Table B-1: Compressor Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
3) System power ON/ OFF switch (CB1) remains in the ON position, and the compressor stops after several minutes of operation and remains off.	1) Loss or degradation of power coming from power source. 2) Thermal protective switches are open. 3) Very cold cooling water has caused a restriction of oil flow through the oil injection orifice during startup.	1) Ensure a constant supply of power per Table 1-2: 2) Check for inadequate water cooling, see Table 1-3: 3) Recheck for proper cooling water temperature per Table 1-1: Restart the compressor repeatedly until continuous operation is achieved.

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Appendix C - Electrical Schematic for 8510 Low-Voltage Compressor

Table C-1: 8510 Fuses

Fuse Designation	Amp Rating	Bussman* P/N
1FU	1	MDX1
2FU	1	MDX1
3FU	2	MDX2
4FU	3.2	MDL 3 2/10
5FU	3.2	MDL 3 2/10
6FU	3.2	MDL 3 2/10
7FU	0.5	MDL 1/2
8FU	0.5	MDL 1/2
9FU	0.125	MDL 1/8
*Replacement parts must be Bussman type only.		

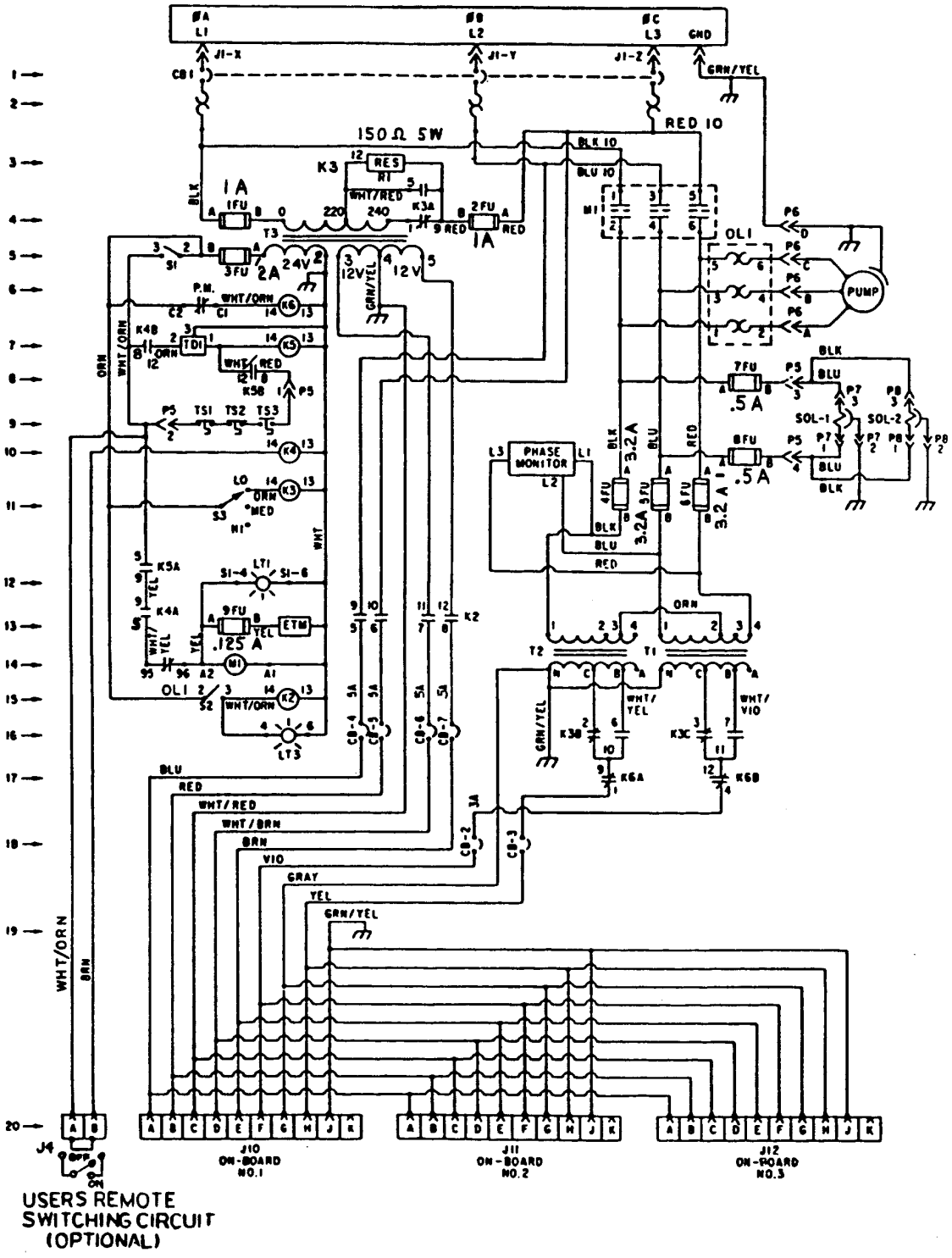

Figure C-1: Electrical Schematic for 8510 Low-Voltage Compressor Drawing No. 8031350 Rev. F

