APPENDIX F - INCREASING AND DECREASING HELIUM GAS PRESSURE

TABLE OF CONTENTS

F-1 CTI SYSTEM

F-1-1 Increasing CTI Helium Gas Pressure

If system static pressure is 225 psig or less, you must add helium to system to bring static pressure to 240 psig. If steady–state dynamic pressure is less than 60 psig, you must add helium to raise pressure to 90 psig, providing static pressure is <240 psig.

CAUTION

Avoid contaminating helium system. Use only 99.9995% certified pure helium gas, preferably with a dedicated regulator and charge line, and follow procedure exactly. Do not open cylinder valve until told to do so.

CAUTION

To avoid over pressurizing system, do not exceed 240 psig static pressure.

1. Loosely attach a two–stage regulator (0–3000 psig/0–400 psig) and charging line to a helium cylinder (99.9995% pure).

Note

Step 2 is performed to purge air from regulator and charging line. This prevents air trapped in regulator from seeping back into helium cylinder, reducing purity of helium.

2. Purge regulator and charging line by doing the following:
   a. Open regulator a small amount as follows:
      1) Turn adjusting knob counter–clockwise until it turns freely.
      2) Turn knob clockwise until you meet resistance.
      3) After meeting resistance, turn knob clockwise approximately 1/8 to 1/4 turn more so regulator is barely open.

