Model 1020R (Air-Cooled) Compressor Installation, Operation and Servicing Instructions

(for use with Cryo-Torr High Vacuum Pumping Systems)

8040274
Rev. 100 (7/2002)

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June 14, 2005

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Section 1
Introduction

1.1 General

The manual provides instructions for installing, operating and servicing the Model 1020R (Air-Cooled) Compressor. If you are installing or operating a Cryo-Torr® High-Vacuum System you should also have available the high-vacuum manual that applies to your particular system:

8040240:	Cryo-Torr 100, 7, 8 and 8F High-Vacuum Pumps
8040252:	Cryo-Torr 10 High-Vacuum Pump
8040219:	Cryo-Torr 250F High-Vacuum Pump
8040308:	Cryo-Torr 250F Enhanced Capacity High-Vacuum Pump
8040259:	Cryo-Torr 400 High-Vacuum Pump
8040266:	Cryo-Torr 500 High-Vacuum Pump

The manuals for a Cryo-Torr High-Vacuum System cover two basic components: the high-vacuum pump and the compressor. Each manual outlines the details necessary for installation, operation and servicing of that component. A manual is shipped with each system component (high-vacuum pump and compressor).

When you purchase a system, you will receive the two manuals necessary for system installation, plus a loose-leaf binder with index tab separators, allowing you to compile a complete indexed notebook.

Table 1.1 presents a summary of specifications for the air-cooled Model 1020R Compressor.

Figure 1.1 shows front and rear views of the 1020R compressor. The controls, indicators, and principal external components are also identified; the legend includes brief functional descriptions of most of the identified items shown.

1.2 Installation, Operation and Servicing Instructions

Installation, Operation and Servicing Instructions for your Model 1020R Compressor provide easily accessible information. All personnel with installation, operation, and servicing responsibilities should become familiar with the contents of these instructions to ensure high quality, safe, reliable performance.

Table 1.1 Specifications for the Model 1020R (Air-Cooled) Compressor

Dimensions (approximate):
Length: 25 inches (635 mm)
Width: 25 inches (635 mm)
Height: 32 inches (813 mm)

Weight (approximate): 315 lb (143 kg)

ELECTRICAL POWER REQUIREMENTS (Steady-State Conditions)

COMPRESSOR PART NO.	VAC	HZ	PHASE	AMPS (MAX.)	OPERATING (1) VOLTAGE RANGE	CONTROL-VOLTAGE RANGE
8031023G001	208 or 230	60	3	23	198-253	—
8031023G002	200 or 220	50	3	23	190-230	—
8031023G003	460	60	3	9	414-506	—
	and 230	60	1	6	—	216-253
8031023G004	380 or 400	50	3	9	353-428	—
	and 220	50	1	6	—	198-228

Note

The nominal operating power requirement for each compressor is 5.0 kw.

Table 1.1 Specifications for the Model 1020R (Air-Cooled) Compressor (Cont.)

Helium Pressures:	
Static	185 ± 5 psig (1225-1292 kPa) (at ambient temperature) (21°C to 27°C)
Supply (Normal Operation)	265-275 psig (1802-1870 kPa) (mean value)
Return (Normal Operation)	65-80 psig (442-544 kPa) (mean value)
Ambient Temperature Operating Range	50°F to 100°F (10°C to 38°C)
Interface Data:	
Length of Input Power Cable	10 ft (3 m)
Length of Cold Head Power Cable	10 ft (3 m)
Length of Control Power Cable	10 ft (3 m)
Gas-Supply Connector	1/2-inch self-sealing coupling
Gas-Return Connector	1/2-inch self-sealing coupling
Adsorber Service Schedule	Replace every year.

Longer lengths can be used.

LEGEND

1.	Top Panel	
2.	Elapsed-Time Meter (ETM)	Indicates total operating hours.
3.	Cold Head ON/OFF Switch (SW3)	Starts and stops the cold head. SW3 interlocks to SW1 which must be ON to operate.
4.	Compressor ON/OFF Switch (SW1)*	Starts and stops the compressor and cooling fan. The switch contains a built-in circuit breaker.
5.	Control Panel	
6.	Front and Side Panels	
7.	Return Pressure Gauge	Indicates return pressure.
8.	Supply Pressure Gauge	Indicates supply pressure.
9.	Gas Charge Fitting	Used to add or remove helium from the system.
10.	Input Power Cable	Connects the compressor to its power source.
11.	Cold Head Power Cable	Provides power to the cold head.
12.	Control Power Cable (used with 380/460-volt compressors only; see Table 1-1)	Supplies 220-volt, single-phase control power. Refer to specifications.
13.	Rear Panel	
14.	Oil Sight Glass	Used for checking the oil level in the compressor.
15.	Gas-Supply Connector	Self-sealing coupling for connecting the helium supply line from the compressor to the cold head.
16.	Gas-Return Connector	Self-sealing coupling for connecting the helium return line from the cold head to the compressor.
	Safety interlock switch (hidden)	Prevents the compressor from being turned on when the rear panel is removed.

*Reference designators relate to the electrical schematics shown in Figures B.1 and B.2.

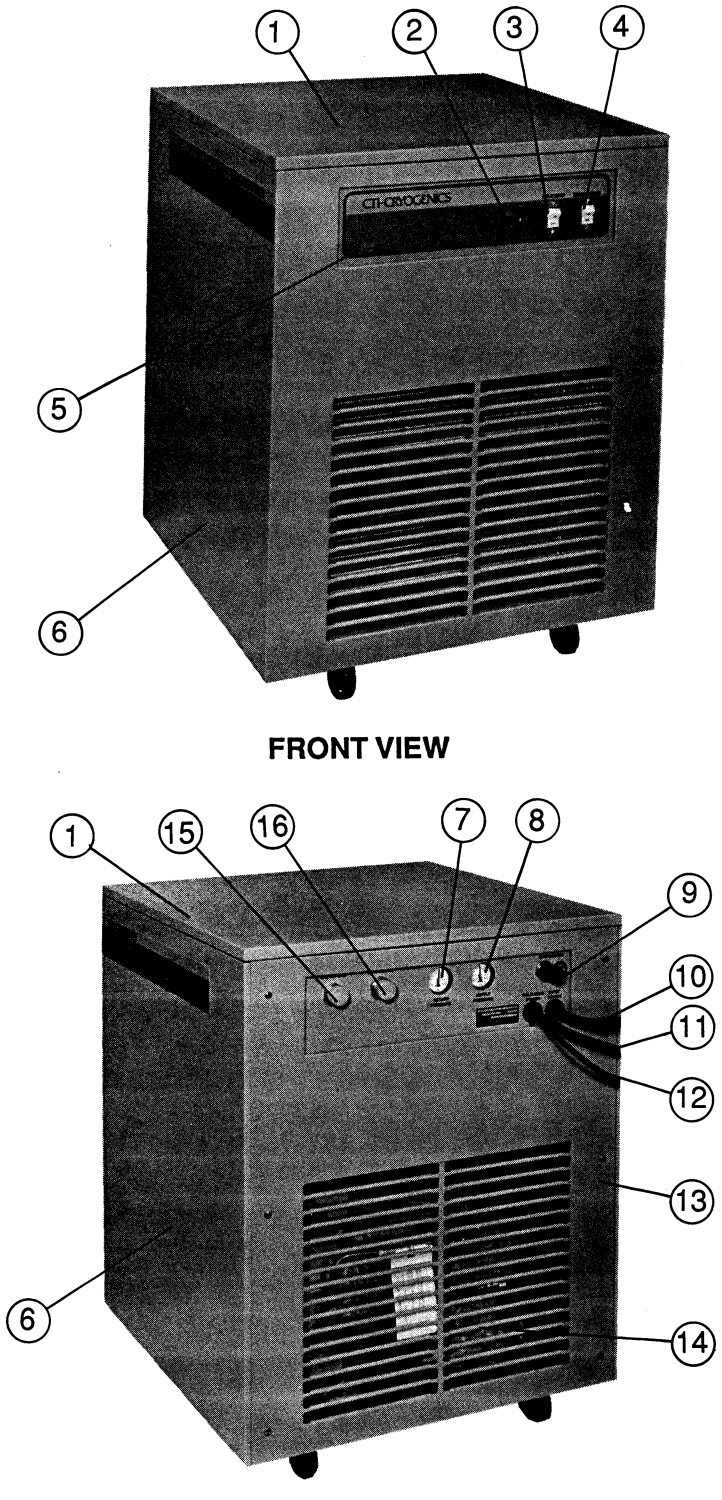

Figure 1.1 The Model 1020R (Air-Cooled) Compressor

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Section 2
Inspection

2.1 Packaging of the System

The Cryo-Torr High-Vacuum Pump System is packaged in three separate cartons. Listed below are the contents of each carton, depending upon which cryopump is included in the system. Note that an Installation, Operation and Servicing Manual is included in the carton for the high-vacuum pump and for the compressor; each manual covers the component packaged in that carton.

When installing a Cryo-Torr High-Vacuum Pump System, CTI recommends that as you unpack a component, you perform an inspection and the necessary tasks for system installation for the component according to the manual included with the component. Final system installation and operation will be performed following procedures in the high-vacuum pump manual that applies to your particular system.