Table C-2: Legend for Figure C-1

Component	Description
CB1	Circuit Breaker, 25 Amps, Main Power
CB2 &CB3	Circuit Breakers, 3 Amps, Cryopump Power
CB4 & CB5	Circuit Breakers, 5 Amps, Heater Power
CB6 & CB7	Circuit Breakers, 5 Amps, On-Board Power
ETM	Elapsed Time Meter
J1	Input Power Connector
J4	Remote ON/OFF Connector
J10 Thru J12	On-Board Power Output Connectors
K2	On-Board Power/Cryopump Heater Relay
K3	Voltage Select Relay
K4	Remote ON/OFF Relay
K5	Compressor Start Relay
K6	Cryopump Phase Monitor Relay
M1	Motor Starter
OL1	Motor Overload Protector
PM	Phase Monitor
PUMP	Compressor Pump
R1	Resistor - 150 Ohms, 5 Watts
S1	Compressor Power Switch (With Lamp LT1)
S2	On-Board Power Switch (With Lamp LT3)
S3	Voltage Select Switch
SOL1	Solenoid Valve - Oil Flow
SOL2	Solenoid Valve - Gas Flow
T1 & T2	Cold Head Drive Transformer
T3	Control Transformer, 24 VAC
TD1	Time Delay Relay
TS1	Thermal Protective Switch -Oil Flow/Gas Discharge Temperature
TS2	Thermal Protective Switch - Oil Flow/Motor Temperature
TS3	Thermal Protective Switch - Oil/Water Temperature

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Appendix D - Electrical Control Module Components of the 8510 Low-Voltage Compressor

