HELIX

On-Board® *IS* Cryopump Installation and Maintenance Instructions

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HELIX

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Cryopump Safety

Introduction

All On-Board®, On-Board® *IS*, and Cryo-Torr® products are designed to provide extremely safe and dependable operation when properly used. You must observe safety precautions during normal operation and when servicing On-Board, On-Board *IS,* and Cryo-Torr systems.

NOTE: Read this manual and follow the safety guidelines in this chapter before installing, operating, or servicing On-Board, On-Board IS, and Cryo-Torr products.

Safety Symbols

The safety symbols in this manual conform to ISO 3864 and ANSI Z535 standards. Table S-1 describes the kinds of symbols used in this manual.

Table S-1: Safety Symbols

Symbol Type	Example	Description
Warning		Identifies the hazard; for example, electric shock

Signal Word Description

CAUTION

This Caution indicates a potentially hazardous situation or unsafe practice which, if not avoided, may result in **minor or moderate personal injury or equipment damage**. This Caution is highlighted in yellow.

CAUTION

This caution indicates a situation or unsafe practice which, if not avoided, may result in **equipment damage**.

.

WARNING

A Warning indicates a potentially hazardous situation which, if not avoided, could result in **serious injury or death**. A Warning is highlighted in orange.

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Cryopump Cautions and Warnings

You must observe the following safety precautions when installing, operating, and maintaining the On-Board®, On-Board *IS* and Cryo-Torr® equipment. If you have any doubts on using this equipment, refer to Appendix A, "*Customer Support*" and call your local Customer Support Center for assistance.

Toxic, Corrosive, Dangerous Gases, or Liquids

WARNING

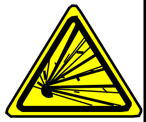
Toxic/Corrosive Gases

Toxic and/or corrosive process gases or liquids that may have been pumped and captured by an On-Board, On-Board *IS*, or Cryo-Torr product could cause severe injury on contact.

Take the following precautions when handling toxic, corrosive, or dangerous gases.

1. Follow all local, state, and national codes when working with caustic materials and liquids.
2. Always vent toxic, corrosive, dangerous gases, or liquids to a safe location using an inert purge gas.
3. Clearly identify on the cryopump which toxic, corrosive, dangerous gas or liquid has been contained in the pump before storing or shipping to Helix Technology Corporation.

Flammable or Explosive Gases

WARNING

Flammable/Explosive Gases

Flammable or explosive gases that may have been pumped and captured by an On-Board, On-Board *IS*, or Cryo-Torr pump might cause severe injury if ignited.

Take the following precautions when handling flammable or explosive gases:

1. Follow all local, state, and national codes when working with flammable gases
2. Always purge the cryopump with an inert gas during regeneration.
3. Always vent flammable or explosive gases to a safe location using an inert purge gas. Purging the cryopump's exhaust line might also be necessary.
4. Do not install a hot filament type vacuum gauge on the high vacuum side of the isolation valve. This could be an ignition source for flammable gases in the product.

High Voltage

WARNING

High Voltage

High voltage electric shock could cause severe injury or loss of life.

Take the following precautions to prevent high voltage risks:

1. Follow all local, state, and national codes when working with high voltage equipment.
2. Disconnect the high vacuum pump system from all power sources before making electrical connections between system components or before performing troubleshooting and maintenance procedures.

High Gas Pressure

WARNING

High Gas Pressure

High helium gas pressure is present in high vacuum pump systems and can cause severe injury from propelled particles or parts.

Take the following precautions when working with high gas pressure:

1. Normal making and breaking of the quick disconnect couplings can be done routinely. However, when a quick disconnect coupling needs to be replaced and separated from the helium flex or solid line, always bleed the helium charge down to atmospheric pressure before any disassembly.
2. During regeneration, a rapid expansion of the cryopumped species occurs within the cryopump. Restricting the flow through the exhaust port and exhaust line rapidly increases the pressure in the cryopump. This high internal pressure can cause severe injury from propelled particles or parts.
   - Do not modify or remove the pressure relief valve on the cryopump.
   - Make sure that the path for the regenerated gas is unobstructed.

FastRegen™ Control Users Only

WARNING

Dangerous Gases

During fast regeneration, cold gases vent through the roughing valve and roughing line and into the roughing pump

Take the following precautions in designing an appropriate gas handling system, including roughing pump for toxic, corrosive, or dangerous gases.

- The roughing pump must be compatible with these gases
- The discharge from the roughing pump may include these gases and should be vented in a safe manner
- These gases will be discharged more rapidly into the roughing line than from conventional cryopump regenerations. This might impact the safe handling of discharge gases.

1. Use appropriately sized roughing lines to prevent over pressurization of the roughing line during the expansion of such gases
2. Be sure that the roughing line is compatible with low temperatures
3. Use roughing lines of sufficient length to allow the gases to warm adequately before entering the roughing pump
4. Do not use fast regeneration after pumping large amounts of oxygen unless the roughing system is compatible with oxygen duty

Cryopump Oxygen Procedures

⚠ WARNING

Oxygen Combustion Danger

When oxygen is used as a process gas in the cryopump, combustion could cause severe injury .

Take the following special precautions when oxygen is used as a process gas:

1. Insure that there are no sources of ignition (for example; hot filament vacuum gauges) on the cryopump side of the high vacuum valve operating during the warming or venting of the cryopump.
2. Perform inert gas purge regeneration cycles at flow rates recommended for cryopumps.
3. Regenerate as frequently as practical to minimize the amount of oxidizer present in the cryopump.

It is standard practice in the vacuum industry that any system exposed to richer-than-air oxygen levels should be prepared for oxygen service per the manufacturer's recommendations. This includes the use of oxygen service lubricating oils in roughing pumps or dry roughing pumps.

⚠ WARNING

Explosion Danger

Explosion occurring from ozone in the cryopump could cause severe injury. Ozone can be present as a by-product of oxygen processes.

Ozone may be unknowingly produced if oxygen is a process gas in an ionizing procedure; for example, sputtering, etching, and glow discharge. Explosive conditions may exist if ozone is present, especially during the warming of the cryopump. Signs of ozone presence are:

1. Crackling, popping sounds (as in electrical arcing) occurring within the first few minutes of a regeneration cycle
2. Gas venting from the cryopump during regeneration that has a pungent smell, similar to that present in an arc welding operation or after an electrical storm

NOTE: *A change in process can increase the amount of ozone present.*

If your process can generate ozone, take these precautions:

1. Reduce the oxygen flow rate to the lowest level that the process allows.
2. Shorten the time between regenerations. Daily regenerations may be required. Call Helix Technology Corporation for assistance.

3. Insure that there are no sources of ignition (for example, hot filament vacuum gauges) on the cryopump side of the high vacuum valve operating during the warming or venting of the cryopump
4. Perform inert gas purge regenerations at flow rates recommended for cryopumps.

Section 1 - On-Board *IS* Cryopump Description

Introduction

The On-Board *IS* Cryopump provides fast, clean pumping of all gases in the 10^{-3} to 10^{-9} torr range by condensing gas at low temperatures to achieve low vapor pressures, allowing high pumping speeds and throughputs.

The On-Board *IS* Cryopump is highly-reliable and requires little maintenance. Since the Cryopump exposes no moving parts, operating fluids, or backing pumps to the vacuum, there is no possibility of system or process contamination from the Cryopump.

Installation and Maintenance Instructions

The Installation and Maintenance Instructions for the On-Board *IS* Cryopump provide easily accessible information. All personnel with maintenance responsibilities should become familiar with the contents of these instructions to ensure high performance and safe and reliable operation of the Cryopump.

Microprocessor-Based Control System

The On-Board *IS* Cryopump is equipped with a microprocessor-based control system that allows both monitoring and control of a wide range of important vacuum system functions.

Refer to the ***On-Board IS Cryopump System Operation Guide*** Helix P/N 8040647, that came with the On-Board *IS* Controller, for a complete description of the numerous operational functions that are available.

Remote Operation Options

The On-Board *IS* Cryopump can be controlled remotely using an RS-232 protocol. Multiple Cryopumps can be networked using a proprietary BITBUS™ protocol to an On-Board *IS* Controller. In this configuration, the networked Cryopumps are managed as a group by the On-Board *IS* Controller which coordinates group regeneration cycles and provides a standardized communication link to the process tool host computer. The On-Board *IS* Controller allows all Cryopumps to be addressed by the host system through a single RS-232 port. Using this approach, control of the networked Cryopumps can be fully integrated with the process tool control through RS-232 communication.

Figure 1-1 through Figure 1-2 shows the On-Board *IS* cryopumps.

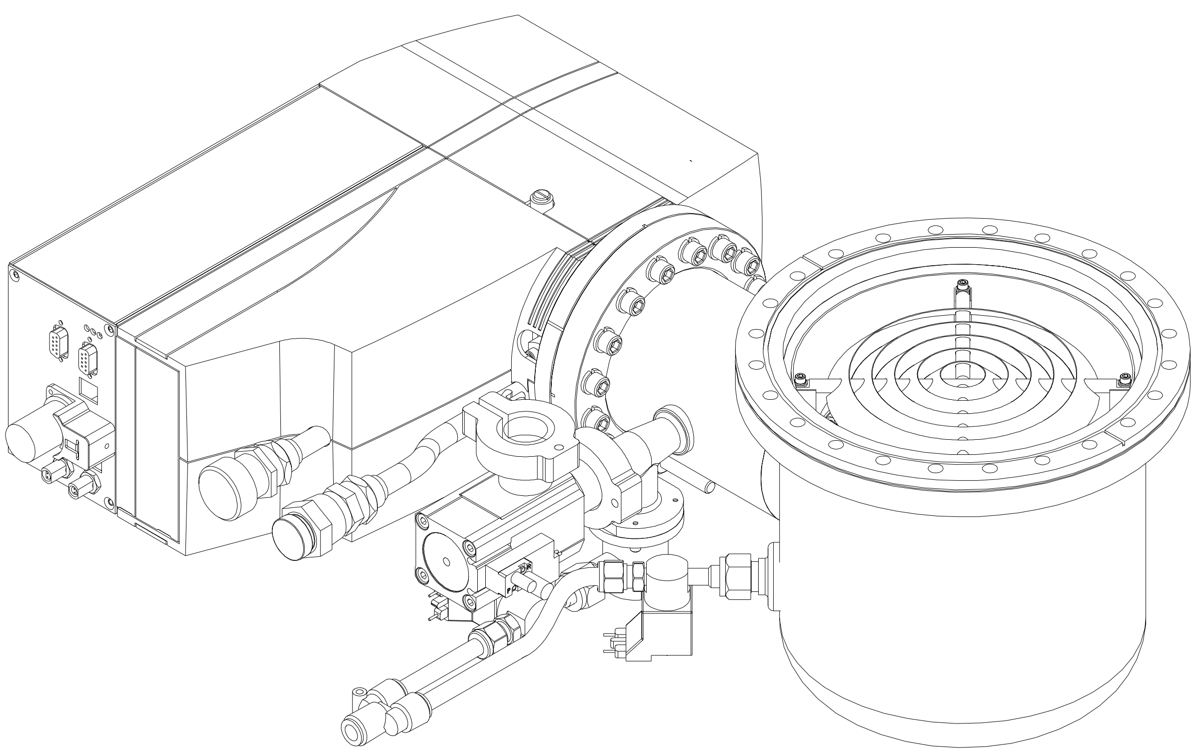


Figure 1-1: On-Board *IS* 8F (Flat) Cryopump

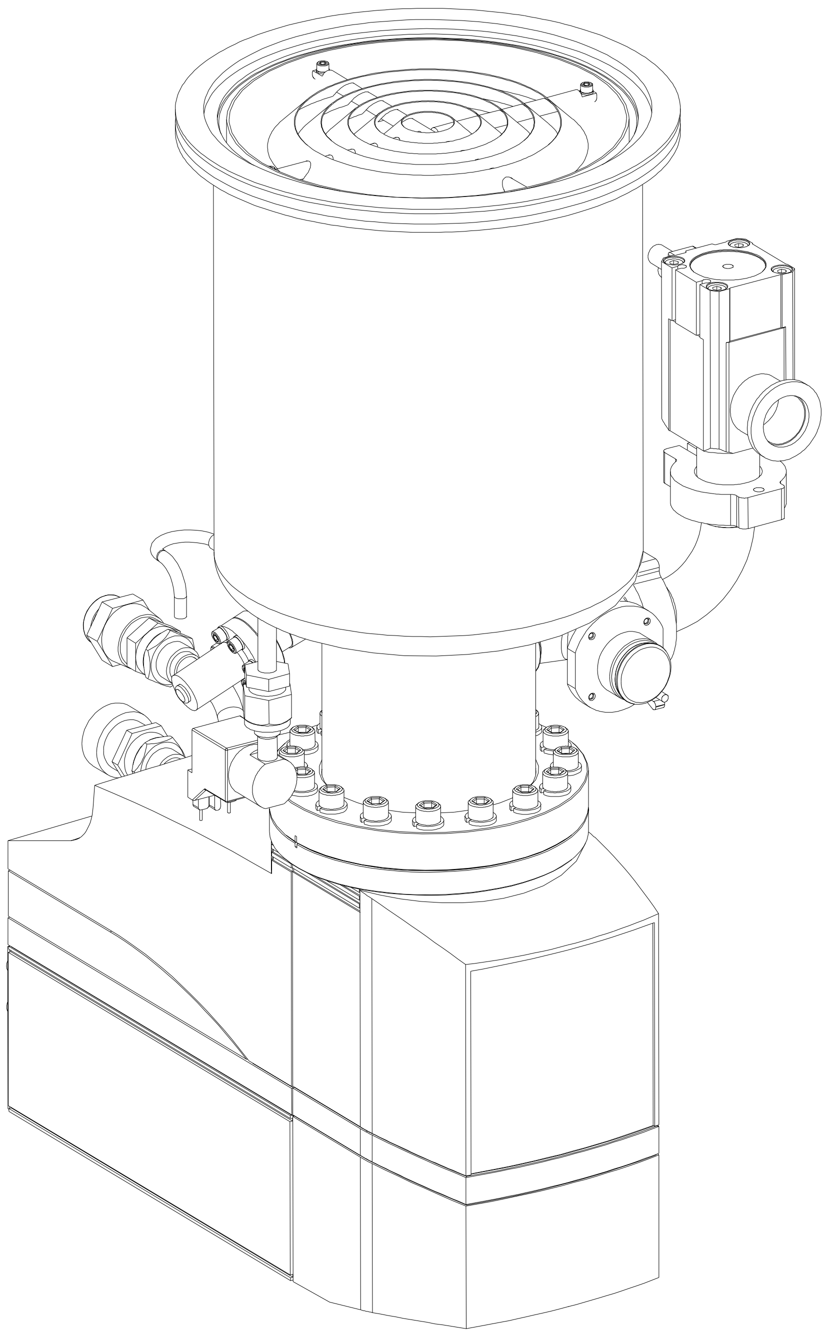


Figure 1-2: On-Board *IS* 8 (Straight) Cryopump

Specifications

Table 1-1: On-Board *IS* 8F Cryopump Specifications (P/N 8185001G001 with Chevron Array)

