

Temescal

FACILITY AND INSTALLATION GUIDE FOR FC/BJD-2000 EVAPORATION SYSTEMS



Revision D, January 2009

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Revision History

0101-8682

Revision	Change Description	Reason/ Application	Date	Approved
-0	Initial version of manual		July '02	
-1	FC-2000 added		Dec '04	
-2	May '06 update. In revision enumeration scheme adopted in Dec. '06, this revision is considered to be Rev. A of 0101-8682-2.		May '06	
B	Changed the revision enumeration scheme to that of other recent Temescal manuals. Altered number and sequence of sections to conform to sequence of sections in the FC-2800 and FC-3800 F & I Guides. Added specifications and instructions regarding water supply #2.	To standardize revision control scheme and section sequence.	Dec. '06	SS
C	Minor text corrections to Sections 1-3. Added Figures 3-1 through 3-8.	Internal review only. Corrections made pursuant to Engineering review. Section 3 illustrations and tables added to bring document into conformity with other F & I Guides.	Dec. '08	--
D	Minor revisions to existing site preparation checklist on pp. 1-3 and 1-4. Added cable-length specification to checklist. Inserted new Figure 3-3.	Pursuant to additional Engineering review plus requests from Customer Service.	Jan. '09	LW

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SUMMARY OF TERMS AND CONDITIONS OF SALE

MECHANICAL WARRANTY: For a period of twelve (12) months from the date of original shipment to Purchaser thereof, the apparatus and each part or component manufactured by Temescal, a part of Edwards Vacuum, Inc., hereinafter known as "Seller," is warranted to be free from functional defects in materials and workmanship. The foregoing warranty is subject to the condition that the apparatus, part, or component be properly operated under conditions of normal use, and that regular periodic maintenance and service be performed, or replacements made, in accordance with instructions provided by Seller. The foregoing warranty shall not apply to any apparatus, part, or component that has been repaired other than by Seller or an authorized representative of Seller, or in accordance with written instructions provided by Seller; that has been altered by anyone other than Seller; or that has been subject to improper installation or abuse, misuse, negligence, accident, or corrosion.

Purchaser's sole and exclusive remedy under the above warranty is limited to, at Seller's option, repair or replacement of defective parts or components, or return to Purchaser of the price of the apparatus. Any such obligation on Seller's part is subject to the following requirements: (x) the defect must be promptly reported to Seller; (y) if so advised by Seller, Purchaser must return the part or component with a statement of the observed deficiency not later than seven (7) days after the expiration date of the warranty to the address designated by Seller, during normal business hours, transportation charges prepaid; and (z) upon examination by Seller, the part or component must be found not to comply with the above warranty. Return trip transportation charges for the part or component shall be paid by Purchaser. In the event that Seller elects to refund the purchase price, the apparatus shall be the property of Seller and shall be promptly shipped to Seller at Seller's expense. This mechanical warranty shall be void and the apparatus shall be deemed to be purchased AS IS in the event that the entire purchase price has not been paid within thirty (30) days of original shipment of the apparatus.

THERE ARE NO EXPRESS OR IMPLIED WARRANTIES THAT EXTEND BEYOND THE WARRANTY HEREINABOVE SET

FORTH. THERE IS NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE APPARATUS OR ANY PART OR COMPONENT THEREOF, AND NO WARRANTY SHALL BE IMPLIED BY LAW.

Items not of Seller's manufacture but resold by Seller are the products of other manufacturers and their warranty, if any, shall apply. THERE ARE NO WARRANTIES OF ANY KIND ON PRODUCTS OF OTHER MANUFACTURERS RESOLD BY TEMESCAL, EXCEPT THE WARRANTY OF TITLE, AND NO WARRANTIES SHALL BE IMPLIED BY LAW. THERE IS NO EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO PRODUCTS OF OTHER MANUFACTURERS.