Table D-1: Legend for Figure D-1

Item Number	Description	Symbol Designation
1	Cryopump Phase Monitor Relay	K6
2	Compressor Start Relay	K5
3	Remote ON/OFF Relay	K4
4	Voltage Select Relay	K3
5	On-Board Power/Cryopump Heater Relay	K2
6	Time Delay Relay	TD1
7	Control Transformer, 24 VAC	T3
8	Cold Head Drive Transformer	T2
9	On-Board Power Switch (with Lamp LT3)	S2
10	Compressor Power Switch (with Lamp LT1)	S1
11	Cold Head Drive Transformer	ETM
12	Fuse - 0.125A, Slow-Blow, Bussman, MDL 1/8	T1
13	Fuse - 0.5A, Slow-Blow, Bussman, MDL 1/2	9FU
14	Fuse - 0.5A, Slow-Blow, Bussman, MDL 1/2	8FU
15	Fuse - 3.2A, Slow-Blow, Bussman, MDL 3 2/10	7FU
16	Fuse - 3.2A, Slow-Blow, Bussman, MDL 3 2/10	6FU
17	Fuse - 3.2A, Slow-Blow, Bussman, MDL 3 2/10	5FU
18	Fuse - 2.0A, Slow-Blow, Bussman, MDX 2	4FU
19	Fuse - 1.0A, Slow-Blow, Bussman, MDX 1	3FU
20	Fuse - 1.0A, Slow-Blow, Bussman, MDX 1	2FU
21	Fuse - 1.0A, Slow-Blow, Bussman, MDX 1	1FU
22	Resistor - 150 Ohms, 5 Watts	R1
23	Motor Starter	M1
24	Phase Monitor	PM
25	Motor Overload Protector	OL1
26	Voltage Select Switch	S3
27	Motor Starter Reset	M1 Reset
28	Remote ON/OFF Connector	J4
29	Input Power Connector	J1
30	On-Board Power Output Connector	J12
31	On-Board Power Output Connector	J11
32	On-Board Power Output Connector	J10
33	Circuit Breaker, 3A, Cryopump Power	CB3
34	Circuit Breaker, 3A, Cryopump Power	CB2
35	Circuit Breaker, 5A, On-Board Power	CB7
36	Circuit Breaker, 5A, On-Board Power	CB6
37	Circuit Breaker, 5A, Heater Power	CB5
38	Circuit Breaker, 5A, Heater Power	CB4
39	Circuit Breaker, 25A, Main Power	CB1