Parameter	Specifications
Rough Pump Connection	NW 25 ISO KF
Integrated Hardware	Roughing Valve Purge Valve Cryopump TC Gauge 1st Stage Diode 2nd Stage Diode 1st Stage Heater 2nd Stage Heater RS-232 Interface
Pumping Speeds: Water Nitrogen Hydrogen Argon	 4000 liters/sec 1500 liters/sec 2200 liters/sec 1200 liters/sec
Argon Throughput @ 20K*	250 - 700 sccm (torr-liters/sec)
Capacities: Argon Hydrogen Nitrogen	 1000 std. liters @ 5 x 10^{-6} torr 750 std. liters @ 5 x 10^{-7} torr (recovery in 30 seconds) 12 std. liters @ 5 x 10^{-6} torr 550 std. liters (recovery to 5 x 10^{-7} torr in 30 seconds)
Crossover	150 torr-liters
Full Regeneration - Cold to Cold (with 1 minute extended purge)	≤ 90 minutes (1 pump/1 compressor) ≤ 120 minutes (6 pumps/1 compressor)
Fast Regeneration	≤ 35 minutes (1 pump/1 compressor) ≤ 60 minutes (6 pumps/1 compressor)
Dimensions	Refer to Installation/Interface Drawing
Weight	67 lbs.
*** Depends upon system configuration**	

Table 1-2: On-Board *IS* 8 Cryopump Specifications
(P/N 8185005G001 with Chevron Array)

Parameter	Specifications
Rough Pump Connection	NW 25 ISO KF
Integrated Hardware	Roughing Valve Purge Valve Cryopump TC Gauge 1st Stage Diode 2nd Stage Diode 1st Stage Heater 2nd Stage Heater RS-232 Interface
Pumping Speeds: Water Nitrogen Hydrogen Argon	 4000 liters/sec 1500 liters/sec 2500 liters/sec 1200 liters/sec
Argon Throughput @ 20K*	250 - 700 sccm (torr-liters/sec)
Capacities: Argon Hydrogen	 1000 std. liters @ 5 x 10^{-6} torr > 5000 cycles @ 10 torr-liter (burst recovery to 5 x 10^{-6} torr) 17 std. liters @ 5 x 10^{-6} torr
Crossover	150 torr-liters
Full Regeneration - Cold to Cold (with 1 minute extended purge)	≤ 90 minutes (1 pump/1 compressor) ≤ 120 minutes (6 pumps/1 compressor)
Fast Regeneration	≤ 35 minutes (1 pump/1 compressor) ≤ 60 minutes (6 pumps/1 compressor)
Dimensions	Refer to Installation/Interface Drawing
Weight	72 lbs.
*** Depends upon system configuration**	

Table 1-3: On-Board *IS* 8F Cryopump Facility Requirements

Parameter	Value
Electrical Power	208 VAC (Range: 180-253 VAC) 5 Amps 50/60 Hz Single Phase
Nitrogen Purge Gas	3/8 inch Tube Connection 60 psig Minimum 80 psig Maximum
Roughing Valve	N/NW-25 ISO KF Flange 1/8 inch Tube Connection Air Supply 80 psig Maximum 1/4 inch tube connection exhaust port

Table 1-4: On-Board *IS* 8 Cryopump Facility Requirements

Parameter	Value
Electrical Power	208 VAC (Range: 180-253 VAC) 5 Amps 50/60 Hz Single Phase
Nitrogen Purge Gas	1/4 inch Tube Connection 60 psig Minimum 80 psig Maximum
Roughing Valve	W/NW-25 ISO KF Flange 1/8 inch Female NPT Tube Connection Air Supply 80 psig Maximum 1/4 inch tube connection exhaust port

Theory of Operation

The On-Board *IS* Cryopumps consist of a refrigerator or coldhead, vacuum vessel, electronics, valves, heaters and temperature and pressure sensors for controlling and monitoring the cryopump.

Cryopumps operate on the principle that gas molecules encountering a sufficiently cold surface (array) will be condensed and held at an extremely low vapor pressure, effectively trapping the molecules and preventing them from returning to the vacuum chamber. Gas molecules that travel into a cryopump are condensed or adsorbed on the cryogenically-cooled arrays and thereby are removed or *pumped* from the vacuum chamber.

The On-Board *IS* Cryopump contains two arrays. The first stage array or inlet array normally operates at temperatures between 100-120K and is primarily used to pump water vapor.

NOTE: First stage temperature can be operated outside the normal operating temperature range. Refer to “Appendix A - Customer Support Information” *and contact the Customer Support Center for more information.*

The second stage array operates at temperatures between 10-20K and is used to pump air gasses such as nitrogen, argon, and oxygen. Activated charcoal is attached to the second stage array, and is used to cryoadsorb hydrogen, helium, and neon. The Cryopump arrays are cooled using a closed cycle, Gifford McMahan refrigeration cycle utilizing compressed gaseous helium as the refrigerant.

Since the Cryopump is a capture pump, it requires a regeneration cycle when it reaches capacity. The On-Board *IS* Cryopump uses an integrated microprocessor, variable speed motor and heaters to provide a fast and thorough regeneration cycle.

The On-Board *IS* Cryopump system consists of the cryopump and a remotely located On-Board *IS* 1000 Compressor which provides the compressed helium. The On-Board *IS* 1000 Compressor can provide helium for multiple Cryopumps through helium supply and return lines. The On-Board *IS* Controller coordinates all Helix Intercomponent Network communications. A typical On-Board *IS* Cryopump system is shown in Figure 1-3.

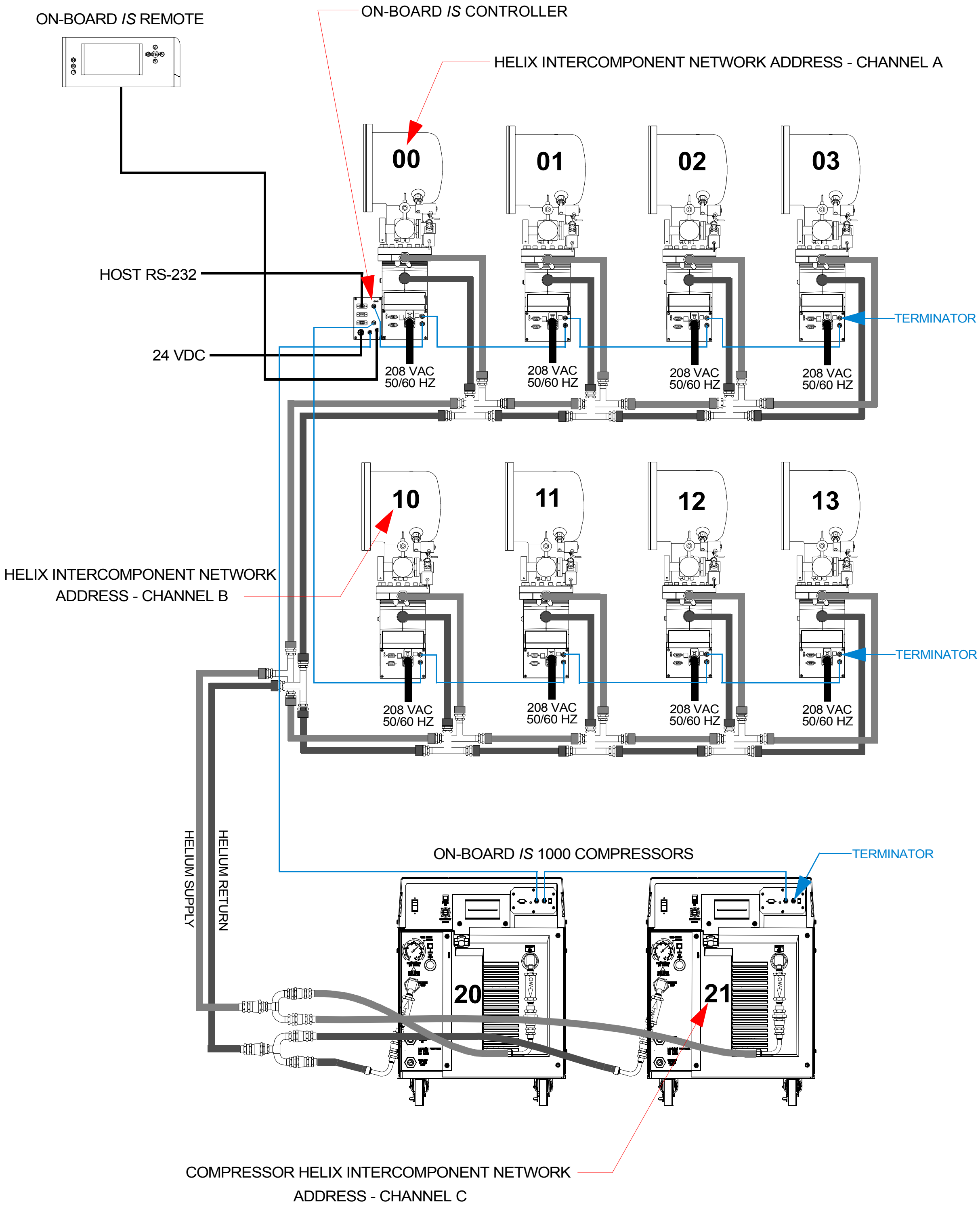


Figure 1-3: Typical On-Board *IS* Cryopump System

Cold Head

The cold head consists of a motor, helium supply and return valves, first and second stage displacer assembly and a cylinder. The cylinder is a welded stainless steel cylinder that is installed in the Cryopump vacuum vessel. The first and second stage arrays are secured to the cylinder inside the Cryopump vacuum vessel.

The displacer assembly is made up of a first and second stage displacer. The displacers are packed with a heat exchange matrix that is used as a thermal reservoir. Each displacer has a seal that causes the helium to flow through the heat exchange matrix inside the displacers rather than between the displacer and the cylinder wall.

Within the coldhead, the motor cycles the displacer assembly up and down the cylinder and actuates the helium supply and return valves. The motor is a direct-drive variable-speed motor, operating between 40-144 rpm.

The following steps and Figure 1-4 describe the Gifford McMahan refrigeration cycle:

1. When the displacer is at the bottom of the cylinder, the helium supply valve opens allowing high pressure helium to fill the cylinder.
2. As the displacer rises, the helium flows through the matrix in the displacers to the bottom of the cylinder.
3. When the displacer reaches the top of the cylinder, the supply valve closes, and the return valve opens allowing the gas to expand and cool.
4. The temperature drop in the expanded helium cools the heat stations, cooling the cryopump arrays.
5. The cooled helium passes out through the return valve, cooling the matrix in the displacers as the displacers move toward the bottom of the cylinder.
6. Steps 1-5 are repeated continuously. With each cycle, the incoming helium is pre-cooled by the matrix as it flows through the displacers, providing an additional increment of refrigeration.