PERFORMANCE WARRANTY: Seller warrants that the apparatus will comply with the specifications set forth in the purchase order. All specifications are subject to the corrections and tolerances allowed by the NEC. If the purchase order expressly provides for factory testing to verify compliance with the specifications, Purchaser shall be entitled to witness the testing and the results of the testing. Upon demonstration of compliance with the specifications by factory testing, Seller's liability for failure to comply with the specifications shall terminate. In the event that the purchase order does not describe a comprehensive test program for demonstration of compliance with the specifications, Seller's test program (which may incorporate extrapolation of data or test results based upon similarity of criteria established by Seller) shall be used for such purpose.

If the purchase order does not expressly provide for factory testing, compliance with the specifications shall be demonstrated by field testing which shall be conducted by Purchaser at Purchaser's expense. Seller shall have the right to: (a) witness the field testing and to verify the results of such field testing; (b) have free access to all data compiled by Purchaser in connection with any field test; and (c) conduct its own field test at its own expense during any fourteen-day (14-day) consecutive period which may be mutually agreed upon by Seller and Purchaser;

provided, however, that Seller shall have the right to field test within six (6) months of receipt from Purchaser of any notice of failure to comply with the specifications. If compliance with the specifications is to be demonstrated by field testing, Purchaser shall conduct and complete all field testing within sixty (60) days of the original shipment of the apparatus and shall promptly notify Seller of any failure to comply with the specifications. Seller shall not be liable for any failure to comply with the specifications demonstrated by field testing unless it receives notice thereof within sixty-seven (67) days of the date of original shipment of the apparatus.

In the event that factory testing or field testing does not demonstrate compliance with the specifications, Purchaser's sole and exclusive remedy under the above warranty is limited to, at Seller's option, repair or replacement of defective parts or components or return to Purchaser of the purchase price of the apparatus. In the event that Seller elects to refund the purchase price, the apparatus shall be the property of Seller.

Any obligations on Seller's part under this performance warranty are subject to the following requirements: (x) the nature of the failure of the apparatus to comply with the specifications must be promptly reported to Seller in writing; (y) if the apparatus has been delivered and field tested, Purchaser must return the apparatus or any part or component to Seller upon its request, not later than sixty-seven (67) days after initial shipment to Purchaser, to the address designated by Seller, during normal business hours, transportation charges prepaid; and (z) upon examination and testing by Seller, the apparatus must be found not to comply with the specifications. Return trip transportation charges for the apparatus or any part or

component shall be paid by Purchaser. This performance warranty shall be void and the apparatus shall be deemed to be purchased AS IS in the event that the entire purchase price has not been paid within thirty (30) days of original shipment of the apparatus.

THERE ARE NO EXPRESS OR IMPLIED WARRANTIES THAT EXTEND BEYOND THE WARRANTY HEREINABOVE SET FORTH. THERE IS NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE APPARATUS OR ANY PART OR COMPONENT THEREOF, AND NO WARRANTY SHALL BE IMPLIED BY LAW.

DISCLAIMER OF LIABILITY: IN NO EVENT SHALL SELLER BE LIABLE FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING FROM ANY SOURCE such as, but not limited to, the manufacture, use, delivery (including late delivery), or transportation of any apparatus, part, or component sold to Purchaser, whether such damages are caused by Seller's negligence or otherwise. Without limiting the generality of the foregoing sentence, Seller shall not be liable for: the cost of capital; the cost of substitute apparatus, services, repairs, components, or parts; loss of profit or revenue; the cost of power, whether purchased or produced by the consumer thereof; loss of use of the apparatus or any part thereof, or of any other property owned by Purchaser; claims or costs of Purchaser's customers; injury to persons, or death; or damages to any property. In the event that any limited warranty or disclaimer of liability is found to be unlawful or inapplicable, or to have failed of its essential purpose, Seller's liability shall be limited to the amount paid by Purchaser for the apparatus.

SAFETY INSTRUCTIONS FOR OPERATING AND SERVICE PERSONNEL

Operators and service personnel should always wear safety glasses. Operators shall not enter areas intended for service access only. Only experienced service personnel should enter such areas, and only after taking the preliminary precautions described in paragraphs 1 through 6 below.

DANGER

Potentially lethal voltages may exist within this unit, even with the line power switched off. Service should only be attempted by qualified personnel. Failure to observe all safety precautions may result in personal injury.