CRYO-TORR HIGH-VACUUM PUMP SYSTEM		
CARTON LABEL	**SYSTEM COMPONENT**	**MANUAL INCLUDED**
Cryo-Torr®	Cryo-Torr 100, 7, 8 and 8F Cryopump	8040240
Cryo-Torr®	Cryo-Torr 10 Cryopump	8040252
Cryo-Torr®	Cryo-Torr 250F Cryopump	8040219
Cryo-Torr®	Cryo-Torr 250F Enhanced Capacity Cryopump	8040308
Cryo-Torr®	Cryo-Torr 400 Cryopump	8040259
Cryo-Torr®	Cryo-Torr 500 Cryopump	8040266
Compressor	Model 1020R (Air-Cooled) Compressor	8040274
Accessories	Installation and Scheduled Maintenance Tool Kit and Accessories, P/N 8032040G004.	None

2.2 The Compressor

On receipt, remove the 1020R Compressor from its shipping carton and inspect the compressor for evidence of damage as described in this Section. If evidence of damage is found, notify the shipper at once. Retain the original shipping carton for use during equipment storage or shipment.

1. Unpackage and remove the compressor from its shipping carton.
2. Inspect the exterior of the compressor for shipping damage.
3. Check the compressor supply pressure gauge. It should indicate 190-210 psig (1292-1428 kPa), or slightly higher if the compressor has been stored in a warm location. If the supply pressure gauge indicates 0 psig, contact the Product Service Department.
4. Remove the rear panel.
5. Inspect the interior of the compressor for evidence of damage or major oil loss.
6. Check the carton contents. It should contain:
   a. Model 1020R Compressor.
   b. Oil prime manifold, P/N 8018129.
   c. Model 1020R (Air-Cooled) Compressor Manual, P/N 8040274.

Section 3: Installation

3.1 Compressor Installation

The following procedures must be followed prior to making any system interconnections.

1. Refer to Figure 3.1 and remove the two washer-head nuts that secure the compressor pump tightly in position. Remove the two red flat washers and discard them.

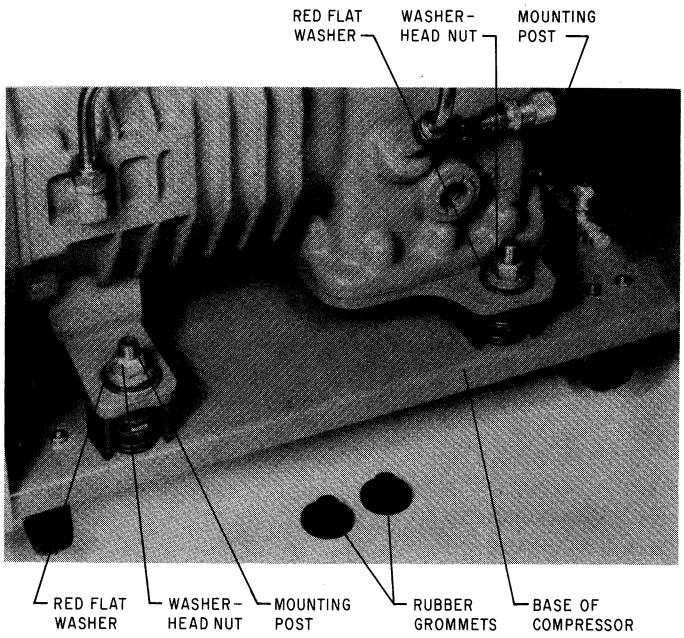


Figure 3.1 Compressor-pump mounting configuration

2. Remove the two rubber grommets that are in the package attached to the compressor; install them, flat side up, onto the two mounting posts.

3. Reinstall the two washer-head nuts and screw them down flush with the tops of the mounting posts.

4. Reinstall the rear panel on the compressor, reactivating the interlock switch (SW2).

5. Using a suitable voltmeter, measure and note the phase-to-phase voltage from the power source.

6. Ensure that both front switches on the compressor are off before connecting it to its power source. Then, plug the input power cable (10, Figure 1.1) and control power cable (12) (when applicable) into the power source: Refer to Table 1.1 for proper requirements.

7. Switch the compressor on and ensure that the fan is operating freely. Leave the unit on for 15 minutes.

8. Switch off the compressor, and disconnect the main power plug.

9. Remove the rear panel of the compressor and check that the adsorber is connected and confirm that the oil level is visible in the sight glass on the compressor pump. If the adsorber is not connected, connect it following the procedure in Figure 5.3. If no oil is visible due to a level below the sight glass, contact CTI-CRYOGENICS Product Service Department before proceeding.

10. Remove the top panel (1, Figure 1.1) as follows:

    a. Remove the two screws from the under side of the top panel that pass through the two brackets at the top of the rear frame and secure the top panel in place.

    b. Raise the rear of the top panel slightly and push the panel toward the front of the compressor until the slots at the front of the top panel are free of the washer-head screws in the compressor frame.

    c. Remove the top panel and set it aside.

11. On the compressors that use 380, 400, or 480 volts input power, remove the perforated-metal top cover of the electrical control chassis, and ensure proper input voltage to the cold head drive motor by making the following output connections for transformer T1 (5, Figure B.3). Refer to the electrical schematic (Figure B.2). Be sure to replace the perforated-metal cover on the electrical control chassis after the connections are completed.

    a. Compressors are shipped from the factory with tap 6 of transformer T1 employed for the output connection. Use this connection if the control voltage supplied to the compressor measures 215 VAC or greater.

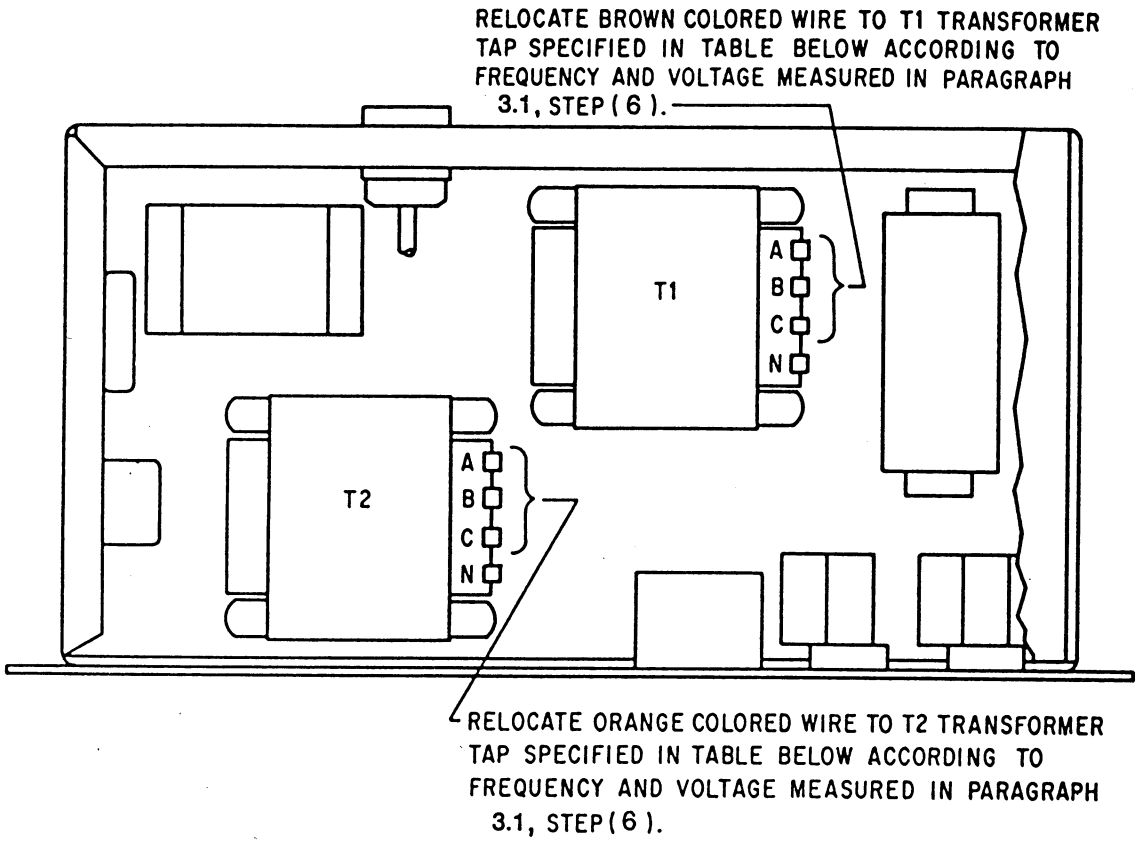
    b. If the control voltage supplied to the compressor measures less than 215 VAC, use tap 5 for the output connection. Move the slip-on lug from tap 6 to tap 5.

12. On compressors that use 200/220 and 208/230 volts input power, remove the perforated-metal top cover of the electrical control chassis. Using the phase-to-phase voltage that was measured in step 5, prepare the "Scott-T" transformers T1 and T2, in accordance with Figure 3.2. Be sure to replace the perforated-metal top cover of the electrical control chassis after the connections are completed.

13. Reinstall the top panel on the compressor, ensuring that the slots at the front of the top panel slip past the corresponding washer-head screws that project from the compressor frame.

14. Reinstall the rear panel on the compressor, reactivating the interlock switch.

15. Install the compressor into its permanent location on a level surface. Allow a minimum clearance of 12 inches (30 cm) at the front and back to ensure adequate airflow.



FREQUENCY (HZ)	VOLTAGE	TRANSFORMER TAP SETTINGS T1 AND T2
50	190-210	B
50	*210-230	C
60	198-230	B
60	*230-253	C

*Factory Setting

Figure 3.2 Preparation of electrical control module (200/220 and 208/230 volts input power)

3.2 Connecting the Compressor to the Cryopump

A component interconnection diagram for the Model 1020R Compressor is shown in Figure 3.3.