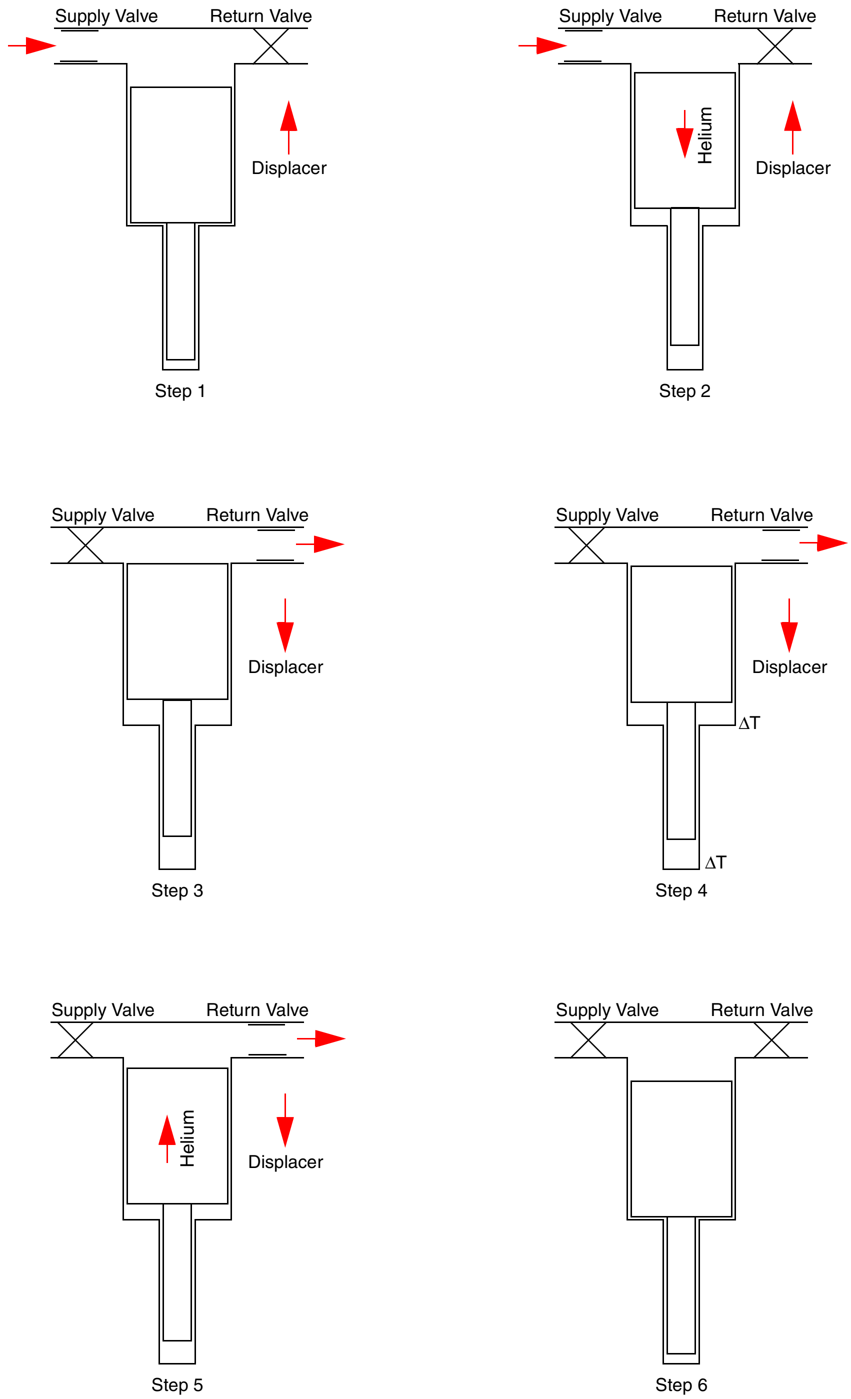


Figure 1-4: Gifford McMahan Refrigeration Cycle

Component Description

The On-Board *IS* Cryopump, shown in Figure 1-5, Figure 1-6, is driven by a variable speed AC synchronous motor and controlled by an advanced microprocessor On-Board *IS* Module. The On-Board *IS* Module conditions the input power and provides RS-232 and BitBus communication capability. The communication protocol and commands are compatible with all On-Board RS-232 and BitBus network commands.

Inlet Port

The Inlet Port is the opening of the vacuum vessel through which process gases enter the cryopump. The Inlet Port is connected to the vacuum chamber via the gate valve.

Vacuum Vessel

The Vacuum Vessel contains the first and second stage condensing arrays which are cooled to condense process gases.

First Stage Array

The First Stage Array is the first condensing array that a process gas molecule encounters within the Cryopump. Gases such as water vapor and hydrocarbons are condensed onto the first stage array which operates at 90 to 120K. The On-Board *IS* Cryopump utilizes either a chevron array or a sputter plate for the first stage array. The chevron array maximizes the Cryopump pumping speed for all gasses. The sputter plate maximizes the water pumping speed while maintaining reduced process gas pumping speeds.

Second Stage Array

The Second Stage Array condenses gases such as N_2, O_2, Ar, CO_2, and CO and operates at temperatures from 10 to 20K. Activated charcoal is attached to the second stage array which cryoadsorbs H_2, He, and Ne.

Refrigerator

The refrigerator consists of a two-stage cylinder (part of the vacuum vessel) and a coldhead assembly, that together produce closed-cycle refrigeration at temperatures that range from 90 to 120K for the first stage and 10 to 20K for the second stage, depending on operating conditions.

First and Second Stage Heaters

The first and second stage heaters are mounted to the cold head cylinder and are used to warm the Cryopump during a regeneration cycle.

Thermocouple (TC) Gauge

The TC Gauge measures cryopump pressure during a regeneration cycle and sends pressure information to the On-Board *IS* Module.

Diode Connector

The Diode Connector is connected to the diodes that are mounted on the first and second stage arrays of the Cryopump. The diodes measure the first and second stage array temperatures. Array temperature information is sent to the On-Board *IS* Module.

On-Board *IS* 8/8F Cryopump Valve Operation

The following describes the operation of the valves in the 8 and 8F On-Board *IS* cryopumps.

Purge Valve

The Purge valve controls the flow of nitrogen to the Cryopump vessel. During a regeneration cycle, the purge valve opens and allows nitrogen to flow through the vessel to dilute and remove the cryopumped gases.

Roughing Valve

The Roughing Valve connects to a system rough pump or dry pump. The rough valve is used during the Cryopump regeneration cycle to rough the Cryopump to rough vacuum (approximately 50-100 microns) before the Cryopump begins to cool down.

Exhaust Valve Purge Valve

The Exhaust Valve Purge Valve purges room temperature nitrogen across the O-ring of the Cryopump relief valve to prevent the O-ring from getting too cold during regeneration. The exhaust valve purge valve actuates whenever the Cryopump rough valve is actuated.

Vacuum Vessel Pressure Relief Exhaust Valve

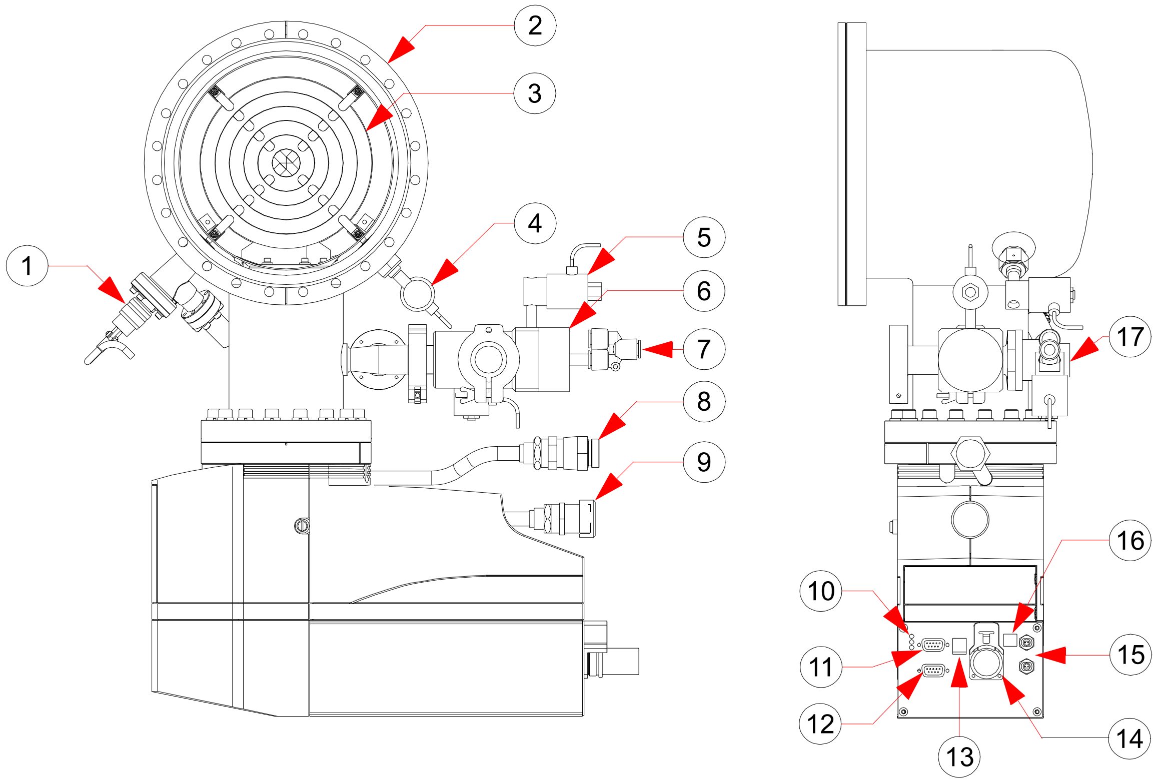
The Vacuum Vessel Pressure Relief Exhaust Valve is a spring loaded valve which releases process gases during a regeneration cycle. The relief valve opens at approximately 2-3 psig.

Helium Supply Fitting

The Helium Supply Fitting provides a connection for high pressure compressed helium from the On-Board *IS* 1000 Compressor to the Cryopump.

Helium Return Fitting

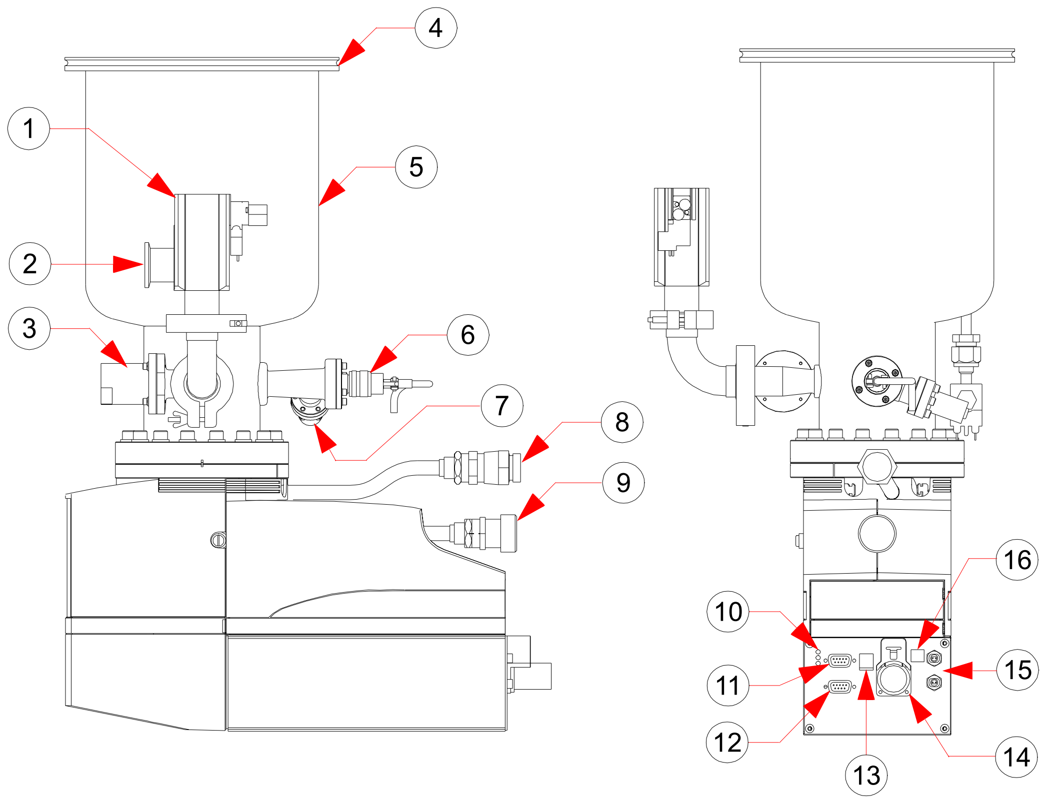
The Helium Return Fitting provides a connection to return low pressure helium which has been cycled through the Cryopump to the On-Board *IS* 1000 Compressor.



LEGEND

1. DIODE CONNECTOR
2. VACUUM VESSEL MOUNTING FLANGE
3. FIRST STAGE ARRAY
4. EXHAUST PURGE VALVE
5. PURGE GAS CONNECTION
6. ROUGHING VALVE
7. PRESSURE RELIEF VALVE AND PURGE VALVE NITROGEN CONNECTIONS
8. HELIUM SUPPLY FITTING
9. HELIUM RETURN FITTING
10. STATUS LED'S
11. HOST (RS-232) CONNETOR
12. SERVICE (RS-232) CONNECTOR
13. ADDRESS SWITCHES
14. MODULE POWER CONNECTOR/MODULE INTERLOCK
15. HELIX INTERCOMPONENT NETWORK CONNECTORS
16. ON-BOARD *IS* REMOTE CONNECTOR
17. PRESSURE RELIEF VALVE

Figure 1-5: On-Board *IS* 8F Cryopump Component Identification



LEGEND

1. ROUGHING VALVE
2. ROUGHING PORT
3. PRESSURE RELIEF VALVE
4. VACUUM VESSEL MOUNTING FLANGE
5. VACUUM VESSEL
6. DIODE CONNECTOR
7. TC GAUGE
8. HELIUM SUPPLY FITTING
9. HELIUM RETURN FITTING
10. STATUS LED'S
11. HOST (RS-232) CONNETOR
12. SERVICE (RS-232) CONNECTOR
13. ADDRESS SWITCHES
14. MODULE POWER CONNECTOR/MODULE INTERLOCK
15. HELIX INTERCOMPONENT NETWORK CONNECTORS
16. ON-BOARD *IS* REMOTE CONNECTOR

Figure 1-6: On-Board *IS* Straight 8 Cryopump Component Identification

On-Board *IS* Module

The On-Board *IS* Module controls the operation of the On-Board *IS* 8/8F . In addition, the On-Board *IS* Module conditions the input power, provides host computer RS-232 and Network communication ports, and setpoint relay outputs. Figure 1-7 shows the On-Board IS 8/8F module components.

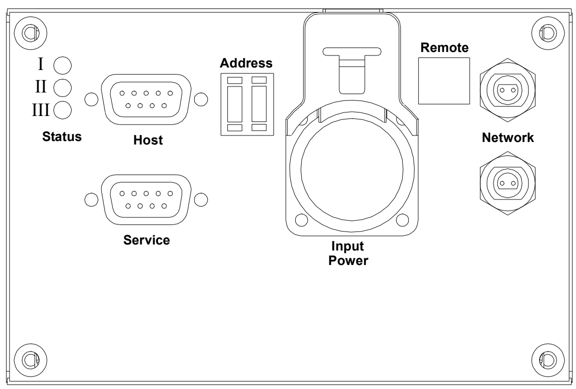


Figure 1-7: On-Board *IS* 8/8F Module Components

Status LEDs

The Status LEDs (I, II and III) give On-Board® *IS* Cryopump, regeneration cycle and network communications status. Table 1-5 describes the LEDs on the 8/8F cryopump. .