This component is designed to operate as part of a system containing high-voltage equipment. Observe the precautions described below when servicing this system, especially when servicing components where high voltages may be present.

1. Before servicing or operating this equipment, read all the component manuals supplied with the system, paying special attention to safety instructions.
2. Post HIGH VOLTAGE WARNING signs in conspicuous locations within the service area.
3. Remove rings, watches, bracelets, and any other metal jewelry before working around high voltage.
4. DO NOT WORK ALONE!
5. Be sure that all equipment is connected to a power receptacle having the correct polarity and grounding, as prescribed by the local electrical codes. Refer to the power supply portion of the documentation to determine the proper electrical ground for high-voltage components.
6. Before servicing any high-voltage component, switch off the electrical power at the component's main power switch. This switch should have a lockout feature. Lock the power off and keep the key with you while you are working on the equipment.
7. Certain electrical parts (e.g., electrolytic capacitors) hold a lethal voltage even after the power is switched off. Before entering any service area, use a grounding hook to discharge such parts. Be sure that these parts are discharged before starting any repairs.
8. DO NOT touch high-voltage leads unless power is off and a grounding hook is connected to the parts to be serviced.
9. The high-voltage components of the system should be equipped with electrical interlocks to protect personnel from injury. DO NOT ATTEMPT TO DEFEAT, OVERRIDE, OR BYPASS THESE PROTECTIVE DEVICES!
10. Never leave loose ends on high-voltage connections.
11. Observe the following warning if the system employs Radio Frequency (RF) power.

DANGER

RF radiation—even at modest power levels—can cause serious injury. If any of the RF components (e.g., the RF power supply, the RF matching network, or the RF electrodes or shielding inside the product chamber) are moved or changed in any way, the RF energy may be radiated outside the equipment. Monitor the equipment to assure that external RF radiation is below the levels prescribed by any and all applicable safety codes.

Special Amendment for United Kingdom Users

All Electrical Power Sources: Safety Precautions

This component is designed to be used in an extra-high-voltage system. Only authorized personnel should be permitted to carry out work on this system.

Prior to any servicing, grounding hooks should be used to short out all high-voltage parts and conductors in both the vacuum system and the high-voltage power supply. Screens protecting extra-high-voltage conductors should be removed only if appropriate action has been taken to ensure that extra-high-voltage conductors are dead and cannot be reenergized inadvertently.

In addition, all personnel should be aware of:

1. The Electricity (Factories Act) Special Regulations (1908 and 1944), in particular, Regulations 18(d) and 28 of the 1980 Regulations, as amended; and
2. The employer's responsibility to set up suitable systems to safeguard the health and safety of employees, according to the Health & Safety at Work etc. Act (1974).

USER RESPONSIBILITY

This equipment will perform in accordance with the instructions and information contained in the user's manual and its referenced documents when such equipment is installed, operated, and maintained in compliance with such instructions. The equipment must be checked periodically. Defective equipment shall not be used. Parts that are broken, missing, plainly worn, distorted, or contaminated, shall be replaced immediately. Should such repair or replacement become necessary, a telephone or written request for service should be made to Temescal, Livermore, CA, a part of Edwards Vacuum, Inc.

The equipment, or any of its parts, shall not be altered without the prior written approval of Temescal. The user and/or purchaser of this equipment shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, damage, improper repair, or alteration by any party other than Temescal.

GUIDELINES AND GOOD PRACTICES

1. Follow applicable clean room procedures (smocks, masks, gloves, etc.).
2. Do not expose the vent and purge valves to excessive pressures. The nitrogen line regulator is factory set at 15 psi and must not be adjusted above 20 psi.
3. Prevent oil, grease, water, sweat, etc. from getting into the vacuum chamber.
4. Replace the source tray shield correctly to ensure that the ceramic parts or the high voltage feedthroughs are protected from being coated.
5. Clean all mechanical parts and seals with lint-free paper/cloth soaked with isopropyl alcohol (IPA). Dispose all IPA-exposed cleaning paper/cloth in a fireproof container, while ensuring proper safety precautions are being followed.
6. Polish scratched surfaces with Scotch-Brite, taking care not to produce any cross scratches.
7. Shaft seals are all ferromagnetic. No lubrication is required.
8. Check the chamber door's seal and sealing surfaces each time before closing it.
9. Check and clean with IPA the source tray seals and sealing surfaces each time before raising the source tray into place.
10. Train staff by competent personnel. DO NOT allow staff to operate or do maintenance and recovery work on the machine until they are trained by competent personnel.
11. Document all alarms, deviations, breakdowns, and servicings done on either a hardcopy or an electronic equipment-log system.