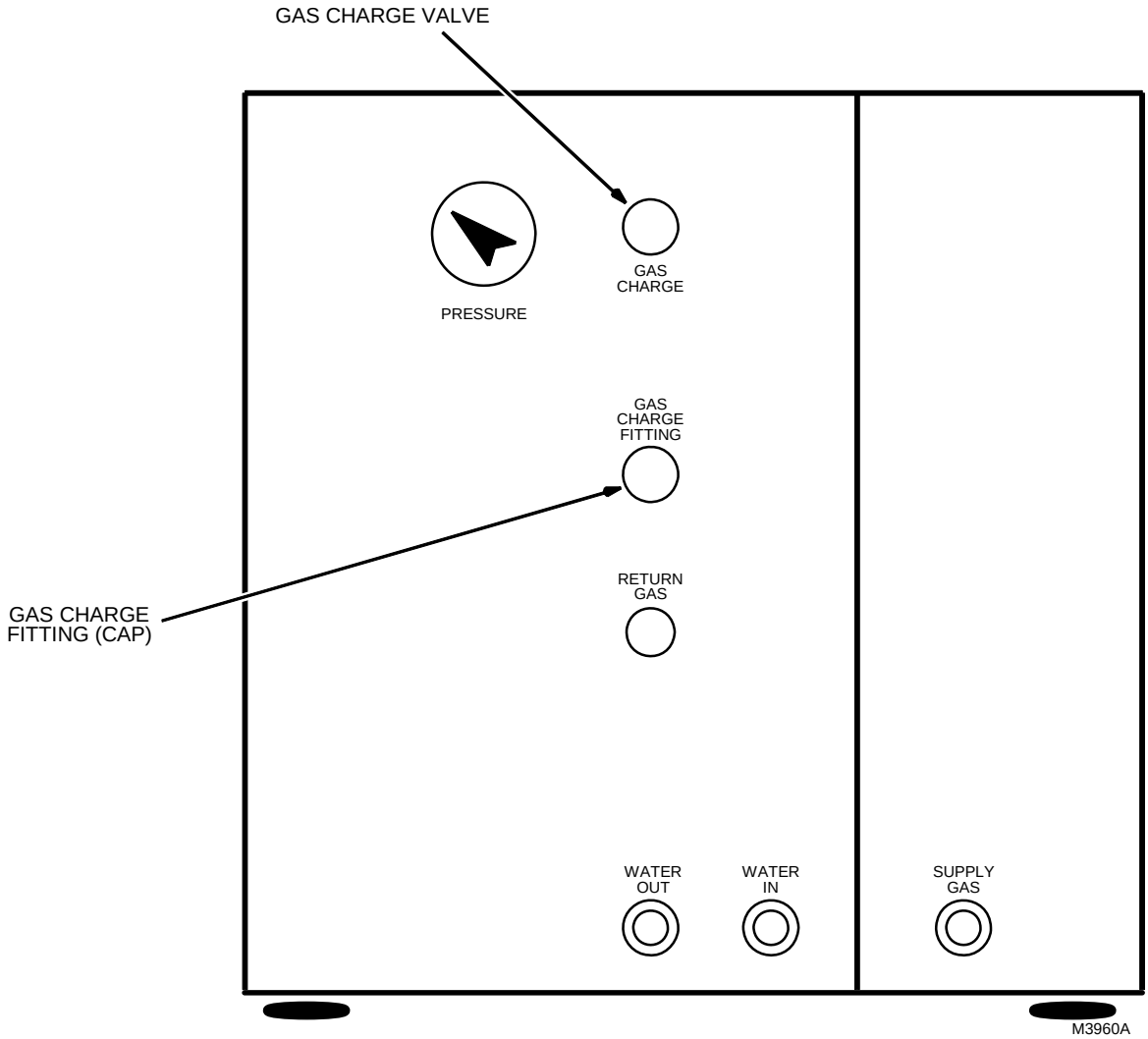
DANGER

FATAL EXPLOSIVE HAZARD!! TO PREVENT POSSIBLE FATAL EXPLOSIVE RELEASE OF GAS, OPEN MAIN VALVE ON GAS CYLINDER VERY SLOWLY. GAS IS AT 2400 PSI.

   b. Open cylinder valve slightly and then tighten regulator to cylinder with a wrench.

F–1–1 Increasing CTI Helium Gas Pressure (continued)

c. Purge line for 10 to 15 seconds.
d. Turn regulator knob counter–clockwise until helium stops flowing, then open cylinder valve fully.
e. Remove cap from compressor gas charge fitting. See Illustration F-1.
f. Open gas charge valve slightly for about 10 seconds to blow any air out of charge fitting.
g. Loosely connect charge line to $^{1}/_{8}$ inch flare fitting on compressor.
h. Repeat Step 2a and allow gas to flow for about 30 seconds.
i. Slightly open compressor charge valve and tighten charge line flare fitting while helium is flowing from both compressor and line.



CTI COMPRESSOR VALVES/FITTINGS
ILLUSTRATION F-1

F–1–1 Increasing CTI Helium Gas Pressure (continued)

3. Adjust pressure regulator to 240 psig.

4. Open charge valve on compressor slowly. Bring pressure, as shown on compressor gauge, to 240 psig at 60° to 80°F (16–27°C).

5. When pressure is correct, close charging valve on compressor.

6. Then, close valve on regulator, not valve on cylinder. By closing regulator valve, rather than cylinder valve, you ensure that there is only clean helium between cylinder and regulator.

7. Disconnect charging line from compressor.

F-1-2 Decreasing CTI Helium Gas Pressure

System static pressure should be 235 ±5 psig at 75°F (24°C) ambient temperature. If static pressure is above 240 psig, you must remove helium to reduce pressure.