Table 1-5: Status LED Description

LED	Purpose	LED States		
		OFF	Amber	Green
I	Cryopump Status	Motor OFF	Motor ON	Motor ON and Temperature Control ON.
II	Regen Status	Normal Operation	Fast Regeneration Cycle in progress	Full regeneration cycle in progress.
III	Network Communication Status	No network communication	Heater Fault Interrupt	Blinking LED - normal network communication.

Control Module Components

The following sections describe the control module components on the On-Board *IS* 8/8F cryopump.

Host

The Host connector allows the On-Board *IS* Cryopump to communicate with a host computer using the CTI-CRYOGENICS command set. Refer to Table 1-6 for additional information on the communication protocol.

*NOTE: Refer to "Appendix A - Customer Support Information" and call the Customer Support Center to request a copy of the **On-Board IS Cryopump System RS-232 Setup Guide** P/N 8040677 if you are controlling the On-Board IS Cryopump system through a process tool host computer.*

Table 1-6: RS-232 Connector Information

Parameter	Value
Baud Rate	9.6 kbs
Data Bits	7
Parity	Even
Number of stop Bits	1

NOTE: The RS-232 Cable must be fully shielded through to the outer shell. Use cable Helix P/N 8132157 or equivalent.

Service

The Service connector allows CTI-CRYOGENICS service personnel to connect diagnostic equipment to On-Board *IS* Cryopump.

Address Selector Switch

The Address Selector Switch establishes the network address (0 - 9) of the On-Board *IS* Cryopump on the Helix Intercomponent Network.

Input Power

The Input Power connector allows 208 VAC to be connected directly to the On-Board *IS* Cryopump. Refer to Table 1-3 for input power specifications.

Remote

The Remote connector allows a remote keypad/display to be connected to the On-Board *IS* Cryopump.

Network

The Network connectors allow the On-Board *IS* Cryopump to be connected to the Helix Intercomponent Network.

Section 2 - Installation

Introduction

This installation information is for both experienced and non-experienced On-Board *IS* Cryopump system technicians. The flowchart in Figure 2-1 highlights the major tasks of On-Board *IS* Cryopump installation. Refer to Figure 2-1 and the appropriate installation procedure in this chapter for the type of On-Board *IS* Cryopump being installed.

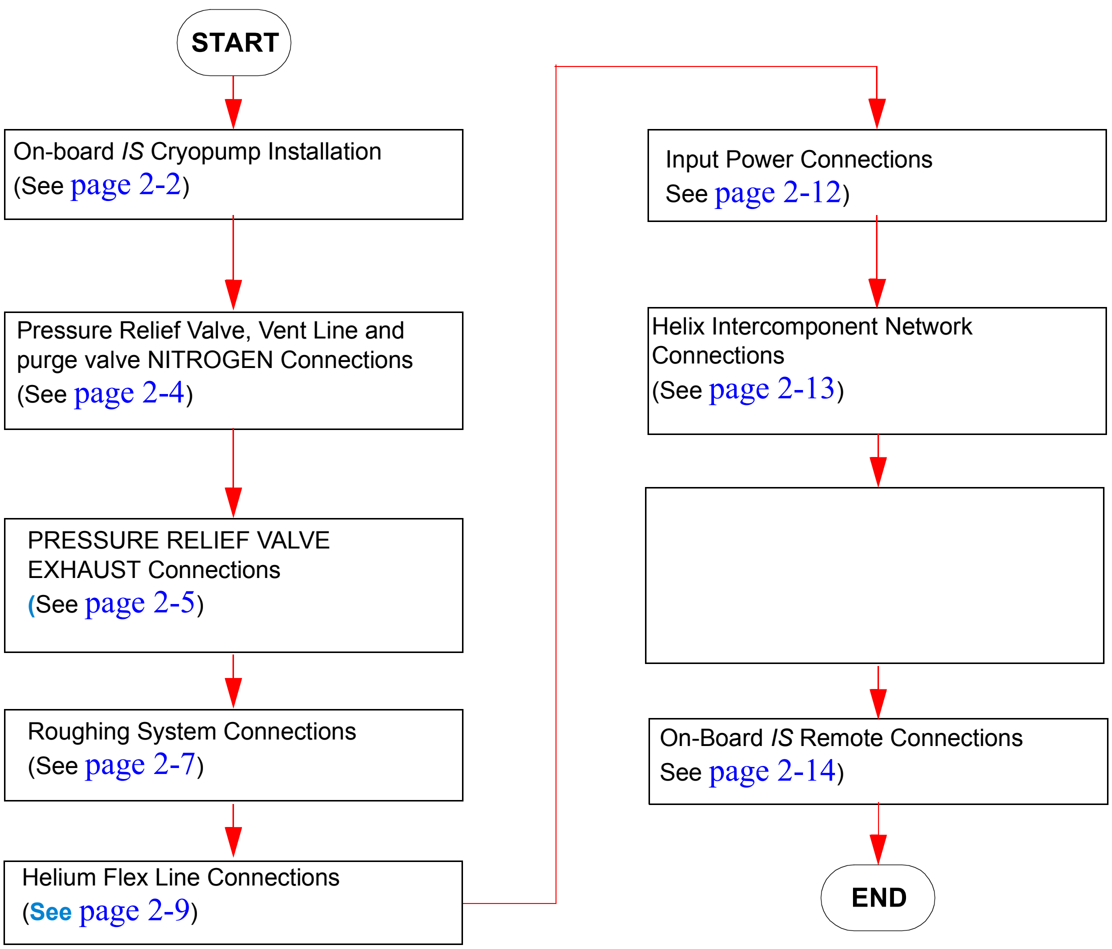


Figure 2-1: Block Diagram for On-Board *IS* Cryopump Installation

On-Board *IS* Cryopump Installation

The On-Board *IS* Cryopump may be installed on the vacuum system Hi-Vac valve flange in any orientation without affecting its performance.

NOTE: Before mounting the On-Board IS Cryopump to the vacuum system, a high-vacuum isolation valve (Hi-Vac valve) should be installed between the On-Board IS Cryopump and the vacuum chamber to isolate the On-Board IS Cryopump from the chamber during rough pumping, cooldown, and regeneration.

Install the On-Board *IS* Cryopump on the vacuum system flange as shown in Figure 2-2 and as follows:

1. Remove the protective cover from the vacuum vessel mounting flange of the On-Board *IS* Cryopump.
2. Clean all sealing surfaces and install the metal seal gasket.
3. Mount the On-Board *IS* Cryopump on the Hi-Vac valve or vacuum chamber mounting flange.
4. Install all mounting bolts and lock washers.
5. Tighten the mounting bolts to mounting flange specifications.

CAUTION

The cryopump is heavy. To avoid injury when removing or installing the cryopumps, use a lifting aid and proper lifting techniques

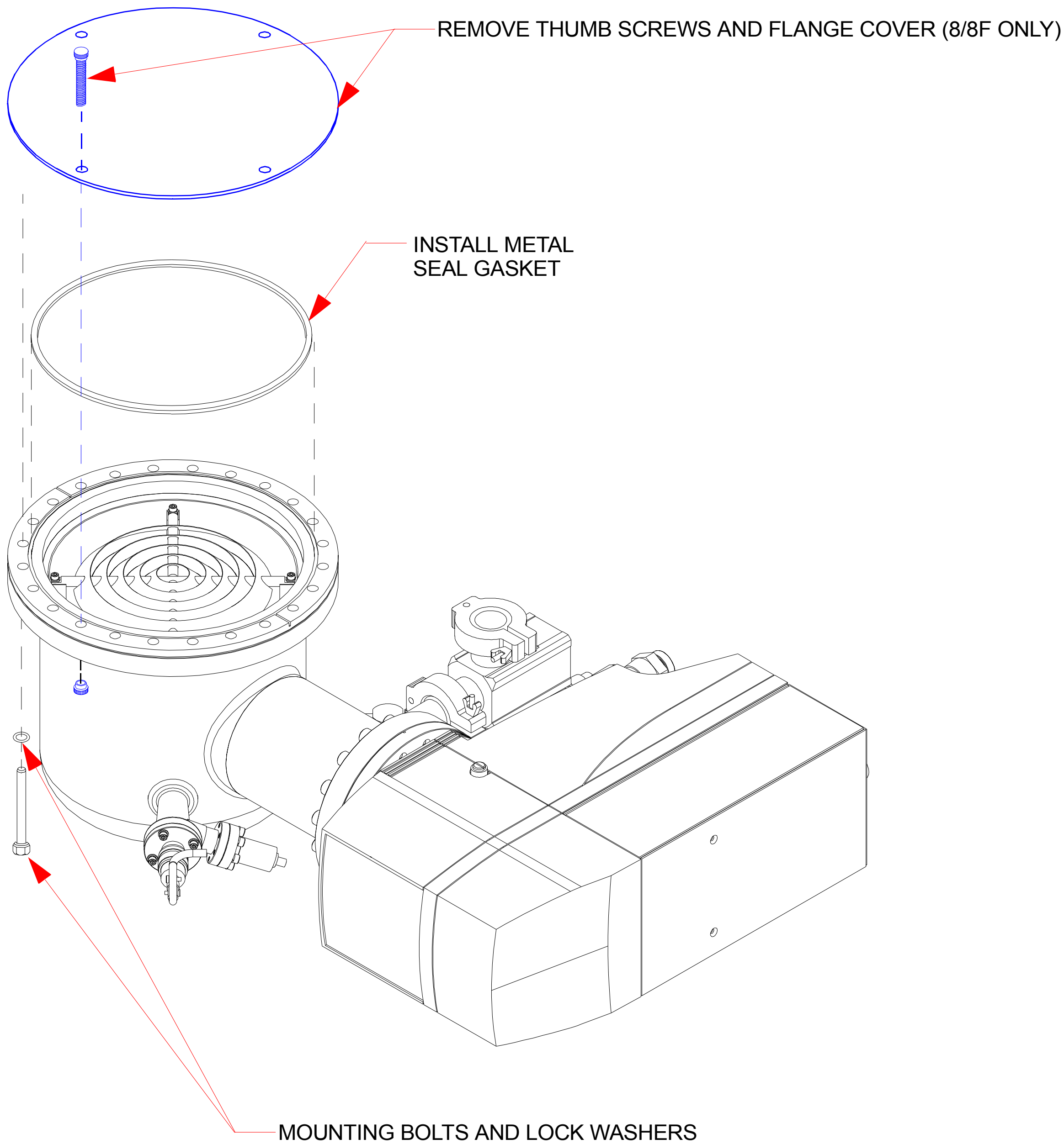


Figure 2-2: On-Board *IS* Cryopump and Metal Seal Gasket Installation (8F Cryopump)

Pressure Relief Valve and Purge Valve Nitrogen Connections

WARNING

If toxic, corrosive, or flammable gases are pumped, a vent line must be connected to the On-Board *IS* Cryopump pressure relief valve and directed to an appropriate exhaust gas system.

Cryopumps create a vacuum by condensing and capturing gasses. As a capture pump, cryopumps have a finite capacity; therefore, periodically the cryopump must be defrosted (regenerated) to restore full performance. A pressure relief valve is provided on the cryopump to vent the gasses that are released during regeneration.

NOTE: The Nitrogen flow must be a minimum of 4 scfm @ 80 psi.

1. Connect tubing to the Nitrogen purge connection as shown in Figure 2-3 . See Table 1-3 and Table 1-4 for requirements.
2. Adjust the Nitrogen supply pressure regulator according to the specifications in Table 1-3 or Table 1-4.

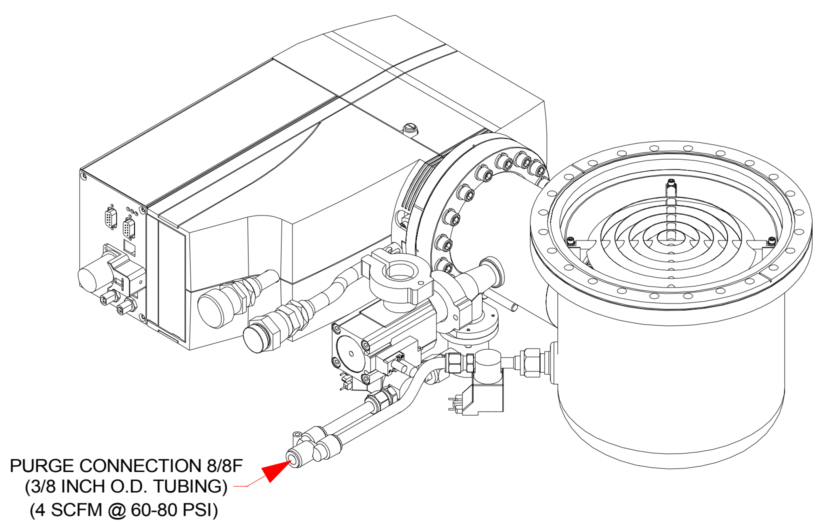


Figure 2-3: Pressure Relief Valve and Vent Line Purge Connections

Pressure Relief Valve Exhaust Connections

The exhaust gas adapter surrounds the pressure relief valve and has a 1/2 inch x 14 NPTF fitting for connecting an exhaust system vent line. The pressure drop through the exhaust system should be kept to a minimum to avoid over pressurizing the cryopump during regeneration. Over pressurization can damage valves, gauges, flanges or the On-Board *IS* Cryopump.

NOTE: The minimum diameter for the exhaust system vent line is 1/2 inch. During regeneration, the exhaust gas system must be able to handle a peak gas flow of 8 SCFM per cryopump being regenerated. Therefore, if four cryopumps are regenerated together the peak flow requirement will be 32 SCFM.

CAUTION

When connecting a vent line to your On-Board *IS* Cryopump pressure relief valve, the 1.30-inch diameter x 1.38-inch long volume around the valve must remain open for proper relief valve operation.

1. Install a customer supplied 1/2 inch x 14 NPTF Tube Adapter in the exhaust gas adapter as shown in Figure 2-4 .
2. Connect a customer supplied 1/2 inch exhaust system vent line to the Tube Adapter fitting as shown in Figure 2-4 .

