

# CTI-CRYOGENICS

## SERVICE BULLETIN

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### DECONTAMINATION PROCEDURES FOR CRYO-TORR<sup>(R)</sup> HIGH-VACUUM PUMPS

Decontamination Procedures No. 1 and No. 2 (see the following pages) are to be used for decontaminating the helium-gas circuits of the cold head and the compressor unit of a CRYO-TORR<sup>(R)</sup> high-vacuum pump.

One of the major sources of helium contamination in CRYO-TORR high-vacuum pumps is the use of helium gas that is of insufficient purity. Helium gas of at least 99.999% purity should be used when decontaminating CRYO-TORR high-vacuum pumps. The helium gas that is typically available for helium-leak detection or welding purposes may not be of sufficient purity and therefore should NOT be used in a CRYO-TORR high-vacuum pumps. Such gas can contain impurities (chiefly nitrogen, neon, and water vapor) to the extent that they will accumulate within the cold regions of the cold head and lead to a reduction in the performance of the CRYO-TORR high-vacuum pump.

Contamination of the helium-gas circuits of a CRYO-TORR high-vacuum pump will usually be indicated by sluggish or intermittent operation (racketing) of the cold-head drive mechanism. Such operation will be accompanied by warming of the condensing and adsorbing arrays (as revealed by an increase in the indicated operating temperature of the cold head) and may also affect the vacuum in the User's vacuum system. In severe cases of contamination, the cold head drive mechanism will seize and fail to operate. Such a failure is caused by a large quantity of contaminants freezing in the cold head.

Decontamination Procedure No. 1 should be used to clean up the cold head and thereby restore its performance. It is important to note that the cold-trapping of the contaminants inside the cold head that occurs during Procedure No. 1 also serves to satisfactorily purify the compressor unit whenever the level of contamination within the helium gas circuits of the CRYO-TORR High-vacuum pump is not severe.

Decontamination Procedure No. 2 should be used to clean up the compressor unit whenever: (a) Maintenance has been performed on the helium-gas circuit of the compressor unit or, (b) It is suspected that the compressor unit has become severely contaminated during operation of the CRYO-TORR high-vacuum pump.

Note: Routine replacement of the compressor-unit adsorber does not contaminate the compressor unit. As shipped, each replacement adsorber is charged with helium gas and is provided with self-sealing couplings that enable installation without contamination of the helium gas charge.

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CTI-CRYOGENICS recommends that the user not employ evacuation to decontaminate either the cold head or the compressor unit (because special equipment and procedures are required).

If the user does, however, choose to evacuate either the cold head or the compressor unit, permanent damage may result to the component concerned if it is turned on while it is being evacuated by a mechanical pump.

OPERATING EITHER THE COLD HEAD DRIVE MOTOR OR THE COMPRESSOR PUMP MOTOR UNDER A VACUUM MAY DESTROY THE MOTOR (DUE TO THE LOW DIELECTRIC STRENGTH OF HELIUM IN THE 50-MILLITORR RANGE).

This is but one of several problems that can result from decontamination by evacuation.

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## DECONTAMINATION PROCEDURE NO. 1

### DECONTAMINATING THE COLD HEAD OF A CRYO-TORR(R) HIGH-VACUUM PUMP

If for any reason, it is suspected that the helium gas in the cold head of a CRYO-TORR(R) high-vacuum pump has become contaminated, proceed as follows to clean up the cold head.

Note: For this procedure, the appropriate evacuation and charging adapter must be employed. Use the evacuation and charging adapter that can be ordered as CTI-CRYOGENICS part number D8032051.

- CAUTIONS:
- (1) WHEN CONNECTING OR DISCONNECTING A SELF-SEALING COUPLING, ALWAYS USE TWO WRENCHES. THIS IS TO AVOID LOOSENING THE BODY OF THE COUPLING FROM ITS ADAPTER.
  - (2) ALWAYS CHECK THAT THE FLAT RUBBER GASKET IS IN PLACE BEFORE CONNECTING A SELF-SEALING COUPLING.
  - (3) IF THE COLD HEAD STARTS TO RATCHET DURING STEP 1 BELOW, PROCEED IMMEDIATELY TO STEP 2.

- (1) Cool down the high-vacuum pump and operate it for at least one hour (preferably three hours if possible).

Note: As a result of this step, the contaminants in the helium gas circuits of the CRYO-TORR high-vacuum pump tend to become frozen inside the cold head, and thereby become trapped inside the cold head. The longer the high-vacuum pump is operated beyond the one-hour period, the greater is the amount of contamination that becomes isolated inside the cold head.