1. Remove cap from gas charge fitting. See Illustration F-1.

2. Open charge valve slightly to reduce pressure.

3. When pressure reaches 235 psig, close charge valve and reinstall cap to gas charge fitting.

F-2 SHIELD COOLER SYSTEM

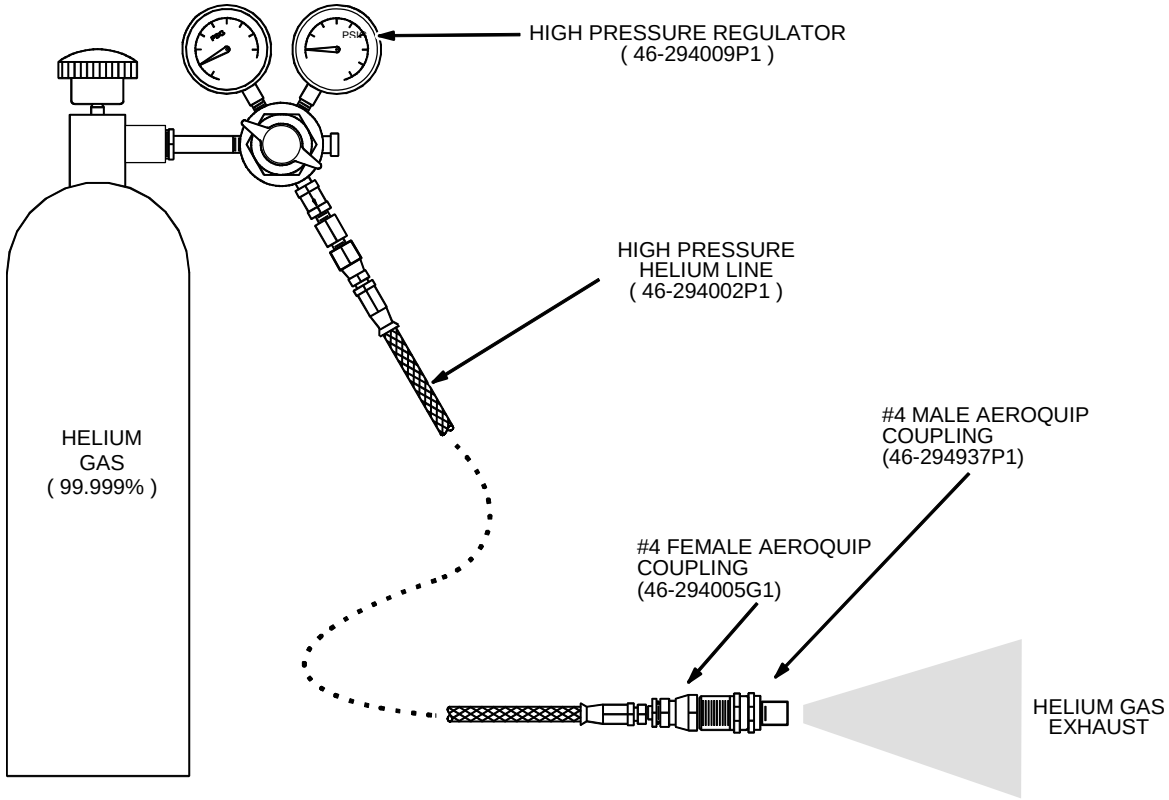
F-2-1 Increasing Shield Cooler Gas Pressure Preparation

CAUTION

The following procedure purges air out regulator and connecting lines before line is connected to a new cylinder of certified 99.999% helium gas.

1. Obtain a cylinder of 99.999% Helium Gas.
2. Loosely attach th high pressure regulator (46-294009P1) to the gas cylinder, per the following steps.
   a. Thread in the screw that connects the regulator to the helium bottle about 2 turns.
   b. Turn regulator handle fully clockwise to open the regulator.
   c. Open helium bottle, and immediately tighten the regulator to the helium bottle.
   d. Close the regulator valve by turning the handle counter clockwise.
3. Attach high pressure helium line (46-294002P1) to regulator at shut off valve. See Illustration F-2.

F–2–1 Increasing Shield Cooler Gas Pressure Preparation (continued)



SET-UP FOR COMPRESSOR CHARGING
ILLUSTRATION F-2

4. Attach the #4 female Aeroquip coupling (46-294005G1) to the end of the high pressure charging line. See Illustration F-2.

