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C-A OPERATIONS PROCEDURES MANUAL

15.5.39 Troubleshoot a Cryo Pump

(Vacuum Group Procedure VA-008.18.1.39)

Note: This document was formerly a C-A Group Procedure. The content of the group procedure was reviewed by the Technical Supervisor. All approvals and/or issue dates of the original group procedure are maintained for present use.

Hand Processed Changes

<u>HPC No.</u>	<u>Date</u>	<u>Page Nos.</u>	<u>Initials</u>
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Approved: _____ *Signature on File* _____
Collider-Accelerator Department Chairman Date

S. Gill

Vacuum Group Procedure VA-008.18.1.39
Original Issue Date: 01/01/00
Revision 01

1. **Purpose:**

To provide an effective procedure for AGS vacuum technicians to start up a cryopump.

2. **Responsibilities:**

The AGS vacuum supervisor shall be responsible for the implementation of this procedure.

7 SYSTEM TROUBLESHOOTING

SCOPE

The following charts will help you in locating system problems. They are intended as a guide. Any questions concerning component failure that is not covered here should be directed to Varian Vacuum Products, Service Operations.

7.1 SYSTEM DIAGNOSTICS

General

If operating problems arise from use of the Varian Cryopump, perform some common sense checks before performing system diagnostics and maintenance.

1. Are the utilities correct and functioning?
2. Is the vacuum system leak tight with the pump off?
3. Are all vacuum system valves in the proper position?
4. Has the pump been regenerated at the proper time? (Pump must be regenerated if the vacuum system "accidentally" went to atmosphere when cold.)
5. Has someone accidentally vented the helium from the compressor? (Check the charge pressure and recharge if necessary per Section 6.3.)
6. Does the compressor show more than 13,500 hours of operation? If so, has the adsorber been replaced?

Note: Original adsorber in Cryostack™ compressor module needs to be replaced after 9,000 hours.

If there is no logical external reason for pump problems, then proceed to the diagnostic chart. Your pump is a sophisticated piece of equipment and only trained technicians should attempt diagnostics. If there is any question please contact a Varian Vacuum Products Service Center for advice.

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The following chart is a guide and should be used to identify common problems most users experience. If these do not solve a problem you are experiencing, call your nearest Varian Service Operation for advice.

PROBLEM	CHECK	SOLUTION
1. COMPRESSOR DOES NOT TURN ON	A. SWITCH ON? B. POWER CONNECTED? C. REMOTE SWITCH INSTALLED AND ON? D. COMPRESSOR CHARGE LOW?	A. TURN ON B. CONNECT C. TURN ON D. RECHARGE COMP.
2. COMPRESSOR TURNS ON THEN OFF	A. WATER FLOW TOO LOW? B. IS LINE VOLTAGE CORRECT?	A. CORRECT B. CORRECT
3. COMPRESSOR ON, BUT NOT EXPANDER	A. EXPANDER CORD CONNECTED? B. EXPANDER MOTOR WIRING DEFECTIVE? C. COMPRESSOR POWER SUPPLY MALFUNCTION?	A. CONNECT CORD B. CHECK MOTOR WIRING CONTINUITY C. CALL VARIAN SERVICE
4. CRYOPUMP DOES NOT COOL DOWN	A. POOR VACUUM IN PUMP DUE TO: 1. LEAK IN VAC SYSTEM 2. LEAK IN CRYOPUMP 3. INADAQUATE ROUGH PUMPING B. HOSES NOT CONNECTED COMPLETELY? C. EXPANDER PERFORMANCE DEGRADED? D. COMPRESSOR PRESSURE LOW E. SYSTEM THERMAL OVERLOAD? F. FAULTY TEMPERATURE SENSOR?	A.1. FIX LEAK 2. FIX LEAK 3. ROUGH FOR PROPER TIME B. CONNECT HOSES/TIGHTEN HOSES C. CALL VARIAN SERVICE D. RECHARGE COMPRESSOR E. REMOVE THERMAL LOAD F. REPLACE SENSOR
5. SYSTEM BASE PRESSURE HIGH AND/OR SLOW PUMPDOWN	A. CRYOPUMP NEAR CAPACITY? B. VACUUM SYSTEM CONTAMINATED? C. LEAK IN VACUUM SYSTEM OR CRYOPUMP? D. 2ND STAGE ARRAY CHARCOAL CONTAMINATED? E. EXPANDER PERFORMANCE DEGRADED? F. COMPRESSOR NOISE?	A. REGENERATE CRYOPUMP B. CLEAN SYSTEM AND/OR RGA ANALYSIS C. FIX LEAKS D. REPLACE 2ND STAGE ARRAY E. CALL VARIAN SERVICE F. CALL VARIAN SERVICE