HEALTH HAZARD

The condensates deposited on the tank walls of a vacuum system are generally in the form of extremely fine particles. The nature, as well as the form, of the materials poses the following potential health hazards:

- a) Inhaling fine particles (powder) may cause damage to the lungs. To help prevent this, wear a protective respirator mask with fine filter that has been approved by the National Institute for Occupational Safety and Health (NIOSH) and the federal Mine Safety and Health Administration (MSHA).
- b) Some substances are toxic and inhaling them should be avoided. Take steps to ascertain whether or not the material being deposited is a known toxic substance. Refer to the Material Safety Data Sheet(s) covering the evaporant(s) in question.
- c) Certain powders (titanium, for instance) can cause flash fires when exposed to oxygen or other oxidizers. Therefore, when opening the chamber door after a deposition cycle, exercise extreme caution and allow time for the coating surface to oxidize. Breakage of some of the more reactive condensates may be hazardous, even when the above precautions are observed. In this situation, fire-protective clothing should be worn.
- d) Certain powders (platinum, for instance) are known to catalyze methyl alcohol vapors upon contact, generating heat in the process and possibly causing a fire to erupt. Therefore, never use methyl alcohol to wipe down or clean any internal tank surfaces of a vacuum system. Use isopropyl alcohol (IPA), instead. Dispose of all IPA-exposed lint-free paper/cloth into a fireproof container, while ensuring all proper safety procedures and precautions are being followed.



Customer Documentation Survey

In an effort to provide continuous improvement and ensure technical accuracy regarding product documentation, we invite you to comment on this Facilities & Installation (F & I) Guide. Please fill out and return this form to Temescal as soon as possible. *Thank You.*

Company: _____ Today's Date: _____

System Ordered: _____ Delivery Date: _____

1. Please rate the quality of the information provided using the following rating system:

1 = Excellent 2 = Good 3 = Acceptable 4 = Fair 5 = Poor

Site preparation checklist	1	2	3	4	5
Descriptions of facility requirements	1	2	3	4	5
Installation instructions	1	2	3	4	5
Installation drawings	1	2	3	4	5

2. Was the information in this manual clearly presented and easy to understand? **YES NO**

If NO, please cite specific references: _____

3. Did you find errors in this manual? **YES NO**
If YES, typographical or technical? (please cite the pages)

4. How important was this F & I Guide in preparing for your system (circle one)?

Essential Important Nice to Have Not Important

5. Do you currently own and operate any other Temescal Systems? **YES NO**
(please specify) _____

6. What kind of information would you like to see in future F&I Guides?

7. Do you have any additional comments/suggestions/complaints? If so, please explain:

Name: _____ Telephone: _____
Fax #: _____ E-mail: _____

Thank you for taking the time to review our documentation. Please mail or fax this form back to:

Temescal, a part of Edwards Vacuum, Inc.
Attn: Customer Support
4569-C Las Positas Road, Livermore, CA 94551
Telephone: 1-800-522-1215 Fax: 925-449-4096

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1.3 General Safety Information

Specific guidelines concerning Guidelines & Practices, Operating Safety Instructions, and warnings concerning High Voltage and Health Hazards can be found in the front of this F&I Guide, as well as in the fronts of the Operations and Service Manuals. Additional safety warnings may also be found in the various component manuals and third party documentation. You will also find throughout the text of these manuals, WARNING boxes that advise of safety concerns. An example of such a warning box appears below.