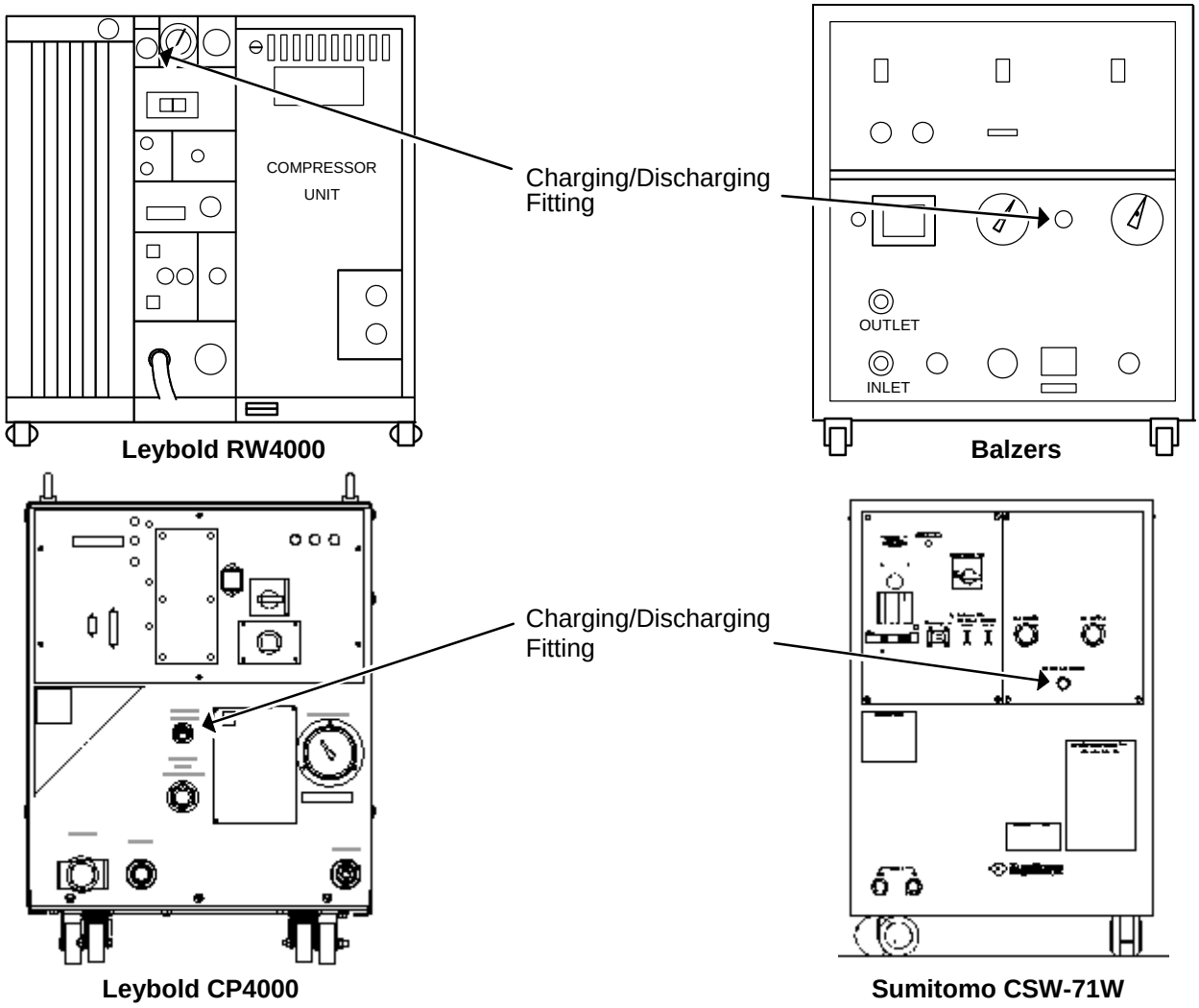
DANGER!!

FATAL EXPLOSIVE HAZARD!! TO PREVENT POSSIBLE FATAL EXPLOSIVE RELEASE OF GAS, OPEN MAIN VALVE ON GAS CYLINDER VERY SLOWLY. GAS IS AT 2400 PSI.