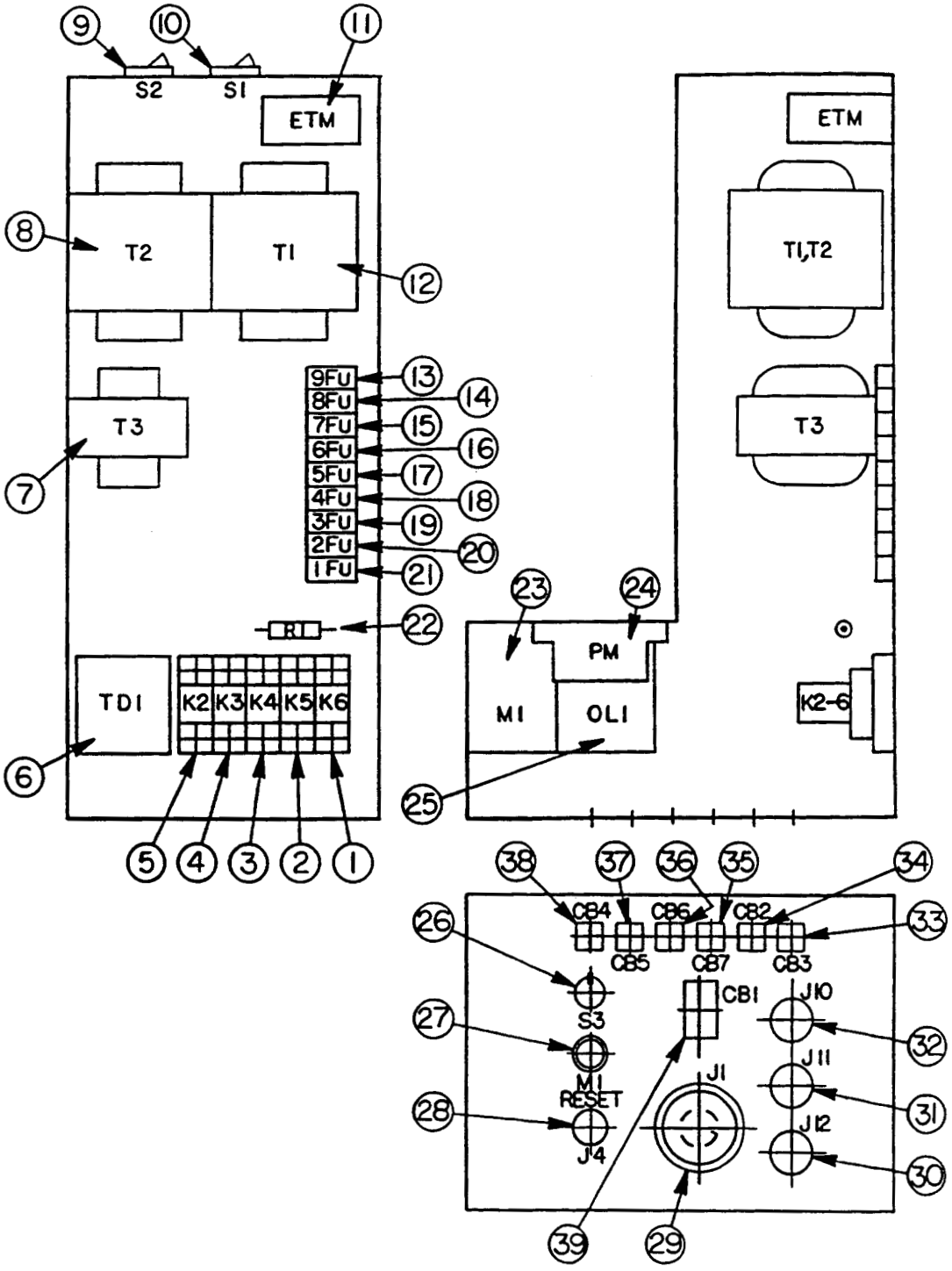

Figure D-1:Electrical Control Module Components of 8510 Low-Voltage

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Appendix E - 8510 Low-Voltage Compressor Flow Diagram