- (2) Shut down the CRYO-TORR high-vacuum pump.
- (3) IMMEDIATELY disconnect the helium return and supply lines from the gas-return and gas-supply connectors at the rear of the compressor unit, but leave them attached at the cold head. (Leave the charging tee attached to the gas-return connection on the Model 20/70 Compressor Unit if this type of compressor unit is being used.)

Notes: (1) It is imperative that the interconnecting lines be disconnected IMMEDIATELY after shutdown so that contamination can not migrate back into the compressor unit.

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- (2) If the interconnecting lines have NOT been disconnected IMMEDIATELY after shutdown, then the high-vacuum pump should be restarted to once again cool down the cold head in accordance with step 1. Steps 2 and 3 should then be performed.
- (4) Attach the evacuation and charging adapter to the disconnected ends of the helium return and supply lines.

CAUTION: IN THE FOLLOWING STEP, DO NOT REDUCE THE PRESSURE BELOW 30 PSIG. TO DO SO MAY RESULT IN THE INTRODUCTION OF ADDITIONAL CONTAMINATION INTO THE COLD HEAD.

- (5) Reduce the pressure in the cold head to a level of 30 psig by using the evacuation and charging adapter.
- (6) Allow 4 hours for the second stage of the cold head to warm up to room temperature.

CAUTION: THE COLD-HEAD SECOND STAGE MUST BE AT ROOM TEMPERATURE BEFORE STEP 7 IS COMMENCED. OTHERWISE, THE DECONTAMINATION PROCEDURE WILL BE INEFFECTIVE.

Note: The warm-up time can be decreased by:

- (a) backfilling the vacuum housing of the cryopump to one atmosphere with dry argon or nitrogen gas, and/or
- (b) wrapping a heating tape around the vacuum housing of the cryopump.

CAUTION: DO NOT HEAT THE CRYOPUMP ABOVE 150° F (66°C). TO DO SO WILL RESULT IN DAMAGE TO SOME MATERIALS IN THE CRYOPUMP.

- (7) Attach a helium bottle, regulator, and charging line to the evacuation and charging adapter and purge the charging line and regulator of air.

CAUTION: DO NOT USE HELIUM GAS THAT IS LESS THAN 99.999% PURE.

Note: After the regulator has been installed on the helium bottle but before the bottle valve has been opened, it is important that the adjusting screw on the regulator be turned clockwise until the regulator is open. Then open the valve on the bottle and immediately back off on the regulator until helium stops flowing. This procedure is required in order that both the regulator and the charging line will be purged and the air trapped in the regulator will not diffuse into the bottle.

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- (8) Perform the following sequence of steps (a) through (d):
  - (a) Pressurize the cold head with helium to the static charge pressure (see Table 1).
  - (b) Depressurize the cold head to 30 psig.
  - (c) Perform flushing steps (a) and (b) four more times.
  - (d) Pressurize the cold head to the static charge pressure and run the cold-head drive motor for 10 to 30 seconds by means of the compressor-unit "ON-OFF" switch and the cold-head "ON-OFF" switch (if one exists).

- (9) Perform steps (b) through (d) four more times.

Note: There will be a total of 25 flushes and a total of 5 drive-motor runs.

- (10) Verify that the cold head is pressurized to the static charge pressure shown in Table 1.
- (11) Disconnect the evacuation and charging adapter from the ends of the helium return and supply lines.

CAUTION: CHECK THAT THE FLAT RUBBER GASKETS ARE IN PLACE BEFORE RECONNECTING THE SELF-SEALING COUPLINGS IN STEP 12 BELOW.

- (12) Reconnect the helium return and supply lines to the gas-return and gas-supply connectors at the rear of the compressor unit.
- (13) Restart the CRYO-TORR high-vacuum pump.

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TABLE 1. STATIC CHARGE PRESSURES USED WITH VARIOUS  
CRYO-TORR<sup>(R)</sup> HIGH VACUUM PUMPS

<u>HIGH-VACUUM PUMP</u>	<u>COMPRESSOR UNIT</u>	<u>STATIC CHARGE PRESSURE * (psig)</u>	<u>PRESSURE TOLERANCE (psig)</u>
CRYO-TORR <sup>(R)</sup> 7	Model 20/70**	135	± 5
CRYO-TORR <sup>(R)</sup> 7	Model 21SC	225	± 5
CRYO-TORR <sup>(R)</sup> 72	Model 21SC	250	+ 0, - 5
CRYO-TORR <sup>(R)</sup> 8	Model 350SC	250	+ 0, - 5
CRYO-TORR <sup>(R)</sup> 10	Model 1020R	185	± 5

\* These pressures are valid when the cold head and the compressor unit are at nominal room temperature 59°F to 77°F (15°C to 25°C).