5. Attach #4 male Aeroquip coupling (46-294937P1) to the #4 female Aeroquip coupling. Hand tighten the fittings together. This will open the helium circuit to allow the charging assembly to be purged.
6. Establish gas flow through the helium line and fittings by slowly opening the main valve on the gas cylinder and tightening the male fitting into the female Aeroquip.
7. Allow helium to purge out the assembly for 2 minutes.
8. Remove the male Aeroquip fitting coupling from the female coupling.

F–2–1 Increasing Shield Cooler Gas Pressure (continued)

9. Close regulator. Shut off compressor power to let supply and return pressures equalize in compressor.
10. Fully open valve on cylinder.
11. Adjust regulator control valve to achieve a pressure of approximately 200 psig.
12. Attach purged charging line assembly with the female Aeroquip coupling to the charging fitting on the front of the compressor. See Illustration F-3.



COMPRESSOR CHARGING FITTINGS
ILLUSTRATION F-3

F-2-2 Increasing Gas Pressure

1. Increase compressor helium pressure by adjusting regulator until compressor's high side gauge shows the proper charge pressure. Refer to Table F-1.
2. If too much helium gas has been added, refer to Section F-2-4, Decreasing Shield Cooler Gas Pressure, to lower the Helium Pressure.

F-2-3 Disconnection and Stowage of Hoses and Regulator

1. Remove Aeroquip coupling from compressor. Restore compressor power.
2. Close regulator.
3. Attach high pressure hose and female Aeroquip to the Male Aeroquip #4 until the helium circuit is opened and gas is flowing.
4. Allow high pressure line and Aeroquip to depressurize.
5. Remove #4 male Aeroquip, and remove the female Aeroquip from the high pressure charging line.
6. Remove the high pressure charging line from the regulator.
7. Close valve on helium cylinder. Bleed off pressure from regulator.
8. Remove regulator from Helium bottle.
9. Store all equipment in carrying case from kit 46-281088G2, Shield Cooler Installation/Maintenance Kit.

F-2-4 Decreasing Shield Cooler Gas Pressure

1. Remove protective cap from, compressor front panel fitting.
2. Connect oil charging hose and fitting (46-294003P1) to the small fitting on the front of the compressor. See Illustration F-2.

Note

Use the Shield Cooler Installation Maintenance Kit (46-281088G2) to perform the necessary maintenance to Shield Cooler Systems.

3. Slowly tighten fitting until you hear gas escaping.
4. When the proper pressure is reached, immediately unscrew fitting and hose to prevent further gas removal. See Table F-1.
5. Replace protective cap on front panel fitting.

TABLE F-1

GAS PRESSURES

Equipment Type	**Charge Pressure PSI**
Balzars	235 ± 5
Leybold RW4000	225 ± 7
Leybold CP4000	203 ± 14
Sumitomo CSW-71A- (10K)	214 ± 3
Sumitomo (4K)	236 ± 3

F-3 S-1 MAGNET P-3 PLUG HELIUM EXHAUST FLOW VERIFICATION

Note

This procedure should be followed in the event of an increase in boil–off or a buildup in cryogen pressure detected in an S-1 Magnet. An obstruction in one of the flow paths of the exhausting helium will change the boil-off performance of the magnet and lead to a pressure buildup in the helium cryostat. The small orifices installed by the factory can also be constricted severely or even closed by a corrosion buildup or by small pieces of styrofoam flaking off of baffle assembly. The following procedure verifies if the exhaust flow rates are still present and are of sufficient volume to maintain adequate vapor cooling of the magnet.

Note

The factory installed orifices may be installed in any of the small pipe fittings that make up the vapor exhaust path. A careful search should be made to locate the fitting with the orifice and make sure the flow meter is “downstream” of the orifice. Some later magnets have small valves installed in place of fixed orifices. Use this method to verify the flow is still adequate or that the valve settings have not been disturbed.