⚠WARNING

The two power ON/OFF switches on the compressor front panel must be in the OFF position before making any and all electrical and gas line connections to the cryopump.

1. Remove all dust plugs/caps from both interconnecting helium lines, and from the gas-supply and gas-return connectors on the cold head and on the rear of the compressor.
2. Connect the interconnecting piping between the compressor and the cold head in the order listed below.

   Note: Read the pressure on the compressor supply pressure gauge (7, Figure 1.1) as each line is connected. The required static pressure is 185 ± 5 psig (1225-1290 kPa), in an ambient-temperature range of 70°F to 80°F (21°C to 27°C).

   a. Connect the helium return line to the gas-return connector on the rear of the compressor.

   b. Connect the helium supply line to the gas-supply connector on the rear of the compressor.

   c. Connect the helium supply line to the gas-supply connector on the cold head.

   d. Connect the helium return line to the gas-return connector on the cold head.

3. If the indicated pressure is higher than 190 psig (1258 kPa), reduce the pressure as follows:

   a. Remove the flare cap from the gas charge fitting (9, Figure 1.1) on the rear of the compressor.

   b. While observing the supply pressure gauge, very ***slowly*** (and only slightly) open the gas charge valve and reduce the gauge indication to 185 psig (1260 kPa).

   c. Close the gas charge valve after the correct charge pressure has been obtained, and reinstall the flare cap.

4. If the indicated pressure is lower than 180 psig (1225 kPa), add helium gas as described in Section 5.2.1.

3.3 Electrical Connection of Compressor

⚠WARNING

1. Never connect the cold head power cable to the cold head while the compressor is running.
2. Ensure that both of the switches on the front of the compressor are off before connecting the compressor to its power source.

1. Connect the cold-head power cable (11, Figure 1.1) of the compressor to the electrical power connector of the cold head.
2. Plug the input power cable and the control power cable (where applicable) into the power source.
3. Switch the compressor and cold head ON/OFF switches to ON and check the cold head for clockwise rotation as viewed through the sight glass.

   Note: The low voltage (200/220 and 208/230 input power) compressor employs a phase monitor (PM) in the control module to prevent the refrigerator starting if the input power is phased incorrectly. Incorrect phasing will cause the refrigerator motor to "hunt" clockwise and counterclockwise, not completing a rotation in either direction. If this is the case, disconnect the input power cable from the power source and reverse the X and Y electrical leads at the compressor plug.

3.4 Multipump Installation

Your 1020R Compressor can be connected to more than one high-vacuum pump at a time. For example, three Cryo-Torr 8 vacuum pumps can be connected to a single 1020R Compressor.

If you are considering a multiple cryopump installation, please contact the CTI-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.

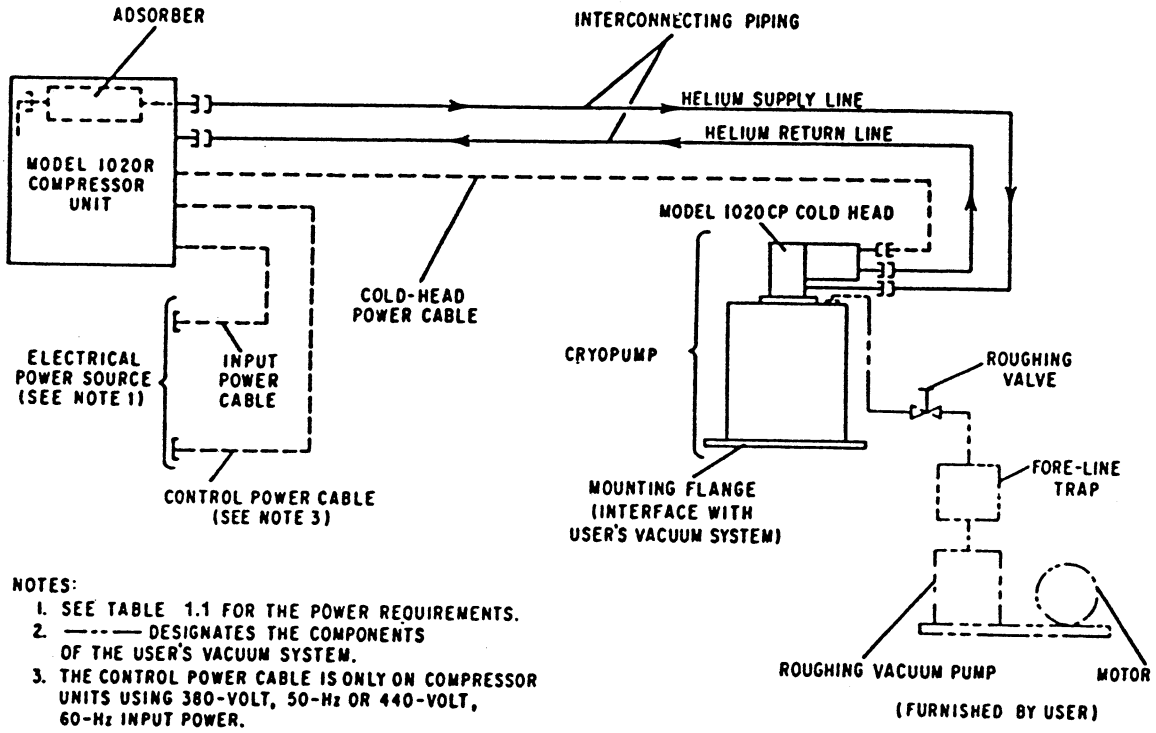


Figure 3.3 Component interconnection diagram for the Model 1020R Compressor

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Section 4
Functional Description

4.1 The Compressor (see Figure 1.1)

The compressor is designed to operate unattended while providing a constant supply of clean helium to the cold head at the proper operating pressure. It consists of a compressor pump, a cooling system, an oil-injection system, an oil separation system, and an adsorber. In addition, the compressor is equipped with a pressure gauge and an electrical-control-chassis. See Table 1-1 for the electrical power specifications. Refer to Appendix B for information relating to the electrical circuits of the compressor.

4.2 Gas and Oil Flows in the Compressor (see Figure 4.1)

Since helium has a low specific heat, it is unable to adequately carry the heat produced during compression out of the compressor, unless a small quantity of oil is injected into the gas stream to keep the compression chamber cool and assist in removing this heat. Most of this oil comes from the bulk oil separator.

Helium returning from the cold head at suction (i.e., low) pressure goes to the compressor pump where it is compressed to supply (i.e., high) pressure. When the helium gas is compressed, it heats; it must then pass through a heat exchanger to remove the heat of compression. Since the compressor is oil-lubricated (and oil is added to the helium flow), a bulk oil separator is used to remove most of the oil from the helium. The helium gas then goes through a second separator (oil-mist) where the remaining oil is removed. Finally, a charcoal filter (adsorber) is used to remove any remaining contaminants.

4.3 Pressure Regulation in the Compressor (see Figure 4.1)

A 235-psi differential-pressure relief valve is incorporated in the compressor that limits the operating pressure differential between the helium supply and return lines. This function allows the compressor to be run without operating the cold head. As soon as cryocooler operation reaches a steady-state condition, further pressure regulation is unnecessary.

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Section 5: Maintenance

The only scheduled maintenance required for the 1020R Compressor is the replacement of the compressor adsorber after 1 year of operation. When the compressor is used at 50 Hz power, the actual elapsed time will 1.2 times that which is shown on the meter. Unscheduled maintenance is concerned with the addition of helium gas to the system.

⚠WARNING

Always disconnect the high-vacuum pump from all sources of electrical power before performing any maintenance.

5.1 Scheduled Maintenance - Replacing the Adsorber Part No. 8080260K001

Replace the adsorber as follows after a maximum of 4,500 hours of operation, as indicated by the elapsed-time meter.

1. Disconnect the input power cable and control power cable (when applicable) of the compressor from its electrical power source.
2. Disconnect the self-sealing couplings (Figure 5.1) from the gas-return and gas-supply connectors at the rear of the compressor.
3. Remove the rear panel.
4. Remove the two screws from the under side of the top panel that pass through the two brackets at the top of the rear frame and secure the top panel in place.
5. Raise the rear of the top panel slightly and push the panel toward the front of the compressor until the slots at the front of the top panel are free of the washer-head screws that project from the compressor frame. Remove the top panel.
6. Remove the adsorber from the compressor as shown in Figure 5.2, disconnecting the self-sealing couplings per Figure 5.1.

⚠WARNING

Depressurize the adsorber before disposing of it. Attach the depressurization fitting, (included in installation tool kit), to the coupling half at either end of the adsorber and tighten it slowly.

7. Install the replacement adsorber as follows:

   Note: The adsorber used in the Model 1020R Compressor is symmetrically designed, so that either of its two self-sealing coupling halves can serve as the adsorber-inlet connection or as the adsorber-outlet connection.

a. Remove the dust caps from the self-sealing coupling halves at each end of the replacement adsorber.