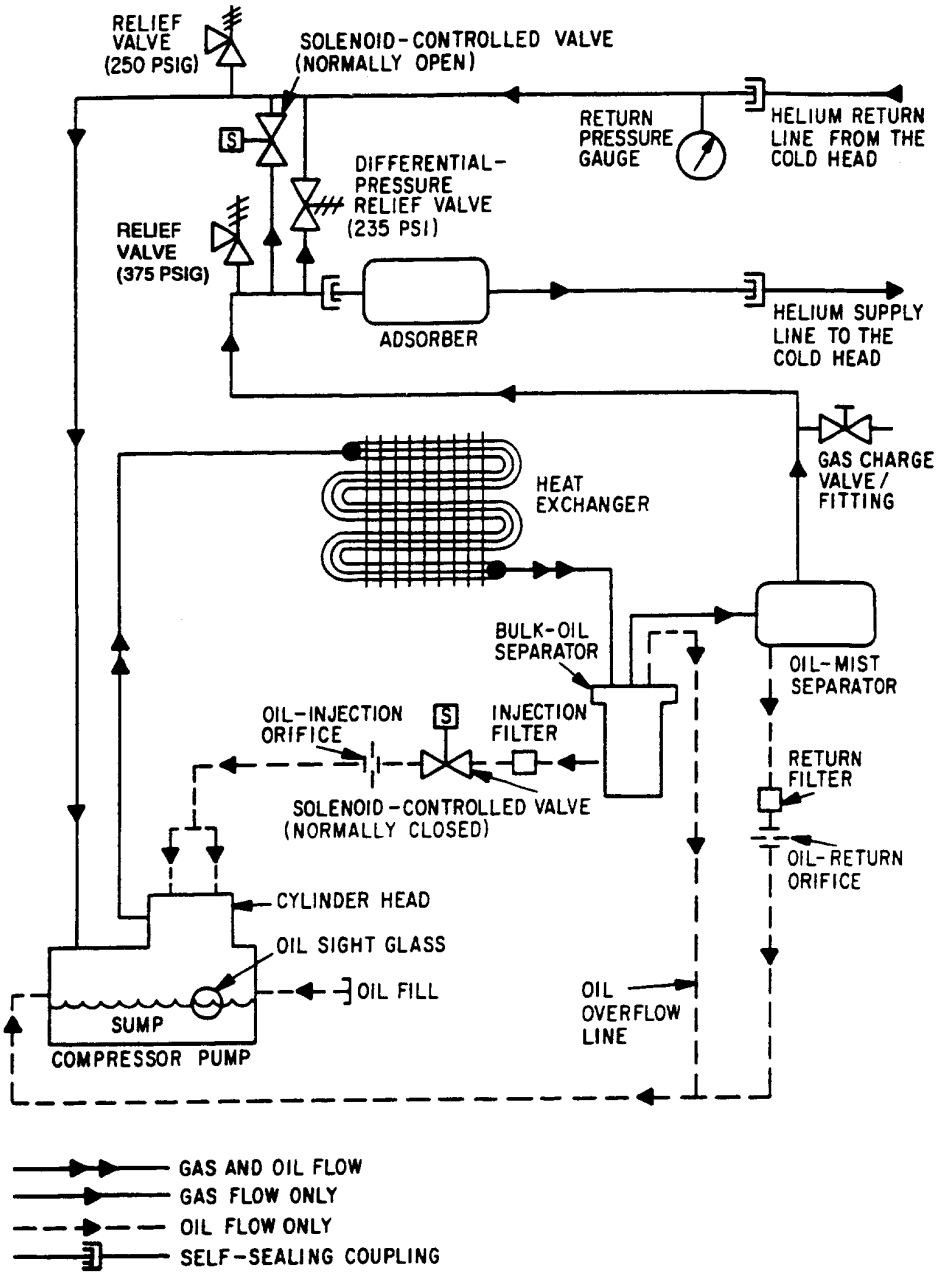

Figure E-1: Flow Diagram of 8510 Low-Voltage Compressor

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Appendix F - Multiple Cryopump Installation with Single 8510 Low-Voltage Compressor

Your 8510 Compressor may be used to drive a number of multiple On-Board cryopump combinations.

Figure F-1: depicts a typical multi-cryopump installation with an 8510 Low-Voltage Compressor. As shown in this figure, a power cable is connected from the compressor to each cold head; also, the components are helium connected in parallel (all supply fittings piped together).