<p style="text-align: center;">WARNING LETHAL VOLTAGES PRESENT</p> <p>Residual Voltages can be present in numerous parts of the equipment, even after the source power has been switched off. Before touching the source tray or the electron beam gun, you MUST use a properly connected ground hook to touch all accessible vacuum cubicle parts that could be charged with high voltage.</p>
--

This equipment contains electrical and electronic interlocks and alarms, to protect personnel from injury. **DO NOT DEFEAT, OVERRIDE, OR BYPASS THESE PROTECTIVE DEVICES!** When the TCS is in Service Mode, numerous safety interlocks are bypassed.

These safety warnings and notices are not only for the protection of the people who operate or maintain the equipment, but also for the equipment itself. Failure to comply with these safety standards can cause serious injury or death, and significant damage to the equipment.

BEFORE OPERATING ANY EQUIPMENT, READ ALL OPERATOR MANUALS, SAFETY NOTICES AND WARNINGS AND COMPLY WITH THEIR GUIDELINES.

1.4 Site Preparation Checklist

The customer is responsible for providing properly rated power, water, air, and gases services to their appropriate termination points at the System prior to installation. Specific requirements and installation specifications required for each system are detailed in this Facilities and Installation (F&I) Guide.

The customer is also responsible for meeting all applicable facility, electrical and safety codes in routing power, water, air, and gas lines to and between the modules of the system. For more specific details, please read the remainder of this Facilities & Installation (F&I) Guide. If you have any questions concerning your installation, please feel free to call Temescal Customer Support (1-800-522-1215, ext. 2891).

Please complete the Site Preparation Checklist on the next page, checking off each requirement as it is completed. Sign and date the completed Checklist and fax it to Temescal (925-449-4096), Attn: Customer Support Coordinator. When Temescal receives the completed checklist, the installation date for your system will be scheduled.

(FC/BJD-2000)

SITE PREPARATION CHECKLIST

The Customer is responsible for providing properly rated power, water, air, and gases services to their appropriate termination points at the System prior to installation. Please read this Guide for more specific details.

As each requirement is completed, place a check mark in the appropriate check box below. When ALL requirements have been completed, sign and date this page, then fax this checklist back to Temescal (925 449-4096), Attn: Customer Support Coordinator.

- Environment:** For additional information, see section 2.1.
- | | |
|-------------------------|------------------------------|
| Ambient Air Temperature | 55°F to 90°F (12°C to 32°C), |
| Relative Humidity | 50% maximum |
| Air conditioning | Capable of 5 kW cooling |

Water (conditioned): For additional information, see section 2.2.

- Cold Water Supply #1 (Vacuum Cubicle)**
- | | |
|------------------------|-----------------------|
| Max. inlet pressure | 100 psig (6.89 bar) |
| Min. delta pressure | 50 psig (3.45 bar) |
| Inlet temperature | 50°–70° F (10°–21° C) |
| Filtered to 50 microns | |
- Flow Rate Requirements:
- | | |
|-------------------------|---------------------------------------|
| Chamber walls and doors | 2–3 gpm (7.57–11.36 L/min.) |
| Each e-beam source | 2.75 to 5.0 gpm (11.4 to 18.9 L/min.) |
| Each crystal monitor | 0.5 gpm (1.9 L/min.) |

- Cold Water Supply #2 (Cryopump Compressor)**
- | | |
|--------------------------|-----------------------------|
| Min./max. inlet pressure | 30/100 psig (2.07/6.89 bar) |
| Inlet temperature | 10°–30° C |
| Min. flow rate | 1.50 gpm (5.7 L/min.) |

- Optional Hot Water**
- Note: Pneumatics air pressure must be at least 10 psi greater than max. hot or cold water pressure.*
- | | |
|-------------------------|-----------------------------|
| Max. inlet pressure | 90 psig (6.21 bar) |
| Min. delta pressure | 50 psig (3.45 bar) |
| Flow rate | 2-3 gpm (7.57–11.36 L/min.) |
| Approximate temperature | 140° F (60° C) |
| Filtered to 50 microns | |

Compressed Gases: For additional details, see section 2.3.