\*\* In case of doubtful identify, note that the Model 20/70 Compressor Unit operates on 120 volts/60 Hz or 110 volts/50 Hz. (See rear of compressor unit.)

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## DECONTAMINATION PROCEDURE NO. 2

### DECONTAMINATING THE COMPRESSOR UNIT OF A CRYO-TORR(R) HIGH-VACUUM PUMP

When the level of contamination within the helium-gas circuits of a CRYO-TORR(R) high-vacuum pump is not severe, the use of Procedure No. 1 will generally decontaminate the compressor unit as well as the cold head. This is because contaminants in the compressor unit will have become isolated inside the cold head during the procedure.

Use Procedure No. 2 to decontaminate the compressor unit when the following conditions exist.

- (a) Maintenance has been performed on the helium gas circuit of the compressor unit (for example, replacing a filter or an orifice). For this condition, commence the cleanup with step 3 below.
- (b) It is suspected that the compressor unit has become severely contaminated during operation of the CRYO-TORR high-vacuum pump. For this condition, commence the cleanup with step 1.

- CAUTIONS:
- (1) WHEN CONNECTING OR DISCONNECTING A SELF-SEALING COUPLING, ALWAYS USE TWO WRENCHES. THIS IS TO AVOID LOOSENING THE BODY OF THE COUPLING FROM ITS ADAPTER.
  - (2) ALWAYS CHECK THAT THE FLAT RUBBER GASKET IS IN PLACE BEFORE CONNECTING A SELF-SEALING COUPLING.

Note: When a Model 20/70 Compressor Unit is being decontaminated, it is necessary that its charging tee be left attached to the gas-return connection.

- (1) Shut down the CRYO-TORR high-vacuum pump.
- (2) IMMEDIATELY disconnect the helium return and supply lines from the gas-return and gas-supply connectors at the rear of the compressor unit but leave them attached at the cold head.

Note: To clean up the cold head, which will also have become contaminated, proceed in accordance with steps 4 through 13 of Procedure No. 1.

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(3) Perform the following sequence of steps for compressor-unit decontamination.

- (a) Reduce the static pressure of the compressor unit to a level of 30 psig by removing the flare cap from the helium-gas charge fitting at the rear of the compressor unit and opening the helium charge valve while observing the supply pressure gauge.
- (b) Attach a helium bottle, regulator, and charging line to the male flare fitting on the helium charge valve (or to the charging tee that is attached to the gas-return connection of a Model 20/70 Compressor Unit) and purge the charging line and the regulator of air.

CAUTION: DO NOT USE HELIUM GAS THAT IS LESS THAN 99.999% PURE.

Note: After the regulator has been installed on the helium bottle but before the bottle valve has been opened, it is important that the adjusting screw on the regulator be turned clockwise until the regulator is open. Then open the valve on the bottle and immediately back off on the regulator until helium stops flowing. This procedure is required in order that both the regulator and the charging line will be purged and the air trapped in the regulator will not diffuse into the bottle.

- (c) Pressurize the compressor unit to the static charge pressure. (See Table 1.)
  - (d) Perform flushing steps (a) through (c) four more times.
  - (e) With the compressor unit pressurized at the static charge pressure, run the compressor unit for 1 to 2 minutes.
- (4) Perform this sequence of steps (a) through (e) two more times.

Note: There will be a total of 15 flushes and a total of 3 runs of the compressor unit.

- (5) Allow the compressor unit to cool to room temperature.
- (6) Verify that the compressor unit is pressurized to the static charge pressure shown in Table 1.

CAUTION: CHECK THAT THE FLAT RUBBER GASKETS ARE IN PLACE BEFORE RECONNECTING THE SELF-SEALING COUPLINGS IN STEP 7 BELOW.



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- (7) Reconnect the helium return and supply lines to the gas-return and gas supply connectors at the rear of the compressor unit.
- (8) Restart the CRYO-TORR high-vacuum pump.

Note: As the Cryopump continues to operate, any residual contamination of the compressor unit will have become isolated in the cold head and can be readily removed from the cold head by using Procedure No. 1

- (9) As soon as convenient (but preferably after 48 hours or more of operation), carry out Procedure No. 1 starting with step 2 in order to decontaminate the cold head.