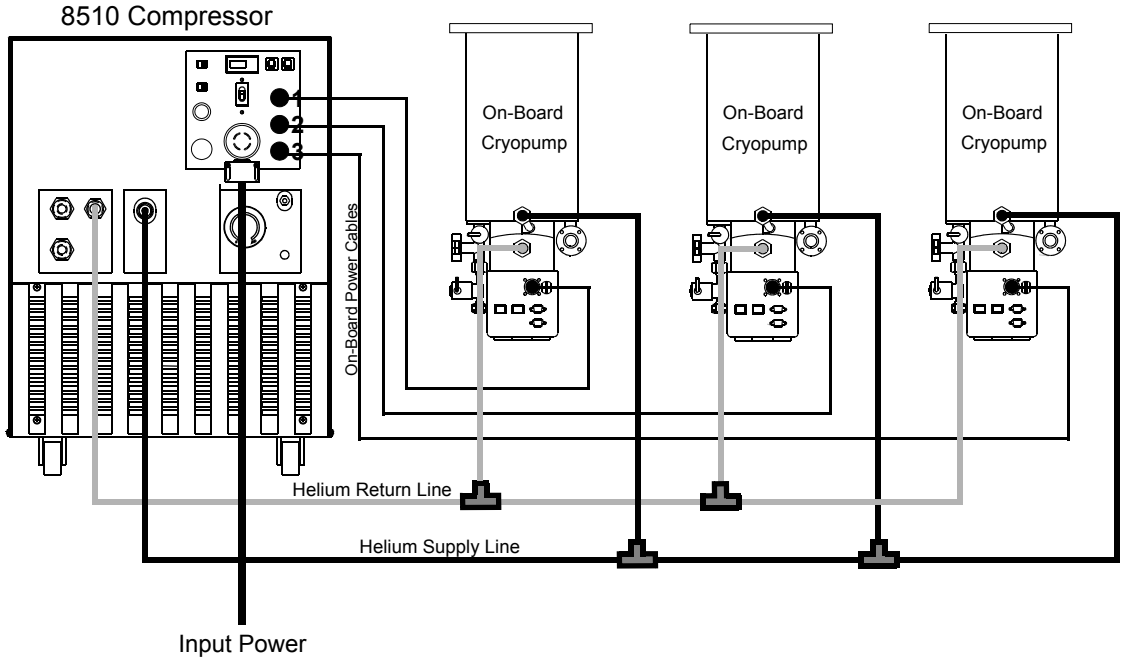

Figure F-1: Typical Multiple Cryopump Installation with Single 8510 Low-Voltage Compressor

Shown in Figure F-1: is a typical multiple cryopump installation. If you are considering a multiple cryopump installation please contact the BROOKS-CRYOGENICS, U.S.A., Application Engineering Department (1-800-447-5007) for technical assistance in the selection and sizing of the manifolds and interconnecting lines for your particular installation.

Preliminary System Requirements

Installation of the 8510 Low-Voltage Compressor for use with a single cryopump is covered in **Section 3 - Installation**. Installation for multiple cryopump usage is similar, but requires that system charge pressure be established for a given high-vacuum pump system. Additionally, the following parameters must be considered before the system can be assembled.

- All system components must be assembled and be operational for system static charge pressure determination.
- All system components must have static charge pressures of 195-205 psig at 70° F to 80° F (21° C to 27° C).

Determining System Charge Pressure

To establish the helium gas charge pressure of a multiple cryopump installation proceed as follows:

1. Assemble your multiple cryopump system components.
2. Check the compressor pressure gauge to insure static pressure is in the 195-205 psig (1345-1415 kPa) range.
3. If it is necessary to reduce helium gas pressure then perform the following:
   a. Disconnect the charging line from gas charge fitting on rear of compressor.
   b. Open the gas charge valve very slowly. Allow helium gas to escape until pressure gauge reads 50-100 psig (345-690 kPa).
   c. Close the gas charge valve and reinstall the charging line to the gas charge fitting, refer to step 4 for procedure.
4. If the pressure is low, attach a helium bottle, regulator, and charging line to the compressor and perform the following:
   a. Remove the flare cap of the gas charge fitting on the rear of the compressor.
   b. Loosely attach a charging line from the helium pressure regulator on the helium bottle to the 1/4-inch male flare fitting installed on the helium charge fitting of the compressor.

NOTE: *Use only 99.999% pure helium.*

   c. Set the helium pressure regulator to 10 to 25 psig (70-125 kPa). Allow helium gas to flow through the charging line

and around the loosened flare fitting for 30 seconds to purge the charging line of air. Then tighten the flare nut at the end of the charge line.

d. Slowly add helium gas until compressor pressure gauge reads 195-205 psig (1345-1415 kPa).

5. Turn on the system power ON/OFF switch.
6. Note helium pressure gauge reading immediately after startup. It should read 50-100 psig (345-690 kPa). If necessary add additional helium gas by slowly opening the helium charge valve on the rear of the compressor until the helium pressure gauge rises to 50-100 psig (345-690 kPa).
7. Allow the cryopump to operate until a cooldown temperature of 20K or less is reached.

Adjust the helium pressure if necessary as described in step 6 until the helium pressure gauge reads 80-100 psig (550-690 kPa) while the system is operating.

8. Allow the system to reach steady state. Recheck the helium pressure.
9. When steady state is achieved, shut the system off and allow the system time to reach steady state conditions at room temperature.
10. When the system reaches room temperature, the pressure reading on the compressor gauge is the system charge pressure.

NOTE: *Record the compressor static pressure in your operating log. This is the static pressure for your particular installation and should be used for checking compressor performance or when troubleshooting the installation.*

11. Ensure that the helium charge valve on the compressor is tightly closed. Then shut off the helium pressure regulator or the helium bottle. Remove the charging line from the male flare fitting and reinstall the flare cap.

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