- Vent Gas:** Clean Dry Air (CDA) and/or Nitrogen (N₂) (recommended)
60 to 120 psig (4.14 to 8.27 bar)
- Pneumatic Air:** 90 to 120 psig (6.21 to 8.27 bar)
- Helium:** One bottle, 99.999% pure.
- Optional Process Gas:** Argon, 99.995% minimum purity
1 to 4 sccm (for FC ion beam source without PBN) or
3 to 7 sccm (for FC beam ion source with PBN)

Electrical: For additional information, see sections 2.4 and 2.5.

- Ground:** System requires good earth ground, low impedance to RF as well as DC. For illustrations and additional details, see section 2.5.
- Main System (Drop #1)**
 208 Volts ac, 50/60 Hz, 3-phase 4-wire, 150 A, or
 400 Volts ac, 50/60 Hz, 3-phase 5-wire wye, 100 A
- HV Power Supply (Drop #2)** (Select one power supply only)
CV-6SLX, 208 Volts ac, 50/60 Hz, 3-phase delta (4-wire), 20 A
CV-6SLX, 400 Volts ac, 50/60 Hz, 3-phase wye (5-wire, with neutral), 10 A
CV-12SL, 208 Volts ac, 50/60 Hz, 3-phase delta (4-wire), 40 A
CV-12SL, 400 Volts ac, 50/60 Hz, 3-phase wye (5-wire, with neutral) 20 A
- Site Preparation and Installation Instructions:** Section 3 of this F&I Guide has been read and understood.

Specification of Cable and Helium Line Lengths

Use this section of the checklist to specify the lengths of the nominal, component-to-component route of helium lines, power and control/data cables, and 3"-wide copper ground strap in your installation. Temescal will add length as appropriate for service loops. Helium lines, power cables, and control/data cables are available in 10-ft. increments from 10 ft. to 70 ft.

NOTE

Specified cable/helium line lengths should reflect actual routing as anticipated in your installation, not the shortest distances between the connection points on the various components. For each cable or line, enter a length that is the nearest multiple of 10 ft. above the anticipated cable/line run.

Table 1-1 Length of Control/Data Cables (see Figure 3-10)

Cable Description	Required Length
Vacuum cubicle to cryopump compressor	
Vacuum cubicle to operator station	20 ft.*

*Std. cable of fixed length. Custom cables of other lengths can be quoted.

Table 1-2 Length of Utility Power Cables (see Figure 3-10)

Cable Description	Required Length
PD Box to cryopump compressor	
PD Box to vacuum cubicle	

Table 1-3 Length of Bundled Power and Control/Data Cables (see Figure 3-10)

Cable Description	Required Length
PD box to Operator station	
PD Box to mechanical pump	

Length of 3"-wide copper grounding strap required to connect vacuum cubicle to facility's RF grounding point (see Figures 2-1 and 2-2): ___ ft.

Length of helium lines connecting vacuum cubicle to cryopump compressor (see Figure 3-8): ___ ft.

Customer: _____ Date: _____

Company: _____ System Number: _____

2

Facility Requirements

This section of the Guide specifies the requirements for the various facilities services, including:

- Environment (subsection 2.1)
- Water (subsection 2.2)
- Compressed gases (subsection 2.3)
- Electrical power (subsection 2.4)
- Electrical grounding (subsection 2.5)

The customer is responsible for properly preparing the site for the delivery, installation, and operation of the system ordered. Site preparation includes providing properly rated power, water, air, compressed gases to their appropriate facility termination points. Before system installation can be scheduled, site preparation must be completed, and the Site Preparation Checklist (see Section 1.4) must be completed and returned to Temescal.

2.1 Environment

Ambient Air Temperature	55° F to 90° F (12° C to 32° C)
Relative Humidity	50% maximum; must be free of corrosive fumes and vapors
Air Conditioning	Capable of 5 kW cooling

2.2 Water

Both cold and hot water must be filtered to 50 microns. In addition, the water supplied to the system must have a ph level of between 6.0 and 8.0. To prevent hard water deposits, it must be conditioned to maintain a calcium carbonate (CaCo3) content of less than 75 ppm. Actual water-flow requirements may vary, depending on your system and its components.