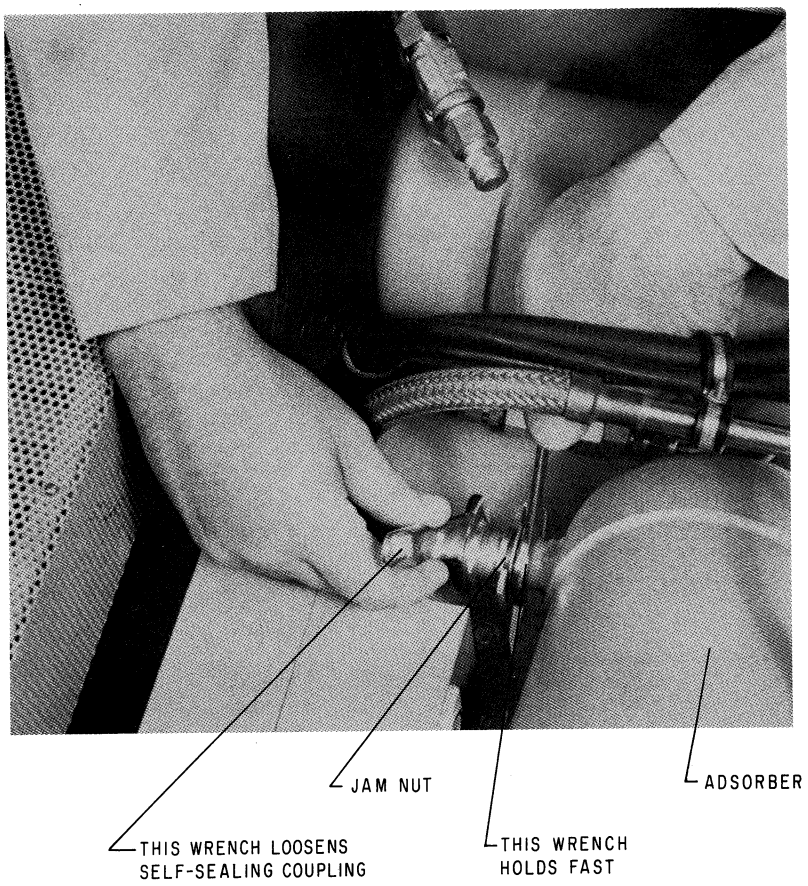
b. Install the replacement adsorber by performing the steps in Figure 5.2 in the reverse order. Reconnect the self-sealing couplings per Figure 5.3.

5.2 Unscheduled Maintenance

5.2.1 Adding Helium Gas

⚠CAUTION

If the supply pressure gauge indicates 0 psig, contact the Product Service Department.



1. Use two wrenches (supplied) to avoid loosening the body of the coupling from its adapter.
2. Unscrew the two self-sealing coupling halves. Minor gas leakage may occur while turning the connecting half. Complete the disconnection quickly to minimize gas loss.

Figure 5.1 Procedure for disconnecting a self-sealing coupling

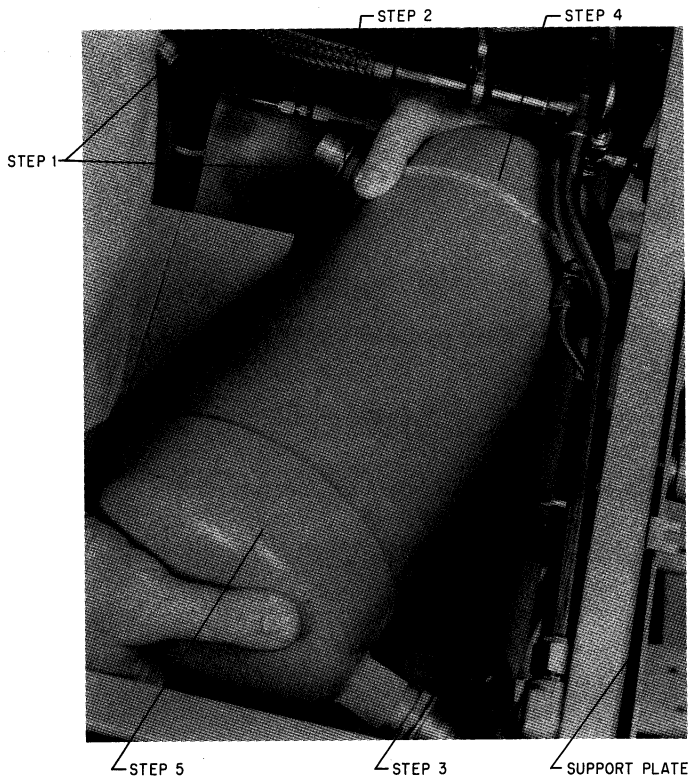
During normal operation, it should rarely be necessary to add helium gas. If you need to add gas frequently, it is important that you check for leakage. Many leaks are caused by improperly tightened self-sealing coupling connections or improperly seated relief valves.

To add helium gas, proceed as follows:

⚠CAUTION

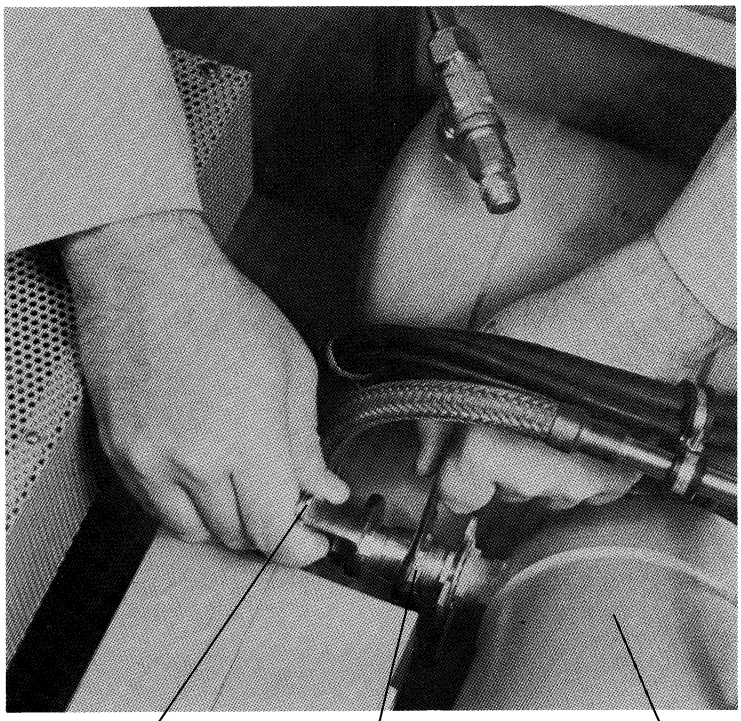
Do not use helium gas that is less than 99.999% pure.

1. Remove the flare cap from the gas charge fitting on the rear of the compressor.



1. Disconnect the adsorber-inlet self-sealing coupling.
2. Remove the jam nut that secures the adsorber-inlet self-sealing coupling half to its support brackets.
3. Remove the jam nut that secures the adsorber-outlet self-sealing coupling half to its support plate.
4. Raise the inlet end of the adsorber until it clears the support bracket.
5. Move the outlet end of the adsorber inward until it clears the support plate. Then remove the adsorber, retaining all hardware.

Figure 5.2 Removing the adsorber from the Model 1020R Compressor



1. Ensure that the flat rubber gasket is clean and in place before connecting a self-sealing coupling.
2. Use two wrenches (supplied) to avoid loosening the body of the coupling from its adapter.
3. Screw the two self-sealing coupling halves together (make the first few turns by hand). Minor gas leakage may occur while turning the connection half. Complete the connection quickly to minimize gas loss.
4. Be sure the coupling is firmly seated; do not apply more than 35 foot-pounds of torque.

Figure 5.3 Procedure for connecting a self-sealing coupling

2. Connect a helium bottle to the gas charge fitting by loosely attaching a charging line from the 1/4 inch male fitting installed on the helum charge valve. A two-stage regulator having a delivery pressure range of 10 to 30 psig is recommended.

⚠CAUTION

Perform the following procedure to ensure proper decontamination of the user's regulator and charging line.

1. Before opening the helium bottle valve, turn the adjusting screw on the regulator clockwise until the regulator is fully open.

2. Open the valve on the helium bottle and immediately turn the adjusting screw on the regulator counterclockwise until the helium flow stops.

3. Set the pressure regulator to 10 to 25 psig, bleeding helium throught the charging line. Allow the gas to flow freely around the lossened flare fiting for 30 seconds to purge the charging line of air. Complete the purge by tightening the flare nut at the end of the charging line.

4. Reset the pressure regulator to 200-225 psig. Then perform step a or b below, depending upon whteher the compressor is running or not running:

   a. Compressor is running (normal operating condi tions): Slowly open the helium charge valve on the rear of the compressor unil the supply gauge rises to 260 psig.

   b. Compressor is not running (70° F to 80° F ambient temperature): Slowly open the helium charge valve on the rear of the compressor unil the supply and return gauges both rise to 185 psig. Then, close the charge valve. The return pressure gauge reading will lag that of the supply pressure gauge.

5. Ensure that the helium charge valve on the compressor is tightly closed. Shut off the pressure regulator on the helium bottle, remove the charging line from the male fitting, and reinstall the flare cap.

5.2.2 Decontamination Procedures

Refer to the Cryoump Installation, Operation, and Service Instructons manual for more information.

5.2.3 Priming the Compressor Oil System

Included with the Model 1020R Compressor is the oil-prime manifold, P/N 8018129. This tool, shown in Figure 5-4, is used to prime the oil system of the compressor when either of the floowing two conditions exist (steps 1 or 2 below):

1. The compressor has shut off automatically due to a loss of helium supply pressure. When this happens, add helium per Section 5.2.1. Then, prime the oil system as outlines in steps 3 - 8 below.

