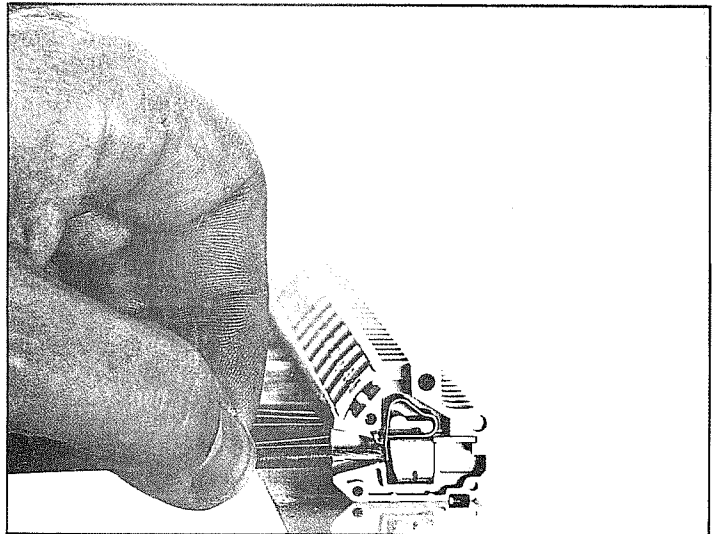
NOTE: SPLICE WIRE #206 TOGETHER

Wiring Installation For SSG

Tools required:

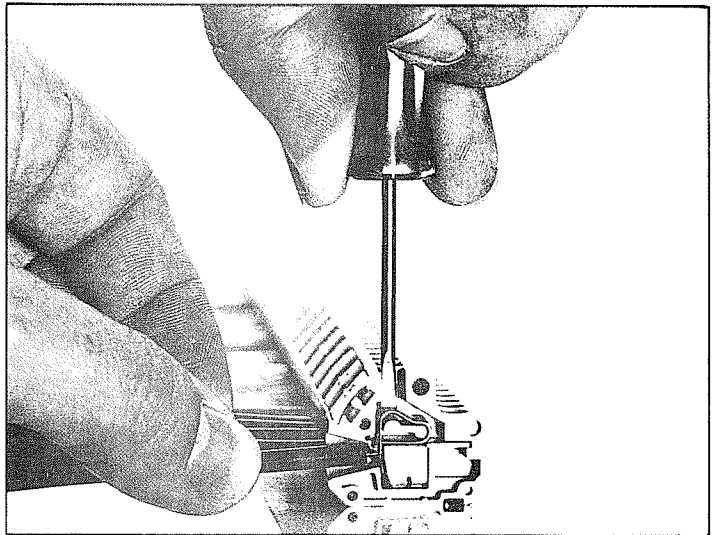
- Small screwdriver
- Wire stripping tool (for 16 to 18 GA. wire)

Strip all connecting wires per wire diagram supplied.

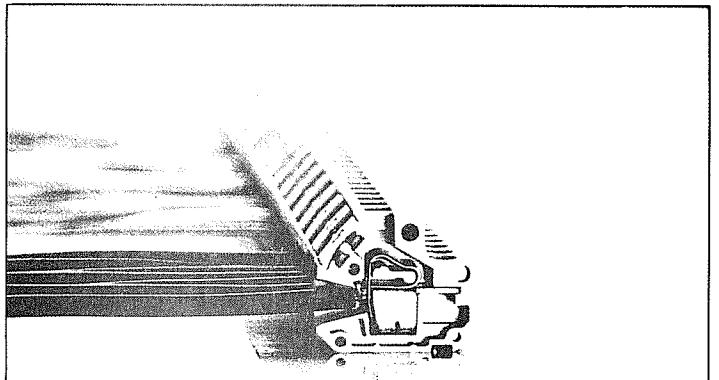


1 conductor per spring

Push down with small screwdriver to open wire engagement hole. Install wire in hole and release screwdriver.



Completed installation of wires.





Vacuum Atmospheres Company

4652 West Rosecrans Ave.
Hawthorne, CA 90250-6896
Phone: (310) 644-0255
Fax: (310) 970-0980

**IMPORTANT
SERVICE BULLETIN**

READ CAREFULLY

Dear Customer:

Vacuum/Atmospheres Company wishes to continue to provide you with the very best service possible. Recent changes in environmental laws now require some changes in our "Returned Goods" policies.

Before any item may be returned for repair or replacement, a **Returned Goods Authorization Number (RGA)** must be obtained from the VAC Sales Department. Be prepared to provide information about the chemicals which the item to be returned has been exposed. VAC Sales may be reached at:

Telephone:	(310) 644-0255	(8:00am – 5:00pm PST)
Fax:	(310) 970-0980	(24 Hours)

The **RGA Number** must be shown on the packing slip accompanying the item and be marked on the outside of the shipping container. Items without a **RGA Number** will not be accepted for repair or replacement.

Material Safety Data Sheet (MSDS) for each chemical, to which the returned item has been exposed, must accompany the item being returned.

Any item being returned must be cleaned for safe handling before being shipped to VAC. **Documentation showing that all contamination has been removed must be provided.** Vacuum Pumps must be drained of all pump oil before being returned. Items that have not been cleaned and made safe for handling **WILL NOT BE ACCEPTED** for repair or replacement.