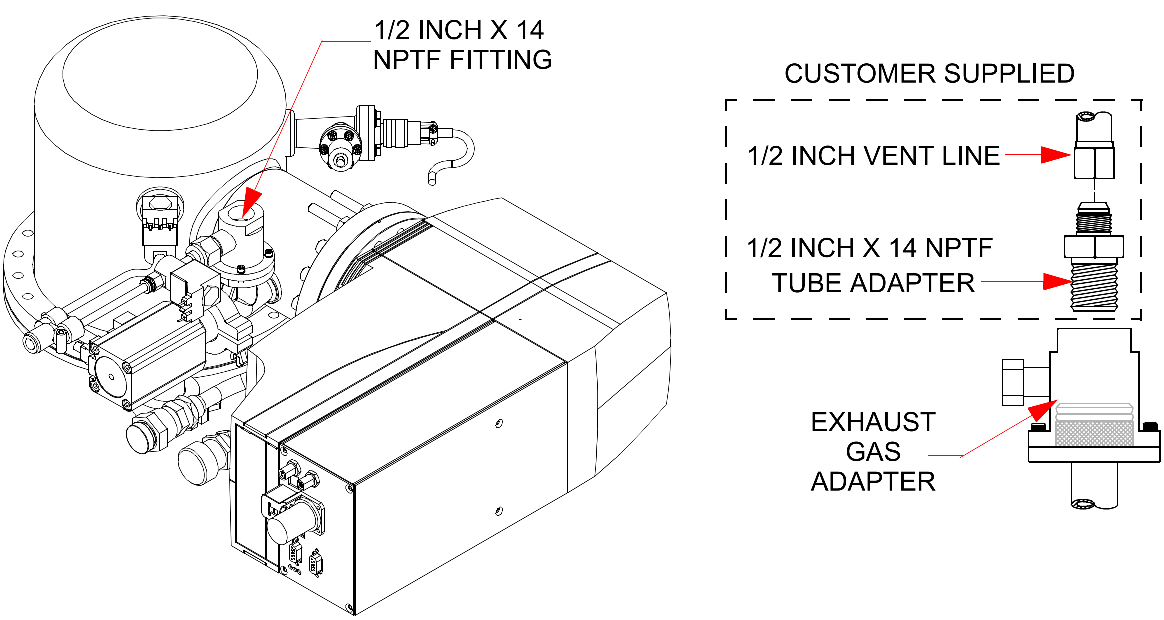


Figure 2-4: Pressure Relief Valve Exhaust Connections

Roughing System Connections

NOTE: The roughing system must provide 10 cfm (measured at atmosphere and at each On-Board IS Cryopump) to successfully utilize Next Generation FastRegen capability.

Connect your On-Board *IS* Cryopump to a roughing pump system using a roughing line with the largest inside diameter possible to minimize the roughing time required during start-up procedures prior to normal operation. The roughing pump should have a blank-off pressure of less than 20 microns.

NOTE: Refer to Figure 2-5 *for all Roughing System Connections.*

1. Loosen, but do not remove the clamp on the roughing valve 90º elbow.
2. Rotate the elbow into the appropriate position to align with the roughing system line. Tighten the clamp.
3. Remove the clamp and blank-off from the On-Board *IS* Cryopump elbow.
4. Connect the roughing system line to the On-Board *IS* Cryopump roughing valve using the clamp provided. Tighten the clamp.

NOTE: Make sure to attach the gas supply line to the valve fitting that has a filter screen at the attachment connection.

5. Attach the roughing valve gas supply line to the roughing valve fitting. Adjust the gas supply according the specifications in Table 1-3 and Table 1-4.

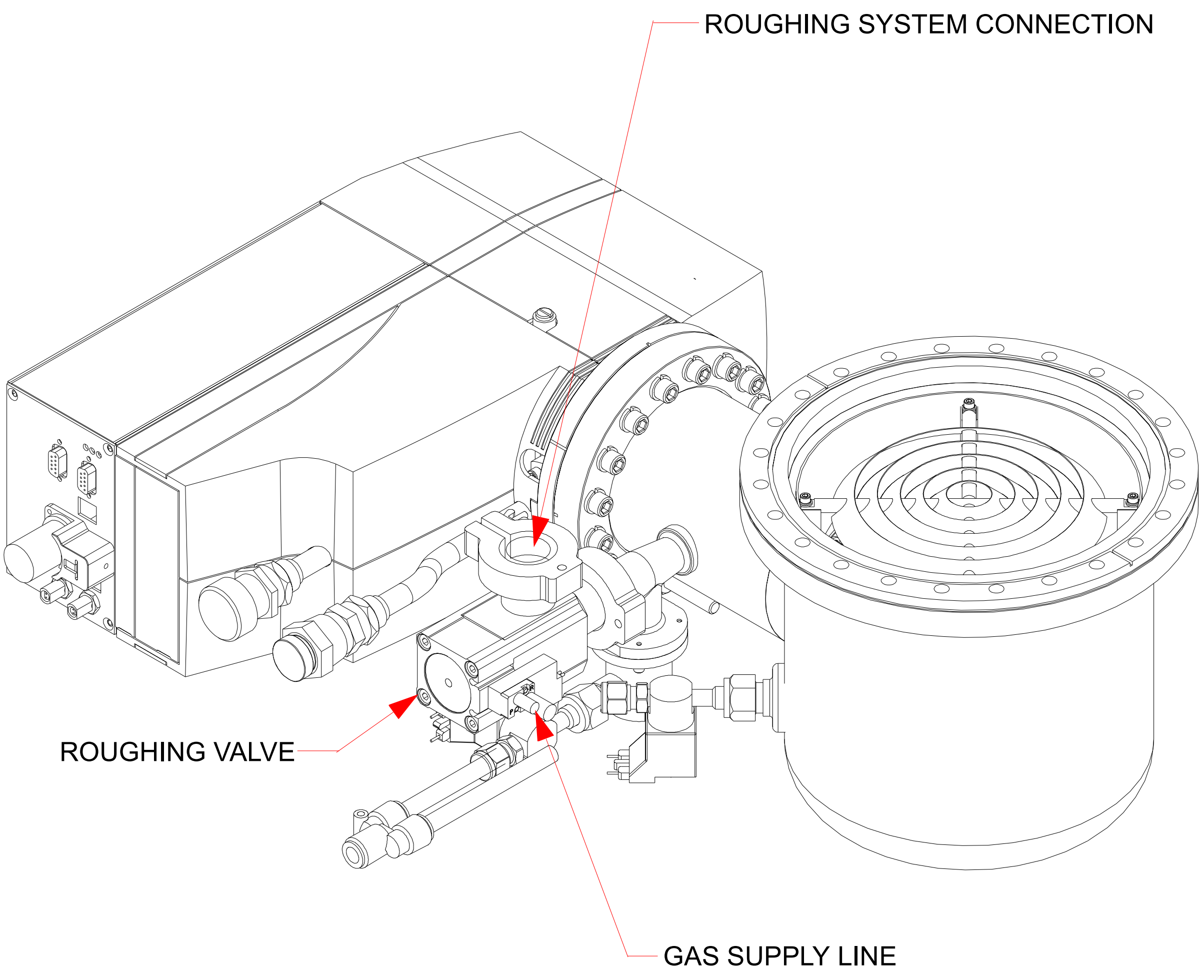


Figure 2-5: Roughing System Connections

Helium Flex Line Connections

CAUTION

Make sure the helium flex lines are connected and disconnected from the On-Board *IS* 1000 Compressor using the following procedure and as shown in Figure 2-6. Failure to follow this procedure could damage connector O-ring seals or cause a helium circuit leak.

CAUTION

The use of several compressors on a single manifold feeding a common supply header and a common return header requires special precautions. Contact CTI-CRYOGENICS for a review of the intended installation and for specific technical instructions.

The On-Board *IS* 1000 Compressor cannot be connected to a helium manifold to which other CTI-CRYOGENICS compressors are connected.

NOTE: The number of On-Board IS Cryopumps connected to an On-Board IS 1000 Compressor will vary based upon the On-Board IS Cryopump models used. Refer to "Appendix A - Customer Support Information" *and contact your local Helix Customer Support Center if you need more information on specific compressor/pump applications.*

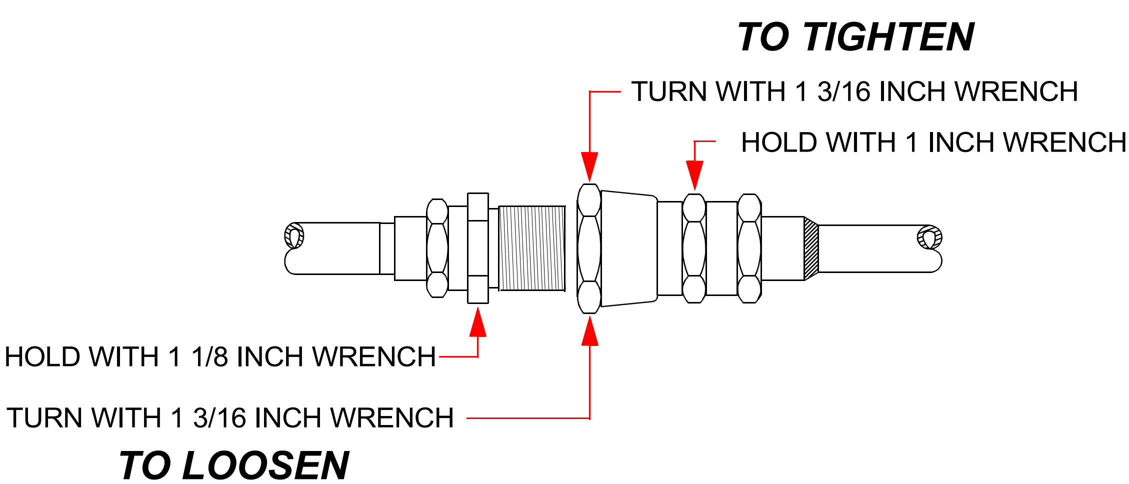


Figure 2-6: Connecting/Disconnecting Helium Flex Line Self Sealing Couplings

Connecting

NOTE: Refer to Figure 2-6 *and* Figure 2-7 *during this procedure.*

1. Remove all dust plugs and caps from the Gas Supply and Return lines, and the On-Board *IS* 1000 Compressor and cryopump Supply and Return connectors. Check for the presence of a flat gasket in the male connector, and no gasket in the female connector.
2. Connect the Gas Return line to the GAS RETURN connector on the rear of the On-Board *IS* 1000 Compressor and then to the GAS RETURN connector on the On-Board *IS* Cryopump or helium manifold. Using two wrenches as shown in Figure 2-6, tighten the connector.
3. Connect the Gas Supply line to the GAS SUPPLY connector on the rear of the On-Board *IS* 1000 Compressor and then to the GAS SUPPLY connector on the On-Board *IS* Cryopump or helium manifold. Using two wrenches as shown in Figure 2-6, tighten the connector.
4. Attach the Supply and Return line identification labels to each end of the appropriate lines.
5. Refer to ***On-Board IS 1000 Compressor Quick Installation Guide***, Helix P/N 8040645 to verify proper system ("OFF" Condition) helium charge pressure.

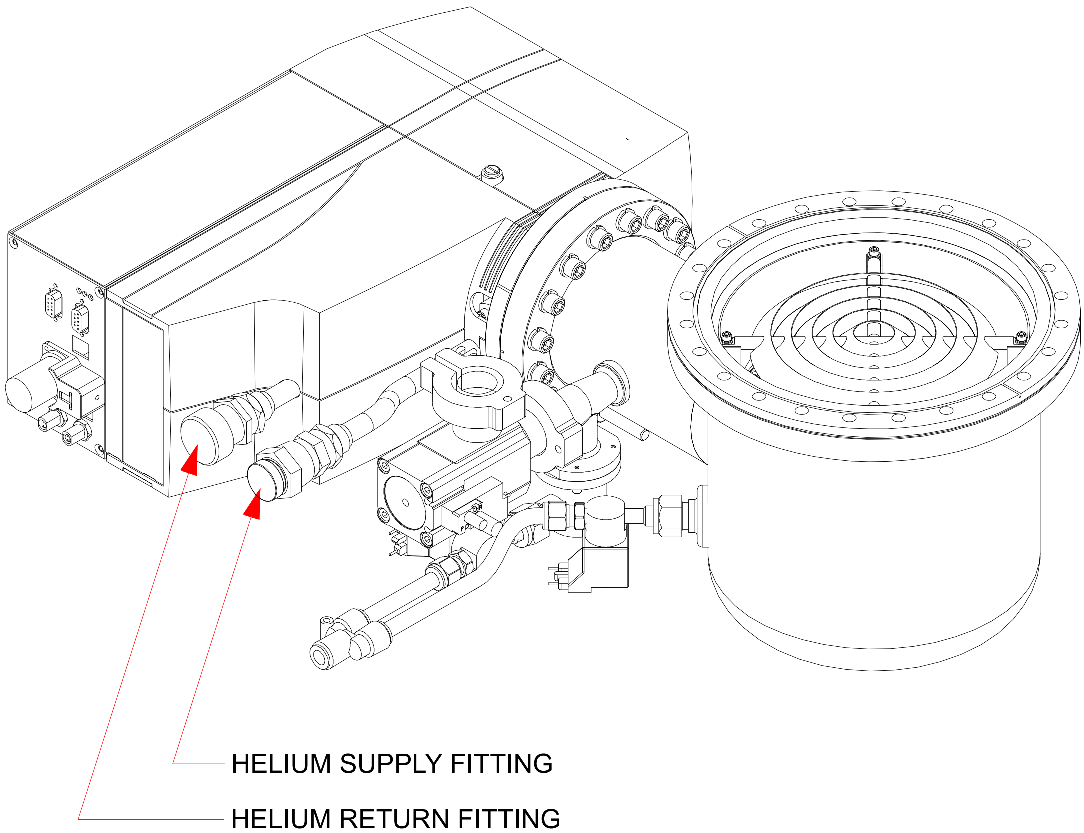


Figure 2-7: Helium Supply and Return Fitting Connections

Disconnecting

NOTE: Refer to Figure 2-6 *and* Figure 2-7 *during this procedure.*

1. Using two wrenches as shown in Figure 2-6, disconnect the two self sealing coupling connectors quickly to minimize helium leakage.
2. Connect the helium-return line from the gas-return connector on the rear of the compressor to the gas-return connector on the On-Board *IS* Cryopump.
3. Connect the helium supply line from the supply connector on the cartridge to the gas-supply connector on the On-Board *IS* Cryopump.
4. Attach the supply and return line identification decals (CTI-CRYOGENICS supplied) to their respective connectors.