1. Mount a Helium Flow Gauge Assembly (GE Part #46-265387G1) on the magnet. Connect the appropriate fitting from each flow meter of the gauge assembly to each of the following exhaust ports: FILL PORT, 40K SHIELD, CRYOPLUG STACK, and CRYOPLUG FLANGE. See Illustration F-4.

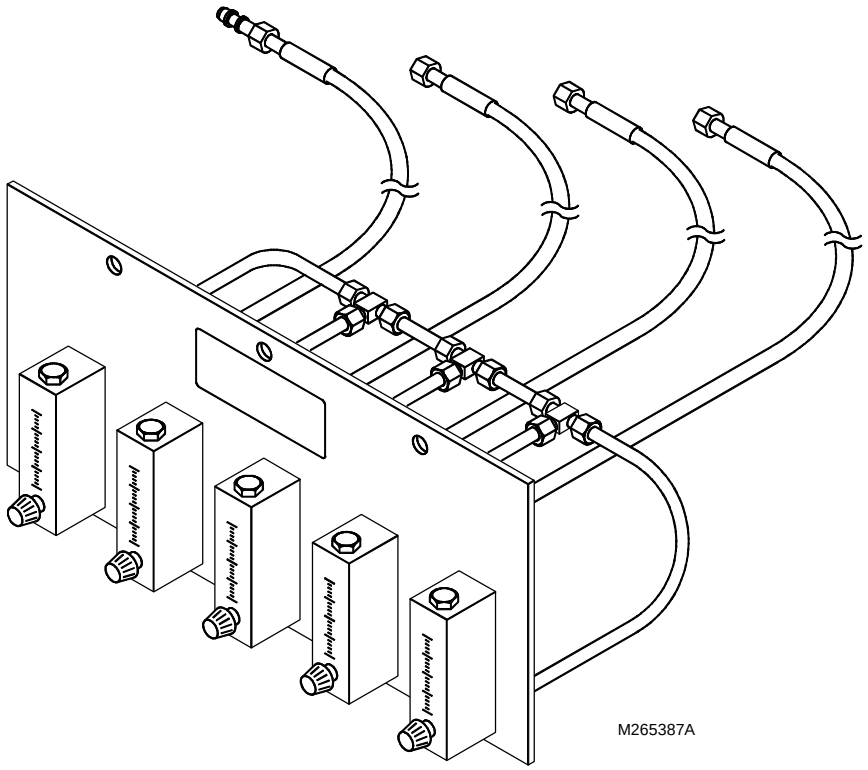
   Note

   Later versions of the S-1 Magnet (Model Number Series 46-260531) have an added helium vapor exhaust line called the Second Penetration. This flow can be spot checked separately by attaching one of the flow meters of the Helium Flow Gauge Assembly to the vapor line leaving the Second Penetration just to the left and below the P-3 Cryoplug. The flow meter should read 0.1 SCFH, with the flow meter needle valve set wide open.

2. Open the needle valves on each flow gauge so the flow is only limited by the orifice in the vapor exhaust
   line and not by the valve setting. The flows should be as follows:

Second Penetration	0.1 SCFH (Model 46-260351)
Vertical Stack	1.7 SCFH
Fill Port	0.3 SCFH
Flange	3.1 SCFH
40K Shield	1.8 SCFH
Total	7.0 SCFH

F-3 S-1 MAGNET P-3 PLUG HELIUM EXHAUST FLOW VERIFICATION (continued)



HELIUM FLOW GAUGE ASSEMBLY
ILLUSTRATION F-4

3. If the readings are close to these values, remove the Flow Gauge Assembly and restore the helium vents to their original configuration.

Note

Abnormal flow values indicate the presence of a problem which must be corrected. Please consult with your magnet support engineer to determine a corrective action for the problem. Some solutions may be simple. For example, low flow rates may be restored by simply cleaning the orifice. Flow values that are much higher may indicate that the cryostat pressure is too high or that the orifice is missing.