CONTINUED

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DIAGNOSTICS CONTINUED

PROBLEM	CHECK	SOLUTION
6. PUMP RUNNING, BUT PUMP WALL FROSTED	A. CRYOPUMP HAS REACHED CAPACITY? B. CRYOPUMP HAS BEEN VENTED TO ATMOSPHERE? C. INTERRUPTION IN POWER OR WATER? D. MALFUNCTION IN REFRIGERATOR E. MALFUNCTION IN REGEN. CONTROLLER IF PRESENT	A. REGENERATE PUMP B. REGENERATE PUMP C. CHECK UTILITIES D. CALL VARIAN SERVICE E. CALL VARIAN SERVICE
7. EXCESSIVELY NOISY EXPANDER	A. PHASING CAPACITOR NOT CONNECTED PROPERLY B. COMPRESSOR CAPACITOR FAILURE C. CONTAMINATED HELIUM IN THE REFRIGERATOR	A. RECONNECT CAPACITOR B. CALL VARIAN SERVICE C. CALL VARIAN SERVICE

7.2 SCHEMATIC, 5.35 COMPRESSOR

The following schematic is for the compressor. It is to be used for reference only. Any work in the power supply area should only be done by qualified service personnel.

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1 SAFETY INFORMATION

SCOPE

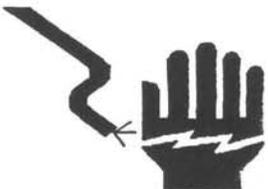
Operating personnel must always be aware of areas of hazards. Safe practices and procedures should always be used and followed. Do not take shortcuts. Do not disable interlocks and always remember the warnings and cautions called out when operating or working around a cryopump.

The information contained in this section is a summary of the operator's related safety precautions. The warnings and cautions are arranged in the order they appear in this manual.

Users of cryopumps should be alert to two levels of hazards identified by the following symbols:

 WARNING
Warnings are used when failure to observe instruction or precautions could result in injury or death to humans or animals.

 CAUTION
Cautions are used when failure to observe instructions could result in significant damage to equipment and/or facilities.

 WARNING

HIGH VOLTAGE
Hazardous voltage. Can shock, burn, or cause death. Turn off power when working in this area. Extreme caution should be used if power is required to make measurements.

 **WARNING**



HIGH PRESSURE

Gas pumped on the cold surfaces of the cryopump can cause explosive high pressure in the pump when the pump is brought back to room temperature.

The pressure relief valve is designed to prevent built-up pressure. Never alter, restrain, or remove the pressure relief valve.

 **WARNING**



POISONOUS AND/OR CORROSIVE COMPOUNDS

Pumping hazardous gases or vapors can result in the presence of hazardous materials during operation or after regeneration that can cause severe injury or death. Always vent the pump and relief valve to a safe location. Take other appropriate precautions for hazardous materials that may remain in the pump.

 **WARNING**



COLD SURFACE

The internal cryoarrays remain cold for some time after power is turned off. They could cause severe frostbite if handled when cold. Never disassemble the pump and handle the cryoarrays unless you have determined they are at room temperature.



WARNING



EXPLOSION

Pumping combustible gases can result in explosive mixtures existing in the pump below the main seal.

Never install an ionization gauge or other source of ignition below the main seal. Never alter, restrain or remove the pressure relief valve.



CAUTION

The cap screw must be removed from bottom of compressor. Failure to remove cap screw can result in equipment damage.



CAUTION

The compressor must be operated in a level, upright position. When being handled or shipped the unit should not be tipped on its side or inverted.



CAUTION

The helium used in the refrigerator must always be high purity. Failure to use helium of the specified purity will result in contamination of the refrigerator and can cause damage to the cryopump.



CAUTION

The helium charge pressure in the refrigerator during operation must always be within specification. Incorrect pressure will result in loss of refrigeration power and/or automatic shutdown.

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CAUTION

The compressor must be supplied with cooling water as specified. Insufficient water cooling will result in the compressor overheating and automatic shutdown.



CAUTION

The compressor must be operated within the specified voltage range. Operating at an incorrect voltage may result in overcurrent and/or compressor damage.



CAUTION

The compressor must never be operated with the adsorber disconnected and the expander connected. Operation in this mode may result in expander motor burnout because of lack of cooling.



CAUTION

The helium hoses must not be bent to less than an 8 inch radius. A smaller radius may overstress the hose and could cause helium leakage.



CAUTION

The cryopump body must never be operated for extended periods of time in high intensity neutron or gamma radiation fields. Organic materials inside the expander will degrade.

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CAUTION

If a heated gas purge is used, do not heat gas above 100°C or damage to the second-stage array can occur.



CAUTION

A molecular sieve trap or liquid nitrogen trap must be installed in line with any mechanical oil-sealed pump used with the cryopump. The trap must be maintained at regular intervals. Failure to do so can cause oil backstreaming into the cryopump. This will permanently damage the second-stage array, causing decreased hydrogen pumping speed and capacity.



CAUTION

The roughing valve must be closed 30 minutes after chilldown has started. Failure to do so can cause oil backstreaming into the cryopump which can permanently damage the second-stage array.