IntelliPurge Connection

1. Connect the position sensors and control solenoid for the high-

vacuum isolation valve to the IntelliPurge connector.

Input Power Connections

CAUTION

Make sure the On-Board *IS* Cryopump Power Cable is connected to a 208 VAC, Single-Phase 5 Amp source according to all local electrical codes.

CAUTION

Do not remove the power connector cap until you are ready to connect the power cord to the On-Board *IS* Cryopump. The power cable clamp assists in securing the On-Board *IS* Module to the pump.

1. Insert a flat blade screw driver into the input power connector on the On-Board *IS* Cryopump Module as shown in Figure 2-8 .
2. Lift the locking tab in the direction of the arrow shown in Figure 2-8 and remove the power connector cap.
3. Connect the Input Power Cable connector to the input power connector on the module and rotate the connector collar until tight.
4. Lower the locking tab to secure the Input Power Cable connector collar.

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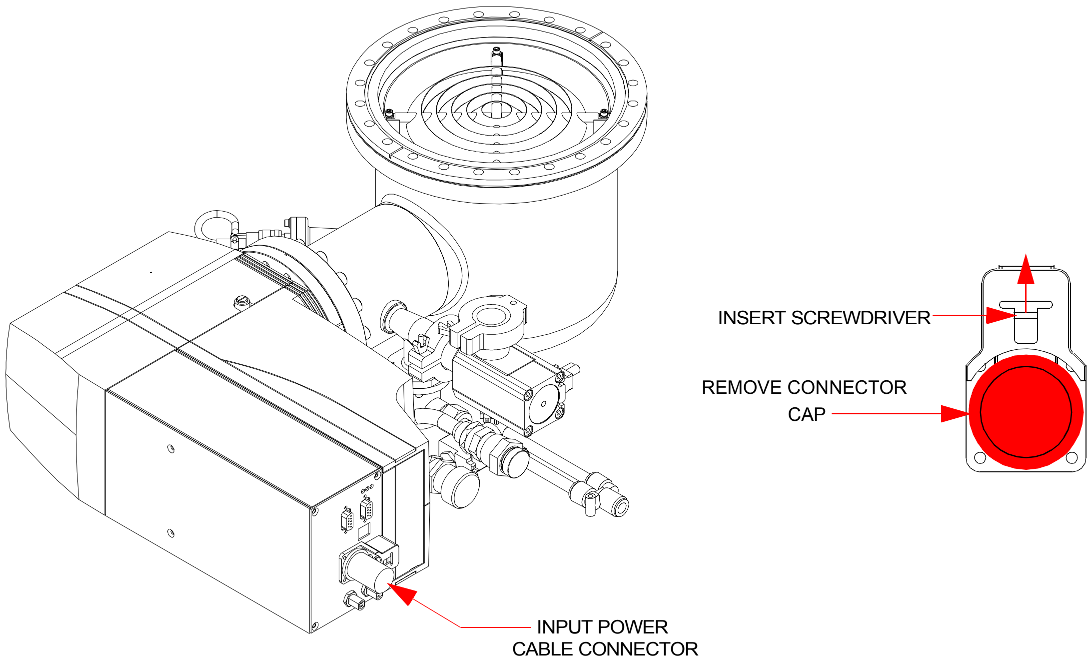

Figure 2-8: Input Power Cable Connection

5. Connect the opposite end of the Input Power cable to a local 208 VAC, Single-Phase 5 Amp source as shown in Figure 2-9.

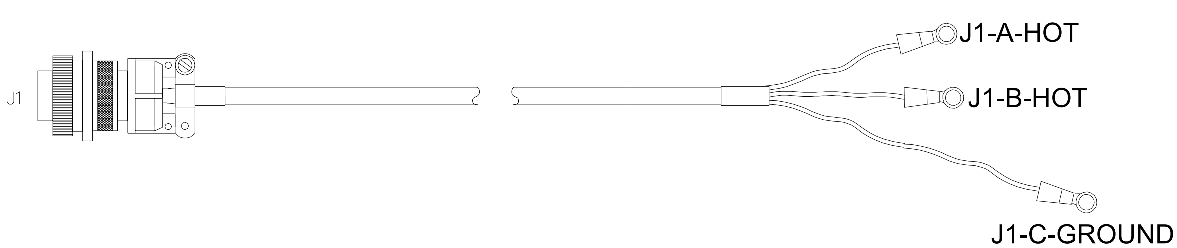

Figure 2-9: Input Power Cable Connections to 208 VAC Source

Helix Intercomponent Network Connections

NOTE: Refer to the ***On-Board IS Controller Quick Installation Guide*** *(8040657) for information on connecting On-Board IS Cryopumps to the Helix Intercomponent Network.*

On-Board *IS* Remote Connections

If desired, an On-Board *IS* Remote can be connected to the On-Board *IS* Cryopump for direct communication with the Cryopump. Refer to the ***On-Board IS Remote Quick Installation Guide*** Helix P/N 8040664 for information on how to install On-Board *IS* Remote.

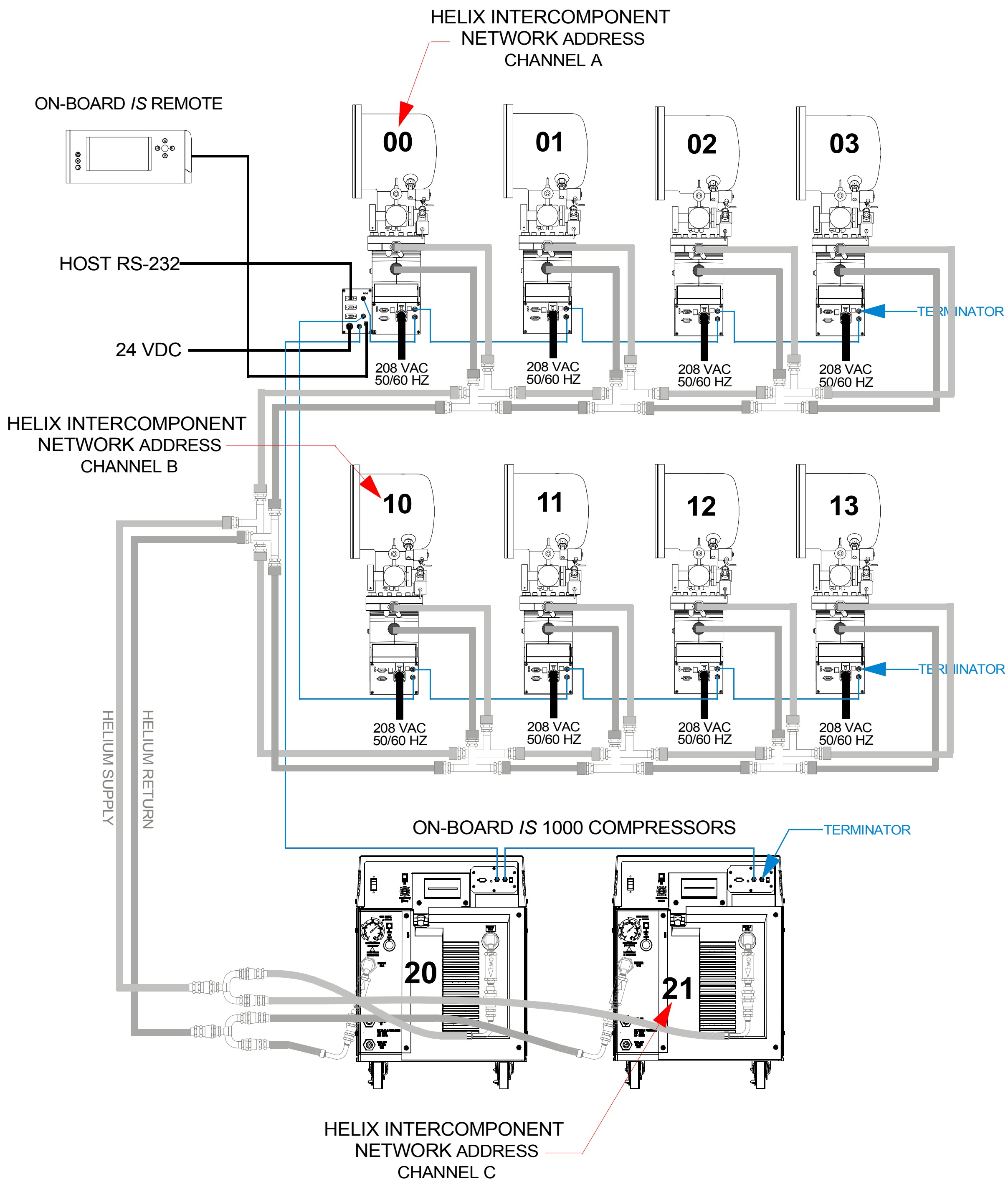

Figure 2-10: Typical On-Board *IS* Cryopump System

Section 3 - Troubleshooting

Introduction

The primary indication of trouble in a vacuum pumping system is a rise in base pressure of the vacuum chamber. A rise in the base pressure may be caused by a leak in the vacuum system, the cryopump reaching capacity, or by the cryopump running too warm.   Typically a high base pressure is caused by an air-to-vacuum leak in the system.

If a leak in the vacuum system is suspected, isolate the On-Board *IS* Cryopump by closing the Hi-Vac valve and leak check the vacuum chamber. Be sure to leak check all potential sources of leaks such as through process gas valves, chamber rough valves, chamber cooling lines. If no leaks are found, a leak may be present on the cryopump side of the Hi-Vac valve. Leak checking on the cryopump side of the Hi-Vac valve should be performed with the On-Board *IS* Cryopump shut off and at room temperature. Leak checking while the On-Board *IS* Cryopump is cold may mask leaks that are present (due to the ability of the cryopump to pump helium). If no leak is found, refer to the cryopump troubleshooting procedures summarized in Table 3-1.

The problems presented in Table 3-1 are followed by possible causes and corrective actions. The causes and corresponding actions are listed in their order of probability of occurrence.

Maintaining a log of certain parameters during normal operation can be a valuable tool in troubleshooting vacuum problems. The log may contain many parameters. However, the following minimum parameters should be included: chamber base pressure, chamber pumpdown time, chamber rate of rise. In addition, a baseline chamber RGA scan is very useful for system troubleshooting

HELIX

Technical Inquiries

NOTE: Refer to"Appendix A - Customer Support Information" *for customer support information and contact Helix Technology Corporation for assistance if required.*

Table 3-1: On-Board *IS* Cryopump Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
High vacuum system base pressure, and a cryopump temperature *below* 20K.	1. Air-to-vacuum leak in vacuum system or in cryopump.	1a. Check vacuum chamber and Hi-Vac valve for leaks. 1b. Check cryopump side of high vac valve for leaks.
	2. High partial pressure of non-condensables (helium, hydrogen, or neon) within the cryopump because the Second Stage array has reached full capacity.	2. Regenerate the cryopump as described in the ***On-Board IS Cryopump System Operation Guide*** Helix P/N 8040647.
High base pressure of vacuum system, and a cryopump temperature *above* 20K.	1. Low Helium Pressure	1. Check compressor Helium pressure. If the helium return pressure gauge reads below the normal operating pressure, add gas as described in the ***On-Board IS 1000 Compressor*** Installation, Operation, and Maintenance Instructions Helix P/N 8040597.
	2. High partial pressure of non-condensables (helium, hydrogen, or neon) within the cryopump because the Second Stage array has reached full capacity.	2. Regenerate the cryopump as described in the appropriate ***On-Board IS Cryopump System Operation Guide*** Helix P/N 8040647.
	3. Excessive thermal load on frontal array.	3. Look for new sources of thermal loads on the cryopump.

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Table 3-1: On-Board *IS* Cryopump Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
Cryopump fails to cool down to the required operating temperature or takes too long to reach that temperature (20K).	1. Low helium pressure. 2. Loose or disconnected helium self sealing couplings. 3. Compressor problems. 4. Leak in vacuum system or cryopump.	1. Add gas as described in the ***On-Board IS 1000 Compressor Installation, Operation and Maintenance Instructions*** Helix P/N 8040597. 2. Fully connect all helium self sealing couplings. 3. Refer to the ***On-Board IS 1000 Compressor Installation, Operation and Maintenance Instructions*** Helix P/N 8040597. 4a. Check vacuum chamber and Hi-Vac valve for leaks. 4b. Check cryopump side of Hi-Vac valve for leaks.
Status LED III is not illuminated.	Network cable is disconnected from the On-Board *IS* Module.	Reconnect network cable to the On-Board *IS* Module.
Status LED III is Amber.	On-Board *IS* Cryopump Heater Failure	*Refer to* "Appendix A - Customer Support Information" *for customer support information and contact Helix Technology Corporation for assistance.*
Rough valve clicks but does not open and close.	Too little or no air pressure to drive valve.	Increase air pressure to 60 to 80 psig.

Section 4 - Maintenance

Helium Circuit Decontamination

The information in Section 4 will guide you through the process of removing gaseous contamination from an On-Board *IS* Cryopump helium circuit by freezing the contaminant in the coldhead of the Cryopump. A contaminated helium circuit will cause the Cryopump to operate in a noisy manner, typically referred to as *ratcheting*, which degrades On-Board *IS* Cryopump performance.

Separate decontamination of the compressor is only required if the compressor has been opened to atmosphere or the helium pressure in the compressor has dropped to zero.