2. The compressor is not running and the supply pressure gauge, mounted on the rear, reads 0 psig.

⚠CAUTION

Whenever this condition exists, contat the Product Service Department for proper corrective action before priming the compressor oil system.

3. Disconnect the self-sealing couplings from the gas return and gas supply connectors at the rear of the compressor as shown in Figure 5.1.

4. Install the oil-primed manifold onto these connectors, attaching the the self-sealing couplings as shown in Figure 5.3.

5. Read the supply pressure and return pressure gauges to confirem thst the charge pressure has remained at 180-190 psig (1125-1292kPa). If necessary, ad helium per Section 5.2.1.

6. Start the compressor and let it run between 30-60 minutes. (Immediately after this priming start-up, the readings of the supply pressure gauge and the return pressure gauge will change to approximately 250 psig and 100 psig respectively).

7. After this oil-system priming period, turn OFF the compressor and remove the oil-priming manifold per Figure 5.1

8. Reconnect the self-sealing couplings, matching the identification tags on the ends of the helium supply and return lines. Start up the system per Section 3.3.

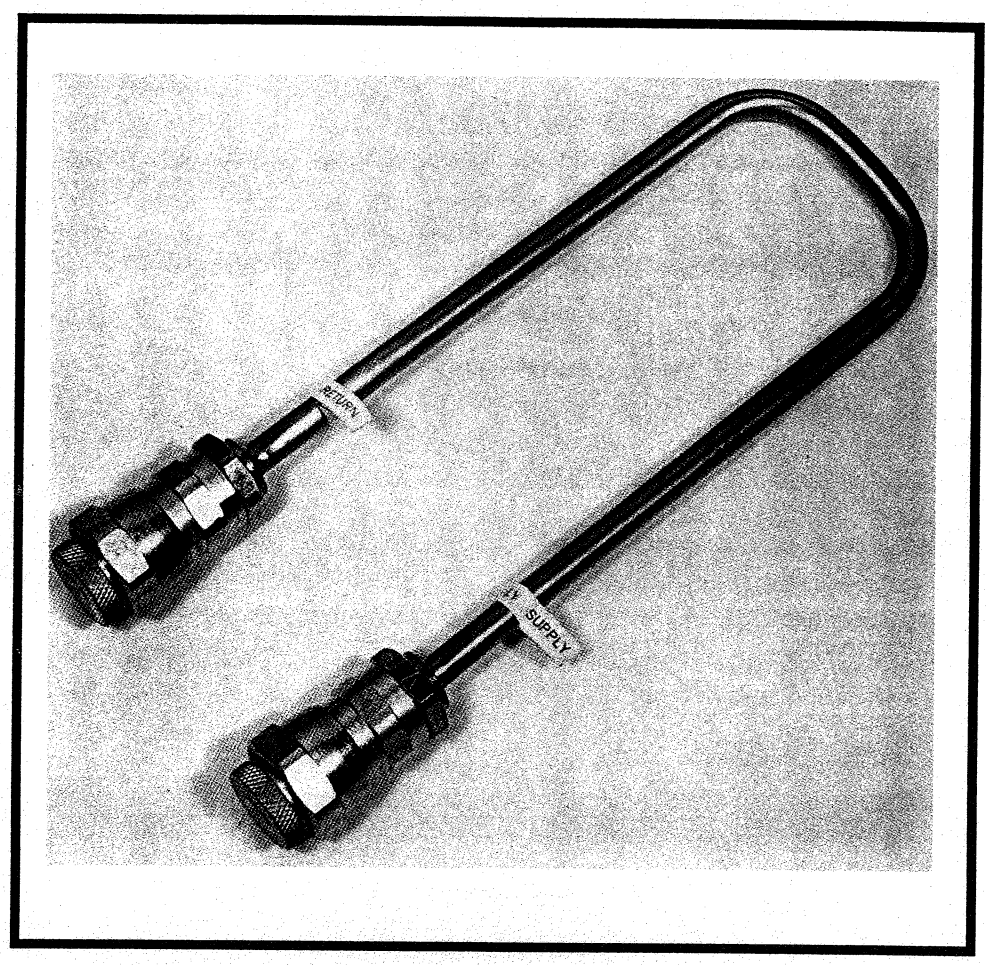


Figure 5.4 The oil-prime manifold

Appendix A
Procedures

A.1 Troubleshooting the Compressor

The compressor troubleshooting procedures are summarized in Table A.1.

A.2 Technical Inquiries

Please refer to page ii of this manual for a complete list of the CTI-CRYOGENICS' world wide customer support centers.

Table A.1 Compressor Troubleshooting Procedures

⚠WARNING

1. Disconnect the compressor from its power source before making any continuity checks.
2. The compressor pump is hot after the compressor has been operating! Use caution if it is not possible to wait for the pump to cool down before working inside the compressor.

Note: Refer to Figures B.1 through B.4 for identification of electrical components.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
1. The cooling fan operates but the compressor pump does not.	1. Incorrect electrical power.	1. Ensure presence of specified electrical power.
	2. The motor contactor overload contacts have opened.	2. Allow time for the motor contactor heaters to cool. Then depress and release the red reset button on the motor contactor. If this action does not correct the fault, contact the Product Service Department for assistance.
2. The compressor ON/OFF switch remains in the ON position when switched on, but: neither the compressor pump nor the cooling fan will run.	1. No power at the prime power source.	1. Ensure presence of specified electrical power.
	2. Internal wiring problem.	2. Ensure proper compressor wiring. If necessary, contact the Product Service Department.

Table A.1 Compressor Troubleshooting Procedures (Cont.)

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
3. The compressor ON/OFF switch will not remain in the ON position.	1. The safety interlock switch is open.	1a. Ensure that the rear panel is securely in place. b. Ensure proper operation of safety interlock switch (SW2) located on the left side of the upper deck just behind the rear panel.
	2. Thermal protective switch TS1, TS2 or TS3 is open.	2. Ensure that switches TS1, TS2 and TS3 are closed.
	3. High current has activated the overload trip in the compressor ON/OFF switch.	3. Contact the Product Service Department for assistance.
4. The compressor pump stops after several minutes of operation.	1. Compressor pump motor temperature is excessively high, causing protective switch TS2 or TS3 to open.	1. Check for proper fan operation and unrestricted airflow.
	2. Insufficient helium charge pressure.	2. Check the supply and return pressure gauges after equalization. If either gauge reads less than 185 ± 5 psig (1225-1292 kPa), prime the oil system.
	3. Main power supply voltage is below specified minimum.	3. Restore voltage to be within the specified range.
	4. Temperature of helium discharge gas is too high.	4a. Ensure an ambient temperature within specified limits. b. Ensure a visible oil level in the compressor sight glass. If no oil is visible, contact the Product Service Department.

Table A.1 Compressor Troubleshooting Procedures (Cont.)

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
4. The compressor pump stops after several minutes of operation. (cont.)	5. Insufficient oil in the bulk-oil separator.	5. Prime the compressor oil system per Section 5.2.3.
	6. Failure of the oil-injection solenoid valve to the compressor pump.	6. Turn the compressor OFF. Electrically disconnect the solenoid coil from the rest of the circuit (see Figures B.1 and B.2) and check the coil for continuity. If continuity does not exist, the coil must be replaced. Contact the Product Service Department for assistance.
	7. Mechanical seizure.	7. Contact the Product Service Department to discuss the repair or disposition of the unit.

Appendix B

Electrical Schematic and Location Information

Electrical schematics (Figures B.1 and B.2) and illustrations showing the physical location of electrical control-chassis components (Figures B.3 and B.4) are provided in case an electrical problem beyond the scope of this manual should occur.

Figure B.1 is the electrical schematic for Model 1020R Compressors that use 208-volt or 230-volt, 60 Hz input power or use 200-volt or 220-volt, 50 Hz input power. Figure B.2 is the corresponding schematic when 440-volt, 60 Hz or 380-volt, 50 Hz input power is used.

The series-trip coils in the compressor ON/OFF switch (SW1) are circuit breakers that will automatically switch SW1 to the OFF position in the event of a current overload. The relay-trip coil in SW1 can be activated by TS1, TS2, or SW2; SW1 will automatically switch to the OFF position. Once SW1 has been automatically switched to the OFF position, it will remain in that position until manually placed in the ON position.

A motor contactor is used to protect the compressor-pump motor of a Model 1020R Compressor that has 440-volt, 60 Hz or 380-volt, 50 Hz input power (Figure B.2). This motor contactor operates as follows:

1. Switching the compressor ON/OFF switch (SW1) to ON energizes the coil of the motor contactor.
2. This causes the three sets of operating contacts to close.
3. Current then flows through the three heaters to activate the compressor-pump motor.
4. If an overcurrent condition develops, the heaters cause the overload contacts to open.
5. After the heaters cool, the red reset button on the motor contactor must be depressed and released in order to close the overload contacts and reactivate the compressor-pump motor.