If you have any questions, please call or fax VAC at the numbers listed above.

[CONTINUE, OVER]

EFFECTIVE JANUARY 1, 1992

DECONTAMINATION OF ROTRON BLOWERS

Vacuum/Atmospheres Company will not accept a returned ROTRON Blower unless the blower has been decontaminated by your facility. **Documentation showing that all contamination has been removed must be provided.**

A **RG** (Returned Goods Authorization) must be obtained from VAC before any blower may be returned for repairs.

ROTRON Blower Disassembly Instructions

Tools Required:

1. 5/32" Allen Wrench.
2. 3/8" Socket Wrench 1/4" Drive.
3. 3/8" Open End Wrench.
4. Rubber Or Wooden Mallet.
5. Safety Glasses and Respirator.
6. #2 Phillips Screwdriver.
7. #3 Phillips Bit and An Impact Type Screwdriver.
8. Soap And Water.

The following procedures are intended to be guide lines for disassembly and should only be followed after a complete review and approval from the Health and Safety Officials in you company.

Provide your personnel with Material Safety Data Sheet(s) (MSDS) for all the materials that your blower has been exposed to in your system **BEFORE** they disassemble it.

Steps:

1. Remove the two en cap retainer screws using the 3/8" socket and the 3/8" open end wrench.
2. Using the mallet to remove the end caps, strike the end cap outwards from the center at the point where the retainer screws went through. You must work on one side at a time working back and forth on the retainer point. It will not matter which side you start on.
3. After removing both end caps, use the 5/32" Allen wrench on the center screw turning it (CCW) to loosen the impeller. Next, slide off the impeller from the shaft.
4. On one end there are three #2 Phillips screws. Remove the screws and the small retainer cap. Next remove the four large Phillips screws using the impact screwdriver.
5. Pull the case apart. **Do Not Use A Screwdriver Between The Case Halves.** Now all of the parts can be washed clean with the appropriate solvents. Air-dry completely.
6. Reassemble the blower. Do not tighten the screws or fully reinstall the end caps.

**Appendix D
Spare Parts Listing**

Table 3. Spare Parts and Accessories List (Pedatrol)

Item	Description	Schematic No.	Part No.	Qty.
1	Foot switch	S2	1122	1
2	Circuit breaker	1CB	7623	1
3	Gas valve solenoid	V2		1
4	Vacuum valve solenoid	V1		1
5	Photohelic	S3	1208	1
6	Toggle switch	S1		1
7	SSG	1SSG		1

Appendix E Warranty

This unit is warranted to be free from defect in factory material and workmanship for a period of 1 year from date of purchase, subject to normal wear, and freedom from undue abuse during handling and operation.

This warranty applies only to new equipment that, after shipment from the factory, has not been altered or mistreated in any manner whatsoever, and does not extend to trade accessories operated with VAC's own equipment.

VAC warrants that it will repair or furnish, FOB its factory, a replacement provided a part is found to have been defective at the time it was received and the defective part is returned to the factory, charges prepaid.

This warranty is the only warranty expressed, implied, or statutory upon which said equipment is sold. All other damages and warranties, statutory and otherwise, being hereby expressly waived by purchaser.

Components purchased from other manufacturers and included in the unit are subject to warranties as offered by the manufacturer of said components; of these components, certain expendable items are not covered; others are warranted for 90 days; others are warranted for 1 year.

Index

- Accessories, 5-1
- Appendixes, A-1
- Application, 1-1

- Circuit breaker, 1-2, A-1
- Customer-furnished items, 2-1

- Dimensions, A-1
- Drawings, B-1

- Electrical,
 - Check, 2-4
 - Connections, 2-4
 - Diagrams, B-1 - B-4
 - Requirements, 2-1
- Establishing atmosphere, 3-1

- Functional description, 1-4

- Gas requirements, 2-2

- Items to remember, 3-5
- Installing,
 - HE-63-P enclosure, 2-3
 - Inert gas line, 2-4
 - Photohelic/SSG, 4-5
 - Pressure control line, 2-4
 - Rack mounting (PC-1), 2-2
 - Sensing line, 2-4
 - Vacuum line, 2-4
- Leak check, 2-7
- Line connections, 2-4

- Maintenance, 4-1
- Manual operation, 2-7, 3-4

- Nomenclature, 1-7

- Operations, 3-1
- Overview, 1-1

- Parts, 5-1
- Parts list, C-1
- Pedatrol
 - Nomenclature, 1-7
 - Setup, 2-2
- Periodic maintenance, 4-1
- Photohelic, 1-4, 2-6, 3-3
- Pressure
 - Bubble test, 2-7
 - Control, 3-2 - 3-4
 - Problems, 4-2

- Rack mounting, 2-2 - 2-3
- Removing photohelic, 4-5
- Replacement policy, 5-1

- Setting up Pedatrol, 2-2
- Solenoid valves, 1-4
- Spare parts, 5-1, C-1
- Specifications, A-1

- Tests,
 - Pressure bubble, 2-8
 - Static leak, 2-8
- Troubleshooting, 4-1 - 4-4

Index (Cont'd)

Utility requirements, 2-1

Vacuum,

Line, 2-4

Requirements, 2-2

Valve, 1-2 - 1-4

Warranty, E-1

Wiring diagrams, B-1 - B-4