Three methods of decontamination are described in Table 4-1 and on the following pages. These methods all have isolating gaseous contamination in common by freezing them in one or more cold On-Board *IS* Cryopumps. The method to be used will most likely be determined by the amount of time available for the decontamination.

Table 4-1: Methods of Decontamination

Method	Starting Condition	Estimated Time	Effectiveness of Decontamination
1. Cooldown and Sequential decontamination of all Next Generation Cryopumps	Requires all On-Board *IS* Cryopumps to be cold.	After all On-Board *IS* Cryopumps are cold, 45 minutes to decontaminate the first On-Board *IS* Cryopump. 30 minutes for each additional On-Board *IS* Cryopump.	Maximum
2. Decontamination of only cold Next Generation Cryopumps	Only one On-Board *IS* Cryopump needs to be cold.	45 minutes to decontaminate the first *cold* On-Board *IS* Cryopump. 30 minutes for each additional *cold* On-Board *IS* Cryopump.	Acceptable
3. Simultaneous decontamination of all Next Generation Cryopumps using helium manifold	Only one On-Board *IS* Cryopump needs to be cold.	45 minutes	Acceptable (may need to be repeated in several months).

NOTE: If the On-Board IS Cryopump does not reach its normal operating temperature (below 20K), then that performance degradation may be caused by any of the following:

a. Helium gas contamination

b. Poor vacuum

c. Thermal load on the On-Board *IS* Cryopump arrays

Performing a Fast or Full regeneration cycle will *not* remove gaseous contamination from a Next Generation helium circuit. Unless the decontamination procedure is performed, the noisy On-Board *IS* Cryopump condition will repeat itself within one - four weeks.

Background

The On-Board *IS* Cryopump contains a cryogenic refrigerator assembly called a *coldhead*. There is no way to visually inspect the internal components, so it is best to detect problems by listening for unusual sounds. If the coldhead runs quietly at start up, but begins to make a *ratcheting* noise after the On-Board *IS* Cryopump is cooled down, then contaminated helium is the most probable cause.

All gases other than helium can freeze in the coldhead. During manufacturing of On-Board *IS* Cryopump systems, gaseous impurities are removed using stringent manufacturing control. The delivered system contains sufficiently low concentrations of gaseous impurities so they are not of concern.

It is possible, over long periods of operation, that additional gaseous contaminants can be released. These gases, along with any air that is added accidentally during installation, will collect in the coldhead as frozen gas. The frozen gas may partially block the regenerator which increases the amount of torque required to drive the displacer mechanism to the point that the motor noise (ie: *ratcheting)* may increase and result in coldhead motor stalling.

These gaseous contaminants can be removed by first freezing them in the coldhead, then disconnecting the helium supply and return lines, warming the coldhead followed by de-pressurizing and pressurizing the helium gas in the coldhead to remove them. The use of this decontamination procedure will return most On-Board *IS* Cryopumps to proper operation without the need for removal of the On-Board *IS* Cryopump from the tool.

NOTE: It is strongly recommended that this procedure be performed as soon as possible after the ratcheting noise appears to minimize mechanical loading on the On-Board *IS Cryopump drive mechanism.*

NOTE: Refer to “Appendix A - Customer Support Information” *and contact your local Helix Customer Support Center for assistance if required.*

Equipment/Tools Requirements

The following tools and equipment must be available to perform this decontamination procedure.

Table 4-2: Decontamination Tools and Equipment

CTI-CRYOGENICS Part Number	Description	Quantity
8080250K003	Maintenance Manifold Kit	1
7021002P001	Charging Hose	1
8043079G060	5 Ft. Flexlines (or longer)	2
-	Ultra Pure Helium (99.999%)	-
571716	1.0 Inch Self Sealing Coupling Wrench	1
571717	1 1/8 Inch Self Sealing Coupling Wrench	1
571718	1 3/16 Inch Self Sealing Coupling Wrench	1
8080015K001	Keypad/display	1
8031403	0-400/0-3000 psig Regulator	1

NOTE: For best results, Helix Technology Corporation suggests the use of a dedicated helium bottle, regulator and charge line which are never separated.

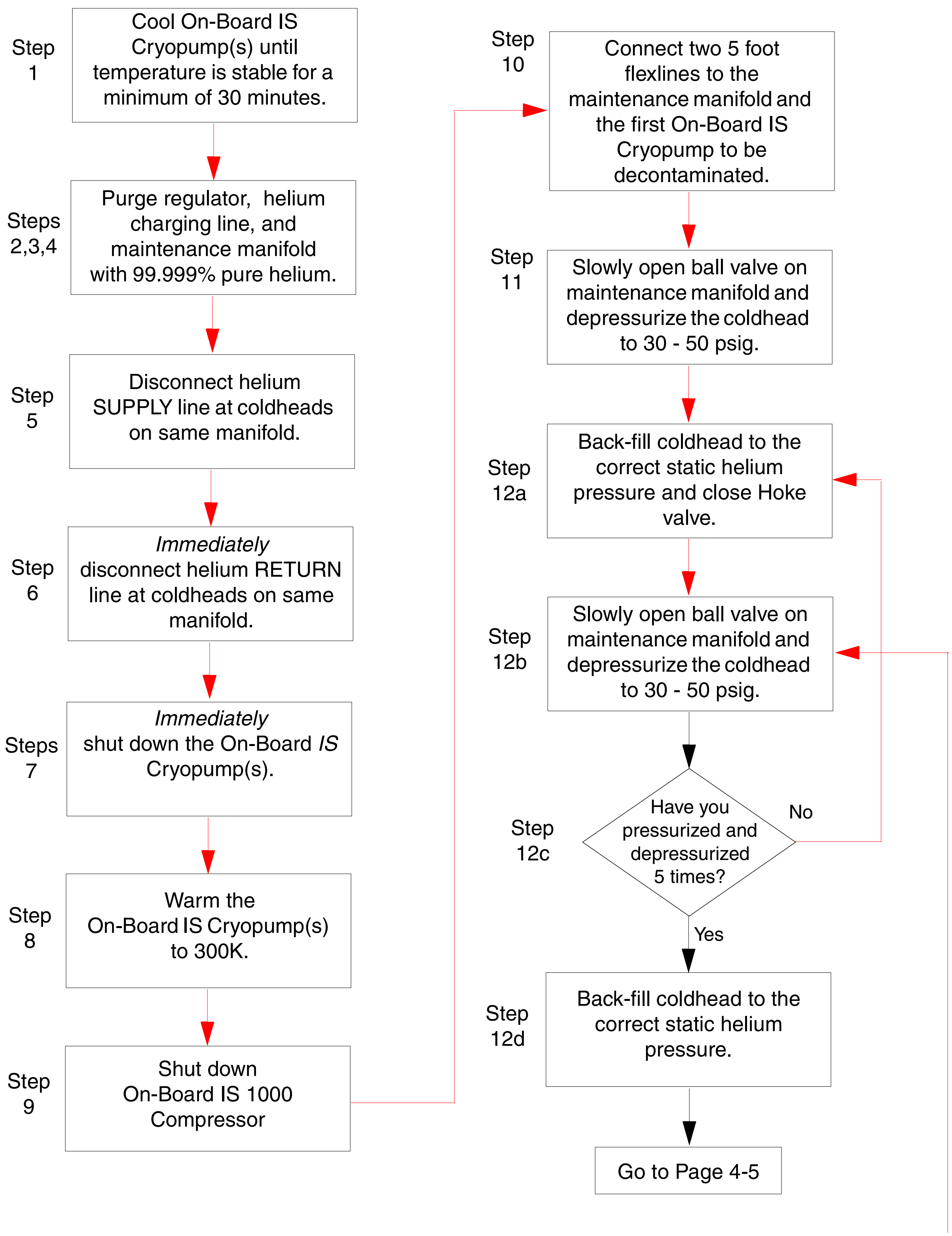

Figure 4-1: Decontamination Flowchart

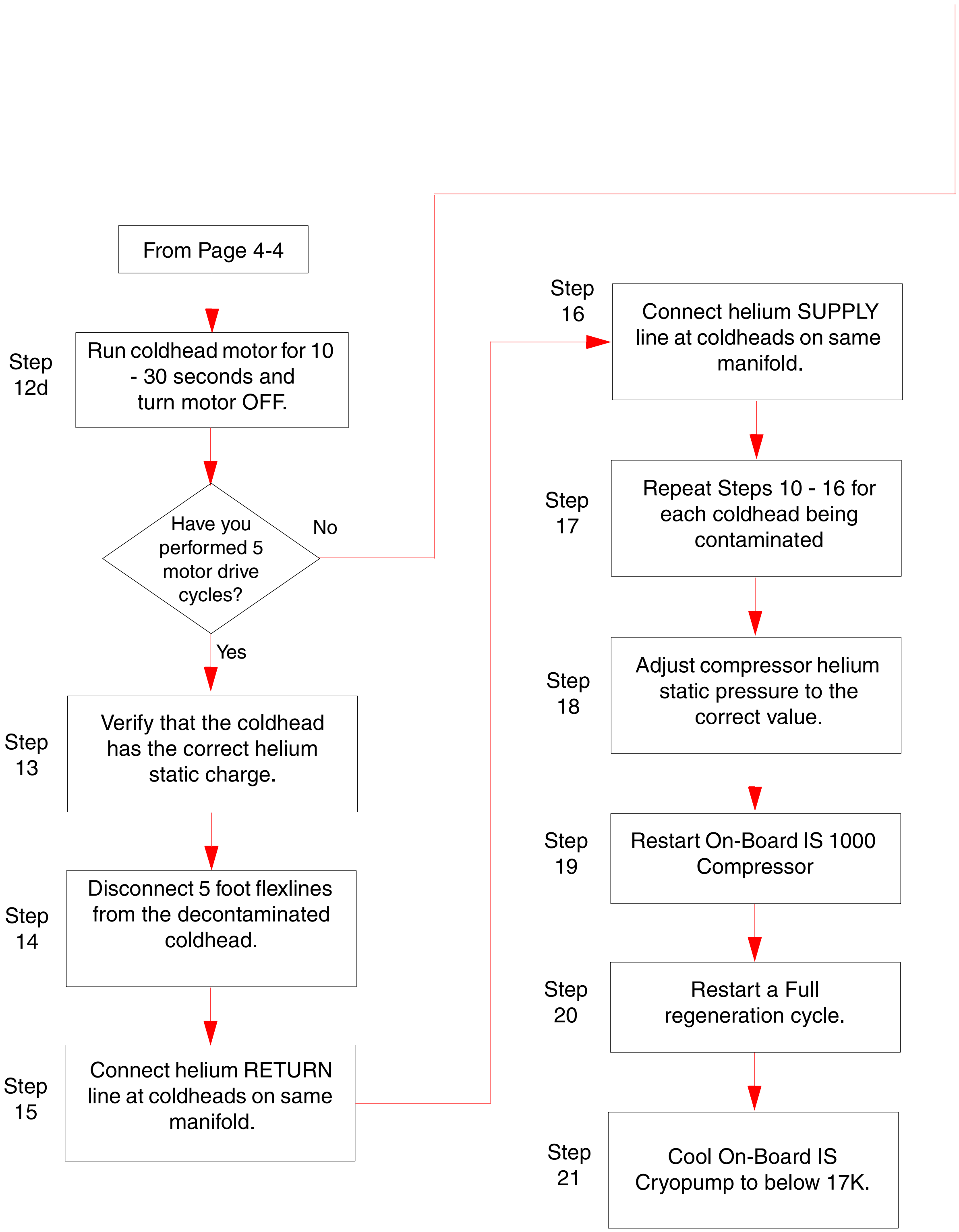

Figure 4-1: Decontamination Flowchart (continued)

Method 1 - Decontaminate all On-Board *IS* Cryopumps

This procedure removes gaseous contamination from the helium circuit by cooling each On-Board *IS* Cryopump so the gaseous contamination is frozen in the coldhead. Each On-Board *IS* Cryopump is then decontaminated in sequence. This procedure is outlined in Figure 4-1.

WARNING

High helium gas pressure may be present within high vacuum pump systems and can cause severe injury from propelled particles or parts.

1. All On-Board *IS* Cryopumps on the same manifold should have been running with second stage below 25K for at least 30 minutes. If not, then cool the remaining On-Board *IS* Cryopumps down and run for 30 minutes minimum after reaching 25K to trap contaminants in the coldhead. Continue with Step 2 even if any pump does not cool below 25K (its performance may already be affected by contamination). Close the high vacuum valves to isolate the On-Board *IS* Cryopumps from the vacuum chamber.

After Step 1 has been completed, all of the coldheads have been cooled and the contaminant gases frozen in the coldhead.

2. Attach a regulator (0-400/0-3000 psig) and charging line to a helium bottle (99.999% pure). DO NOT OPEN THE BOTTLE VALVE AT THIS TIME.
3. Purge the regulator and charging line as described in Steps a through d below. Use only 99.999% helium gas.
   a. Open the regulator a small amount by turning the adjusting knob clockwise until it contacts the diaphragm, turn the adjusting knob so that the regulator is barely open.
   b. Slowly open the bottle valve, and purge the regulator and line for 10 to 15 seconds. Keep the helium flowing to prevent re-contamination.
   c. Loosely connect the charge line to the closed Hoke valve on the maintenance manifold. Refer to Figure 4-3.
   d. Continue to purge the charge line for 30 seconds, and tighten the charge line flare fitting onto the Hoke valve while the helium is flowing.

4. Open the ball valve using the extended handle. Open the Hoke valve. Purge the manifold for 30 seconds, close the ball valve, then close the Hoke valve.

Steps 2 - 4 are required to ensure that the regulator, charging line and the maintenance manifold will be purged of air and that the air trapped in the regulator will not diffuse back into the helium bottle. For best results,

CTI-CRYOGENICS suggests the use of a dedicated helium bottle, regulator and charge line which are never separated.

Once Step 4 has been completed, all of the coldheads have been cooled and the gaseous contaminant frozen in the coldhead. The maintenance manifold has also been connected to the helium bottle and filled with clean helium.