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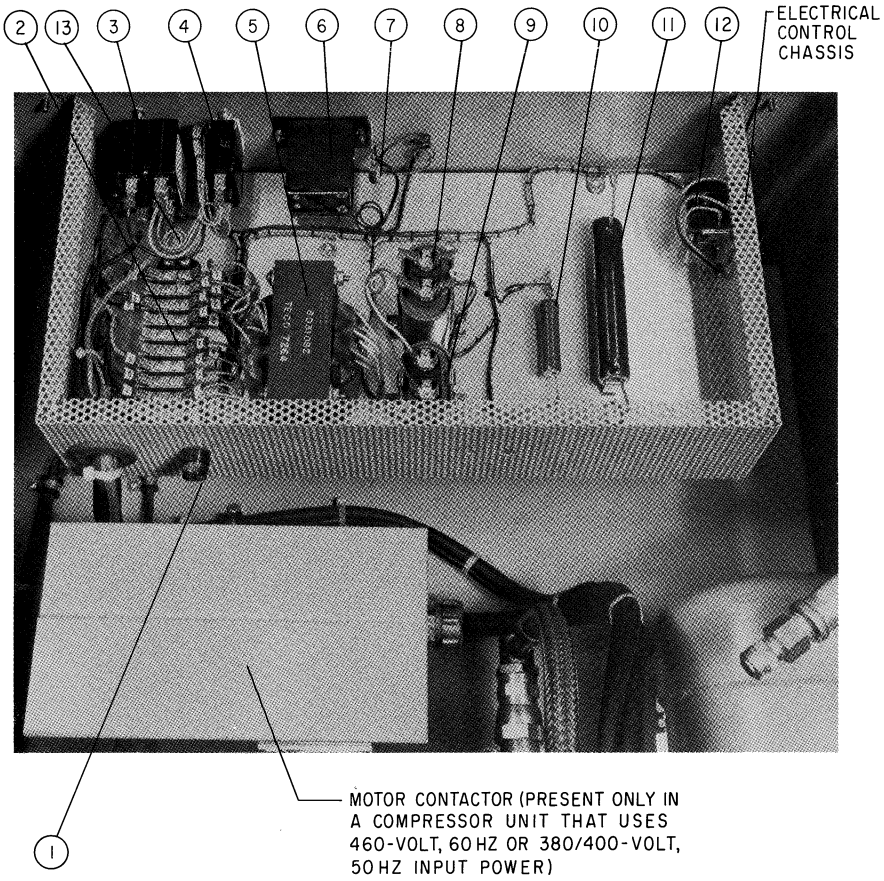
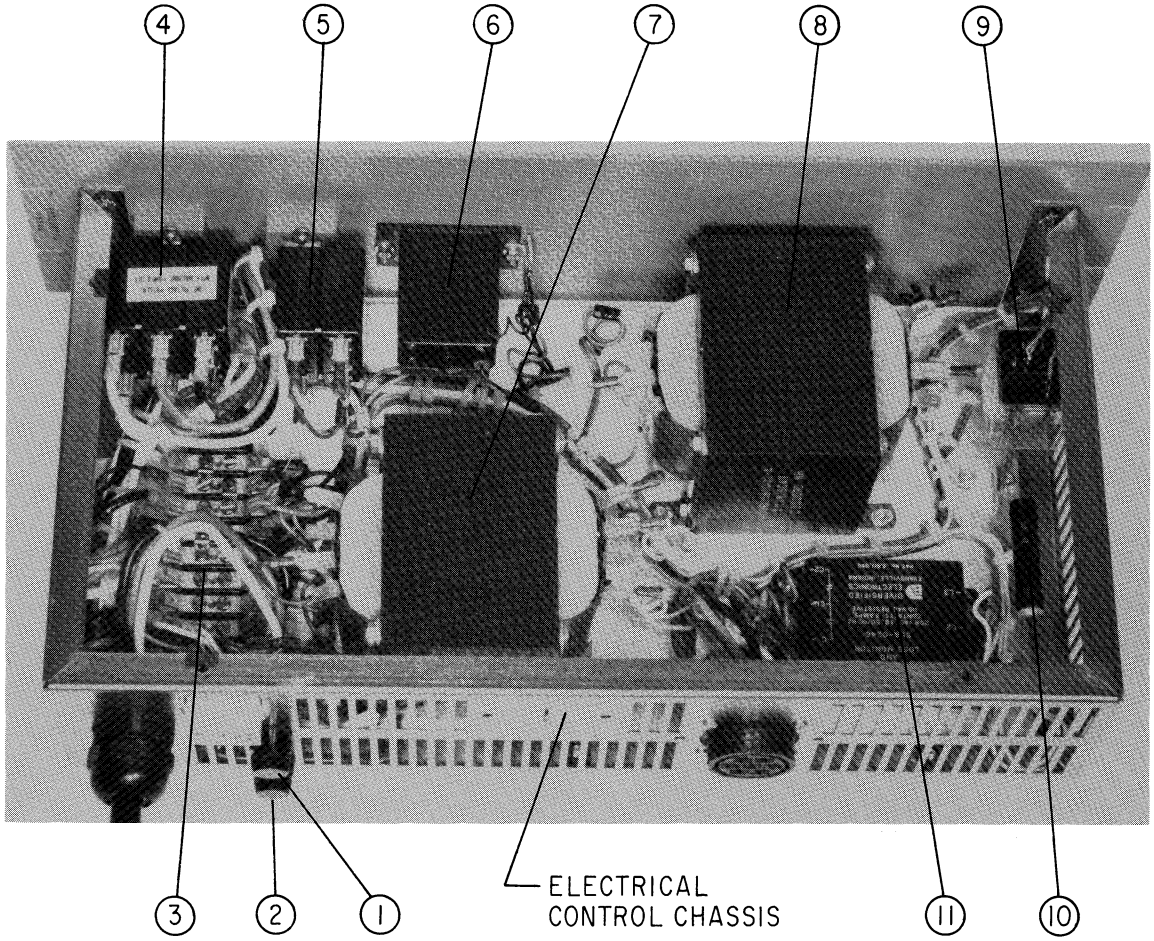


Item Number	Description	Symbol Designation
1	1.0 Ampere Fuse	FX1
2	Terminal Board No. 1	TB1
3	Compressor ON/OFF Switch	SW1
4	Cold Head ON/OFF Switch	SW3
5	Step-down Transformer	T1
6	Elapsed-Time Meter	ETM
7	13K-ohm, 2-watt Resistor	R1
8	6-microfarad Capacitor	C1
9	2-microfarad Capacitor (50 Hz only)	C2
10	5K-ohm, 20-watt Resistor	R3
11	150-ohm, 50-watt Resistor	R2
12	Control Relay for Relay-Trip Circuit	CR1
13	330-ohm (+ 10%) Resistor)	R4

Figure B.3 Components in the compressor electrical control chassis (380, 400, 460, and 480 volts input power)



Item Number	Description	Symbol Designation
1	2.0 Ampere Fuse	FX1
2	2.0 Ampere Fuse	FX1
3	Terminal Board No. 1	TB1
4	Compressor ON/OFF Switch	SW1
5	Cold Head ON/OFF Switch	SW3
6	Elapsed-Time Meter	ETM
7	Cold Head "Scott-T" Drive Transformer	T1
8	Cold Head "Scott-T" Drive Transformer	T2
9	Control Relay for Relay-Trip Circuit	CR1
10	5K-ohm, 20-watt Resistor	R3
11	Phase Monitor	PM

Figure B.4 Components in the compressor electrical control chassis (200/220 and 208/230 volts input power)

Appendix C - Customer Support Information

Customer Support Center Locations

To locate a Customer Support Center near you, please visit our website ***www.helixtechnology.com*** on the world wide web and select *CONTACT* on the home page.

Guaranteed Up-Time Support (GUTS)

For 24 hour, 7 day per week Guaranteed Up-Time Support (GUTS) dial:

800-367-4887 - Inside the United States of America

508-337-5599 - Outside the United States of America

Product Information

Please have the following information available when calling so that we may assist you:

- Product Part Number
- Product Serial Number
- Product Application
- Specific Problem Area
- Hours of Operation
- Equipment Type
- Vacuum System Brand/Model/Date of Manufacture

E-mail

For your convenience, you may also e-mail us at:

techsupport@helixtechnology.com

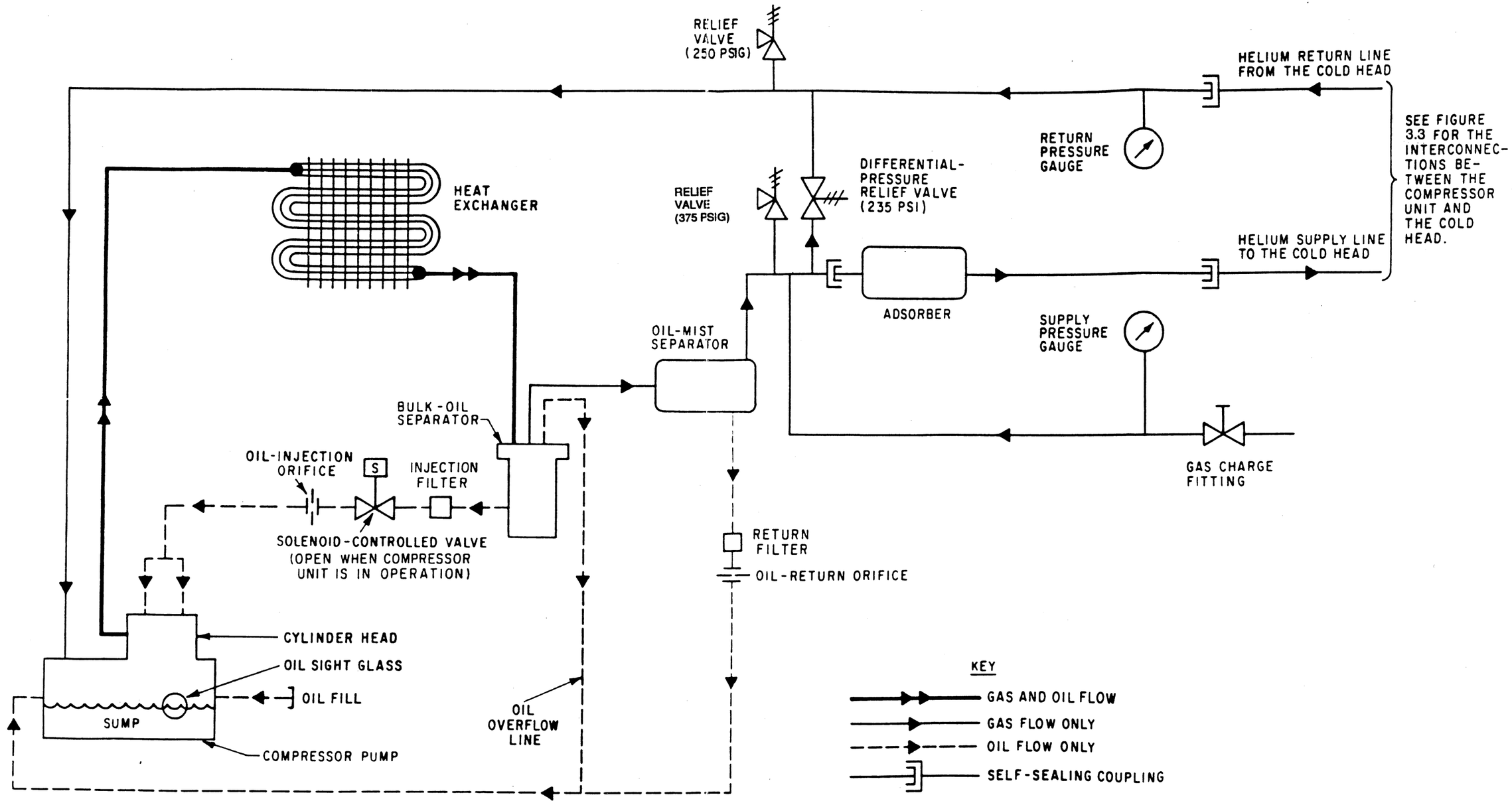


Figure 4.1 Flow diagram for the Model 1020R Compressor

LEGEND FOR FIGURE B.1

CR1 - Control relay for relay-trip circuit

ETM - Elapsed-time meter

FAN - Cooling fan

FX1/FX2 - Cold head circuit fuses (2 amperes)

PM - Phase monitor

R1 - Ballast resistor for elapsed-time meter (13,000Ω, 2W)

R3 - Compressor-unit start resistor (5,000Ω, 20W)

R4 - Current-limiting resistor (330Ω, ± 10%)

SOL - Solenoid coil of the solenoid-controlled valve in the oil-injection line of the compressor

SW1 - Compressor unit ON/OFF switch

SW2 - Interlock switch (located behind rear panel)

SW3 - Cold head ON/OFF switch

T1/T2 - Cold head "Scott-T" drive transformer

TB1 - Terminal board for the electrical-control chassis

TS1 - Thermal protective switch that opens if the compressed helium discharged from the compressor pump becomes too hot

TS2 - Thermal protective switch that opens if the compressor pump motor becomes overheated

Note: To provide the proper output connections for transformers T1 and T2, refer to Figure 3.2.

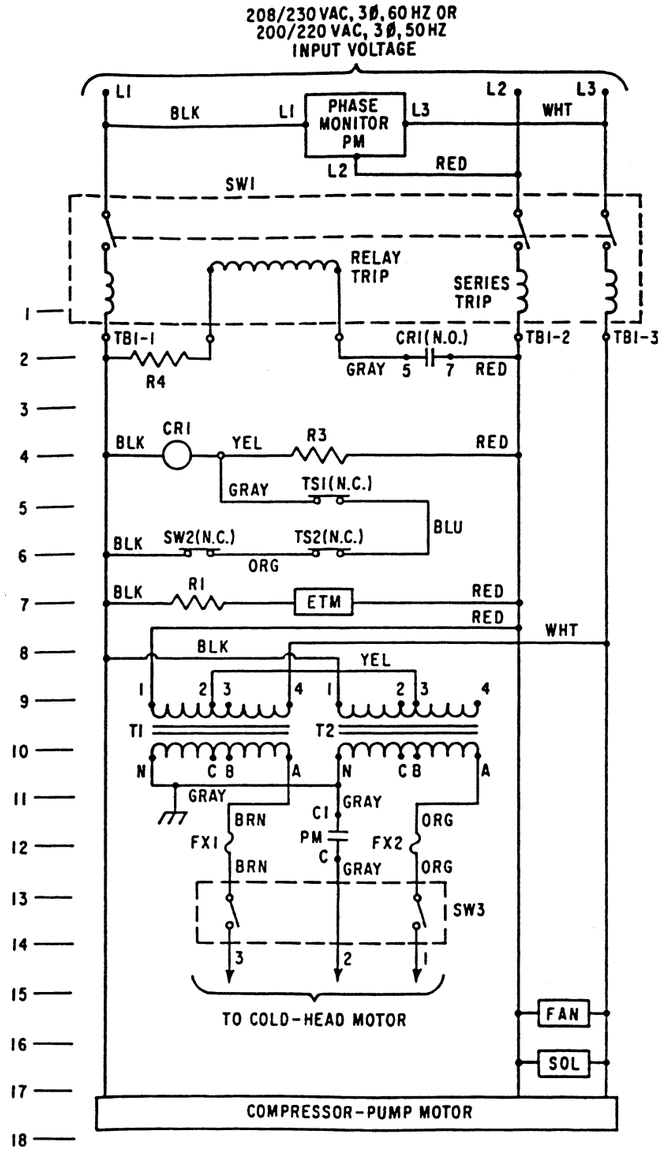


Figure B.1 Electrical schematic for the Model 1020R compressor P/N 8031023G001 or P/N 8031023G002

LEGEND FOR FIGURE B.2

C1 - Cold head drive-motor phase-shifting capacitor (6μFD, 330V)

C2 - Cold head drive-motor phase-shifting capacitor (2μFD, 440V) (for 50 Hz operation only)

CR1 - Control relay or relay-trip circuit

ETM - Elapsed-time meter

FAN - Cooling fan

FX1 - Cold head circuit fuse (1 ampere)

R1 - Ballast resistor for elapsed-time meter (13,000Ω, 2W)

R2 - Cold head drive-motor phase-shifting resistor (140Ω, 100W)

R3 - Compressor start resistor (5,000Ω, 20W)

R4 - Current-limiting resistor (330Ω ± 10%)

SOL - Solenoid coil of the solenoid-controlled valve in the oil-injection line of the compressor

SW1 - Compressor ON/OFF switch

SW2 - Interlock switch (located behind rear panel)

SW3 - Cold head ON/OFF switch

T1 - Cold head isolation transformer

TB1 - Terminal board for the electrical control chassis

TB2 - Terminal board for the compressor

TS1 - Thermal protective switch that opens if the compressed helium discharged from the compressor pump becomes too hot

TS2 - Thermal protective switch that opens if the compressor pump motor becomes overheated

Notes:

1. See Table 1.1 for the electrical power requirements of compressor part numbers 8031023G003 and 8031023G004.
2. Capacitor C2 is for 50 Hz operation only.
3. The operation of the motor contactor is discussed in the text of Appendix B.
4. To provide the proper output connections for transformer T1, refer to Figure 3.2.

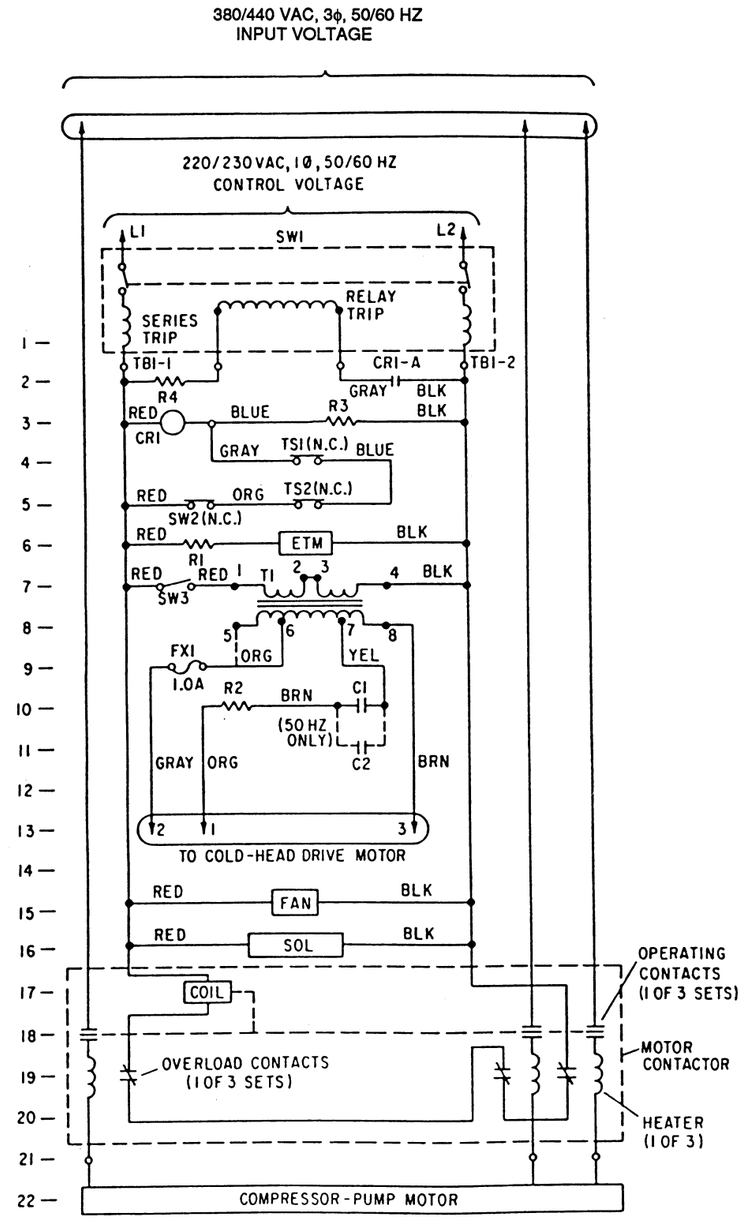


Figure B.2 Electrical schematic for the Model 1020R compressor P/N 8031023G003 or P/N 8031023G004