NOTE: The helium SUPPLY line should be disconnected first to prevent the crosshead relief valve from opening.

5. While each On-Board *IS* Cryopump is still operating, disconnect the helium SUPPLY line at all of the coldheads on the same manifold. The On-Board *IS* Cryopump helium supply line is shown in Figure 4-2.

CAUTION

Be sure to use two wrenches to ensure that the self sealing coupling adapter does not back out during disassembly. Disconnect the helium supply line. Refer to Figure 4-4.

6. Immediately after Step 5, and while each On-Board *IS* Cryopump is still operating, disconnect the helium RETURN line at all of the coldheads on the same manifold. The On-Board *IS* Cryopump helium return line is shown in Figure 4-2.

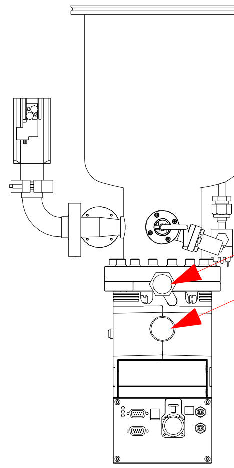

Figure 4-2: On-Board *IS* Cryopump Helium Supply and Return Lines

7. Immediately after Step 7, shut down all On-Board *IS* Cryopumps as described in *Section 1* of the ***On-Board IS Cryopump System Operation Guide***, Helix P/N 8040647.
8. Warm the On-Board *IS* Cryopumps to 300K as follows:
    a. Initiate a Full regeneration cycle.
    b. When the pumps reach 300K, abort the regeneration cycle. Repeat this process on each pump.

After Step 8 has been completed, all of the coldheads have been cooled and the contaminant gases frozen in the coldhead. Helium gas lines have been disconnected at the coldheads, and the coldheads warmed up to 300K. The next step is to remove the contaminant from each coldhead in sequence.

9. Shut down the compressor.
10. Connect the two helium flexlines to the maintenance manifold and the coldhead of the first On-Board *IS* Cryopump to be decontaminated.

CAUTION

Be sure to use two wrenches to ensure that the self sealing coupling adapter does not back out during disassembly. Disconnect the helium supply line. Refer to Figure 4-4.

11. De-pressurize the coldhead to between 30 and 50 psig (200 and 330 kPa) by slowly opening the ball valve and allowing the helium to bleed out slowly.

CAUTION

Reducing the coldhead pressure below 30 psig (200 kPa) may introduce more contaminants into the helium circuit.

12. Perform the following Steps in sequence:

NOTE: Refer to appropriate Compressor Installation, Operation, and Maintenance Instructions for the correct static helium charge pressure.

a. Back-fill the coldhead with helium to the correct static charge pressure by adjusting the regulator to the required pressure, and opening the Hoke valve on the manifold. Close the Hoke valve when the pressure is correct.

b. De-pressurize the coldhead to between 30 and 50 psig (200 and 330 kPa) by slowly opening the ball valve and allowing the helium to bleed out slowly. Do not reduce the pressure to less than 30 psig or the coldhead may be further contaminated.

c. Perform the flushing Steps 12a and 12b four more times.

d. Again back-fill the coldhead to the correct static charge pressure and run the coldhead drive motor for 10 to 30 seconds. Ensure the network cable is removed and turn the motor on then turn the motor off as described in *Section 1* of the ***On-Board IS Cryopump System Operation Guide***, Helix P/N 8040647.

e. Repeat Steps b - d four times. There are a total of 5 drive motor runs with five flushes each for a total of 25 flushes.

NOTE: Refer to appropriate Compressor Installation, Operation, and Maintenance Instructions for the correct static helium charge pressure.

13. Verify that the coldhead has the correct helium static charge pressure.

14. Disconnect the 5 foot flexlines from the decontaminated coldhead supply and return connectors.

15. Reconnect the system helium RETURN line to the return connector on the coldhead as shown in Figure 4-2.

16. Reconnect the system helium SUPPLY line to the supply connector on the coldhead as shown in Figure 4-2.

Once Step 16 has been completed, the decontamination of the first On-Board *IS* Cryopump is completed and charged to the correct pressure with clean helium. The remaining coldheads need to be decontaminated.

17. Repeat Steps 10 - 16 for each coldhead being decontaminated.
18. Once Step 17 has been completed, the On-Board *IS* Cryopumps are ready to be cooled down. Adjust the compressor pressure to the correct charge pressure.

NOTE: Refer to the appropriate Compressor Installation, Operation, and Maintenance Instructions for the correct static helium charge pressure value and adjustment procedure.

NOTE: The charging adapter can be inserted into any helium line at the tool to simplify the final adjustment of system pressure. It should be removed after final pressure adjustment.

19. Restart the compressor.
20. Start a Full Regeneration cycle on all the On-Board *IS* Cryopumps to prepare the vacuum side of the On-Board *IS* Cryopump.
21. Allow the On-Board *IS* Cryopumps cryopumps to cool to below 17K.

If *ratcheting* in the On-Board *IS* Cryopump reappears, refer to “Appendix A - Customer Support Information” and call your nearest CTI-CRYOGENICS Customer Support Center for additional technical assistance.

Decontamination Alternatives

Method #1 Decontaminate All Cryopumps

The preceding procedure is the most effective method to remove gaseous contaminants from the helium circuit. All On-Board *IS* Cryopumps were first cooled down and the contaminant frozen. Each On-Board *IS* Cryopump was decontaminated in sequence.

All On-Board *IS* Cryopumps that are cold must be decontaminated. If they are cold and not decontaminated, then gases frozen in these On-Board *IS* Cryopumps will re-contaminate the helium gas when they are warmed up.

Method # 2 Decontamination of Only Cold Cryopumps

If time is critical, then an alternate method of decontamination, using

Method 1 as a basis may be used. This procedure will also remove gaseous contaminant in the system. If certain On-Board *IS* Cryopumps are warm in Step 1 then they can remain at room temperature (i.e. over 290K). With the compressor on and cold On-Board *IS* Cryopumps left on, run these "warm" On-Board *IS* Cryopumps for 5 minutes. Running these "warm" On-Board *IS* Cryopumps for a short time will move any concentrated contaminant out of these coldheads into the compressor. The contaminants will then be carried to the cold On-Board *IS* Cryopumps where they will be frozen.

In this method, the following Steps replace the corresponding Steps in Method 1:

Step 1 - Method #2

Any On-Board *IS* Cryopumps on the same manifold which are running should have been running below 25K for at least 30 minutes. Any pumps warmer than 290K should be kept warm. Continue with Step 2 even if any pump does not cool below 25K (its performance may already be affected by

contamination). Close the high vacuum valves to isolate the On-Board *IS* Cryopumps from the vacuum chamber.

Step 17 - Method #2

Repeat Steps 10 - 16 for each On-Board *IS* Cryopump which is not above 290K.

Method # 3 Grouped Decontamination using Manifold

The time required to decontaminate each On-Board *IS* Cryopump in Method #1 after it is cooled and warmed up is about 30 minutes. If time is not available to decontaminate each On-Board *IS* Cryopump in sequence, then the alternate is to decontaminate all On-Board *IS* Cryopumps together, i.e.: *Grouped Decontamination*. At least one of the On-Board *IS* Cryopumps must be cold. The decontamination is performed from the compressor side of the common supply and return manifolds.

In this method the following Steps replace the previous Steps:

Step 5 - Method #3

While each On-Board *IS* Cryopump is still operating, disconnect the helium SUPPLY line at the compressor side of the common supply manifold at the tool.

Step 6 - Method #3

While each On-Board *IS* Cryopump is still operating, disconnect the helium RETURN line at the compressor side of the common supply manifold at the tool.

Step 10- Method #3

Verify that the compressor is off. Connect the two 5 foot helium flexlines to the maintenance manifold and the compressor side of the common supply and return manifold.

CAUTION

Be sure to use two wrenches to ensure that the self sealing coupling adapter does not back out during disassembly. Disconnect the helium supply line. Refer to Figure 4-4.

Steps 11 - 16 - Method #3

All connections are to the manifold, not the individual coldheads. All coldhead drive motors are to be run for 10 to 30 seconds using the remote keypads per Step 12d. At the end of Step 16, all of the On-Board *IS* Cryopumps are decontaminated.

NOTE: Follow local, state, and federal guidelines when disposing of waste from cleaned cryopumps.

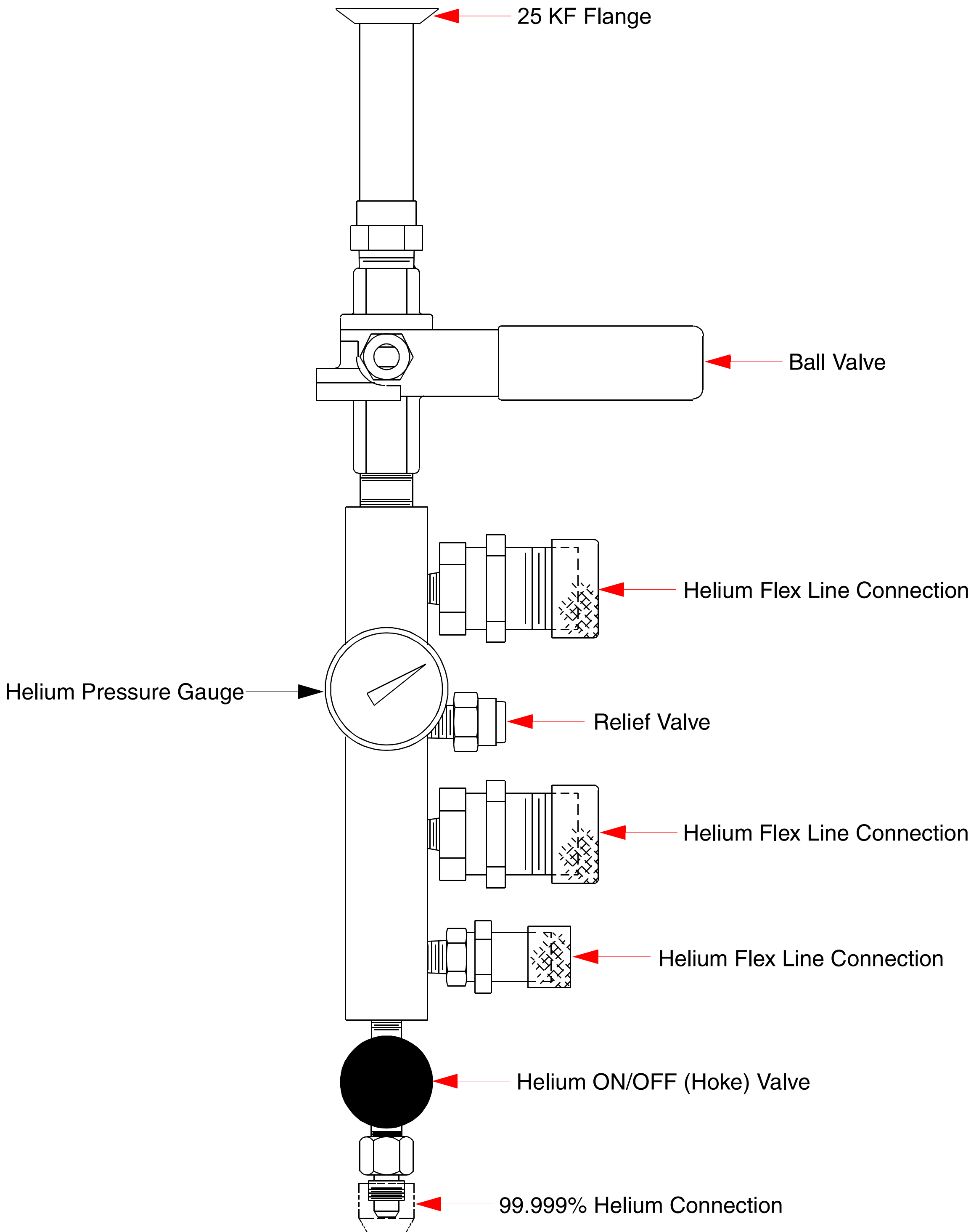

Figure 4-3: Maintenance Manifold Part Number 8032051G004

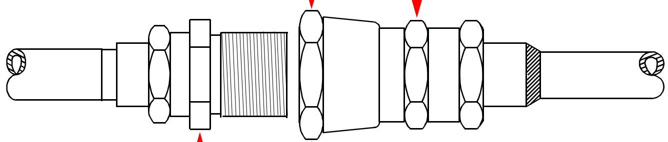

Figure 4-4: Proper Helium Line Coupling Disconnection/Connection

On-Board *IS* Cryopump Cleaning

WARNING

If the On-Board *IS* Cryopump has been used to pump toxic or dangerous materials, you must take adequate precautions to safeguard personnel.

Cleaning the arrays or other interior surfaces of the On-Board *IS* Cryopump vacuum vessel is seldom required because dust buildup does not affect performance, and the special copper alloy cryo-condensing arrays are nickel plated for corrosion resistance.

If you wish to clean the arrays and other interior surfaces, follow the procedures below.

1. Confirm that an adequate supply of indium gasket material, Helix P/N 7100001G006, is available to replace gaskets inadvertently damaged during disassembly.
2. Carefully disassemble the components in the vacuum vessel, including the arrays and radiation shield, to avoid damage to the indium gaskets.

3. Clean the interior surface of the vacuum vessel, the 80K condensing array, and the 80K radiation shield as follows:
   a. Wash each item in strong soap or detergent solution and hot water.
   b. Rinse the items in *clean hot water*.
   c. Air or oven dry all items at 150° F (66° C) maximum before reinstalling into the On-Board *IS* Cryopump.

CAUTION

Do not clean the 15K cryo-adsorbing array, because you may severely contaminate the adsorbent in the cleaning process.

4. Wearing lint-free gloves, reassemble the On-Board *IS* Cryopump. Replace any indium gasket damaged during disassembly.

Appendix A - 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:

1 800-367-4887 - Inside the United States of America

+1 ***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

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