LEGEND FOR FIGURE S.1

CR1 - Control relay for relay-trip circuit

ETM - Elapsed-time meter

FAN - Cooling fan

FX1/FX2 - Cold head circuit fuses (2 amperes)

PM - Phase monitor

R1 - Ballast resistor for elapsed-time meter (13,000Ω, 2W)

R3 - Compressor-unit start resistor (5,000Ω, 20W)

R4 - Current-limiting resistor (330Ω, ± 10%)

SOL - Solenoid coil of the solenoid-controlled valve in the oil-injection line of the compressor

SW1 - Compressor unit ON/OFF switch

SW2 - Interlock switch (located behind rear panel)

SW3 - Cold head ON/OFF switch

T1/T2 - Cold head "Scott-T" drive transformer

TB1 - Terminal board for the electrical-control chassis

TS1 - Thermal protective switch that opens if the compressed helium discharged from the compressor pump becomes too hot

TS2 - Thermal protective switch that opens if the compressor pump motor becomes overheated

Note: To provide the proper output connections for transformers T1 and T2, refer to Figure 3.2.

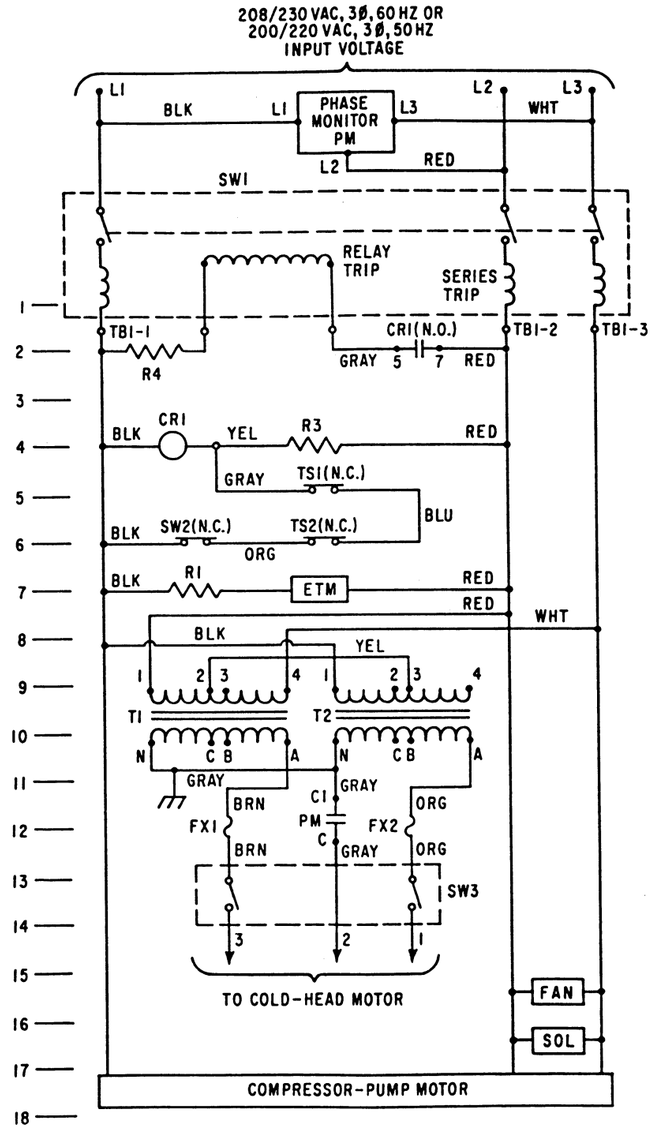


Figure S.1 Electrical schematic for the Model 1020R compressor P/N 8031023G001 or P/N 8031023G002

LEGEND FOR FIGURE S.2

C1 - Cold head drive-motor phase-shifting capacitor (6μFD, 330V)

C2 - Cold head drive-motor phase-shifting capacitor (2μFD, 440V) (for 50 Hz operation only)

CR1 - Control relay or relay-trip circuit

ETM - Elapsed-time meter

FAN - Cooling fan

FX1 - Cold head circuit fuse (1 ampere)

R1 - Ballast resistor for elapsed-time meter (13,000Ω, 2W)

R2 - Cold head drive-motor phase-shifting resistor (140Ω, 100W)

R3 - Compressor start resistor (5,000Ω, 20W)

R4 - Current-limiting resistor (330Ω ± 10%)

SOL - Solenoid coil of the solenoid-controlled valve in the oil-injection line of the compressor

SW1 - Compressor ON/OFF switch

SW2 - Interlock switch (located behind rear panel)

SW3 - Cold head ON/OFF switch

T1 - Cold head isolation transformer

TB1 - Terminal board for the electrical control chassis

TB2 - Terminal board for the compressor

TS1 - Thermal protective switch that opens if the compressed helium discharged from the compressor pump becomes too hot

TS2 - Thermal protective switch that opens if the compressor pump motor becomes overheated

Notes:

1. See Table 1.1 for the electrical power requirements of compressor part numbers 8031023G003 and 8031023G004.
2. Capacitor C2 is for 50 Hz operation only.
3. The operation of the motor contactor is discussed in the text of Appendix B.
4. To provide the proper output connections for transformer T1, refer to Figure 3.2.

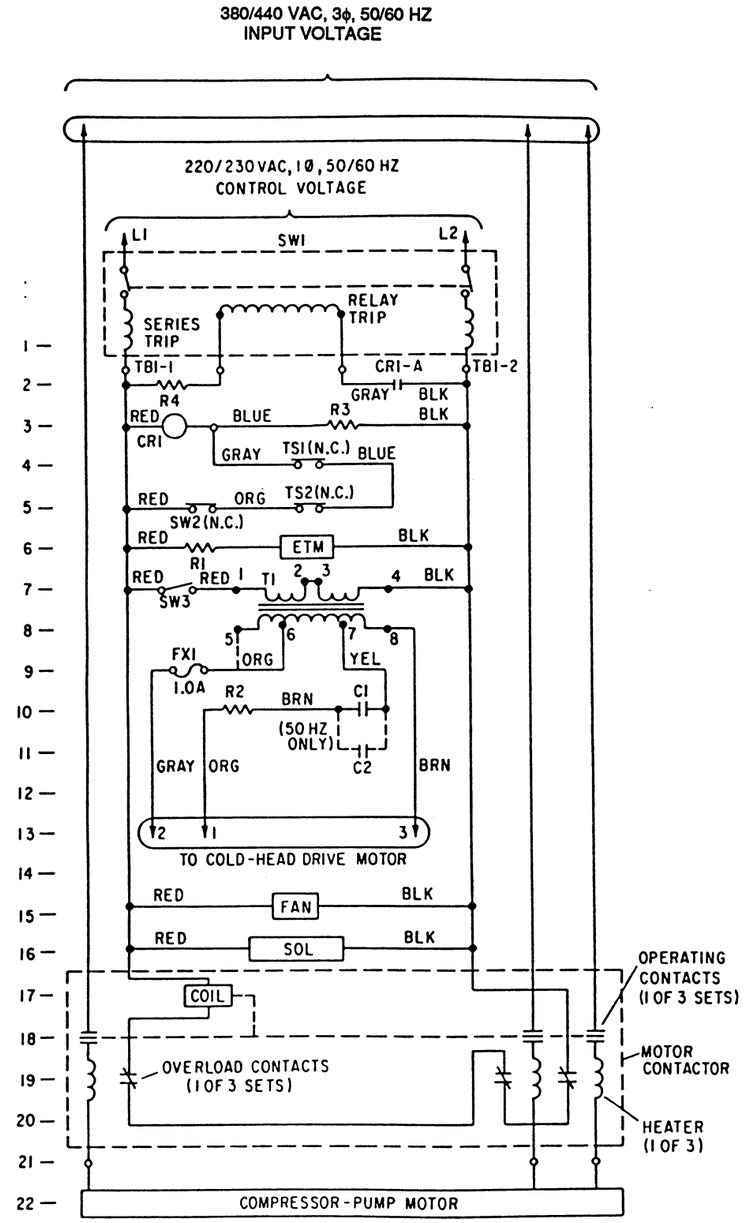


Figure S.2 Electrical schematic for the Model 1020R compressor P/N 8031023G003 or P/N 8031023G004