2.2.1 Cold Water

Note: Condensation on water lines can impair the performance of the equipment and cause damage. Therefore, the cold water temperature should not exceed the dew point.

Cold Water Supply #1 (vacuum cubicle)

Maximum inlet pressure	100 psig (6.21 bar)
Minimum delta pressure	50 psig (3.45 bar)
Inlet temperature	50°–70° F (10°–21° C)
Filtered to 50 microns	

Flow Rate Requirements

• Chamber walls and doors	2-3 gpm (7.57–11.36 L/min)
• Each e-beam source	2.75 to 5 gpm (11.4 to 18.9 L/min)
• Each crystal monitor	0.5 gpm (1.9 L/min.)

Cold Water Supply #2 (cryopump compressor)

Min./max. inlet pressure	30/100 psig (2.07/6.89 bar)
Inlet temperature	10°–30° C
Min. flow rate	1.50 gpm (5.7 L/min.)

2.2.2 Optional Hot Water

Note: Pneumatics air pressure must be at least 10 psi greater than max. hot or cold water pressure.

Flow rate	2-3 gpm (7.57–11.36 l/min)
Max. inlet pressure	90 psig (6.21 bar)
Min. delta pressure	50 psig (3.45 bar)
Approximate temperature	140° F (60° C)
Filtered to 50 microns	

Note: Hot water must not be hot enough to cause scalding or burning to the touch.

2.3 Compressed Gases**2.3.1 Vent Gas (for process and/or purging): Clean Dry Air (CDA) or Dry Nitrogen (N2)**

60 to 120 psig (4.14 to 8.27 bar)

Note: The vent gas delivery pressure of 60 to 120 psig is recommended to minimize pressure fluctuations in the system. However, the system can be damaged if the internal vent gas pressure is greater than 20 psig. FC- and BJD-2000 systems do not provide built-in regulation to reduce the internal pressure as required. The customer should therefore regulate the internal pressure to 20 psig.

2.3.2 Pneumatic Air (oil free) for activation of valves: 90 to 120 psig (6.21 to 8.27 bar)

Note: Pneumatics air pressure must be 10 psi greater than max. hot or cold water pressure

2.3.3 Helium: One bottle, 99.999% pure (For additional details, see section 3.3.1.)**2.3.4 Optional Process Gas: Argon (99.99% minimum purity)**

1 to 4 sccm, for FC ion beam source without PBN, or
3 to 7 sccm, for FC ion beam source with PBN

2.4 Electrical Power Requirements

The Customer is responsible for providing reliable electrical power to supply the requirements of the system ordered. The facility's operating voltage must be specified when the equipment is purchased. Main system power (Drop #1) and high-voltage power (Drop #2) must be properly connected to the power distribution box prior to the actual system installation. Circuit breakers must be of a type designed to handle the currents

indicated. General power requirements are as specified below. Actual requirements may vary, depending on system accessories and options.

2.4.1 Drop #1 (Main System): (15 kVA)

208 V ac, 50/60 Hz, 3-phase 4-wire, 150 A
400 V ac, 50/60 Hz, 3-phase 5-wire wye, 100 A

2.4.2 Drop #2 (High Voltage Supply):

CV-6SLX Power Supply (6 kVA)

208 V ac, 50/60 Hz, 3-phase delta (4-wire), 20 A
400 V ac, 50/60 Hz, 3-phase wye (5-wire, with neutral), 10 A

CV-12SL Power Supply (12 kVA)

208 V ac, 50/60 Hz, 3-phase delta 4-wire), 40 A
400 V ac, 50/60 Hz, 3-phase wye (5-wire, with neutral), 20 A

2.5 Electrical Grounding Requirements

2.5.1 System Low Impedance Ground.

Safe, dependable operation of the HV power supply cannot be ensured unless a good earth ground is provided for the system and the power supply. This ground must provide a low-impedance path for radio frequency (RF) and direct current (DC) electricity. This ground must not be connected to that of any other system or equipment.

Figure 2-1 illustrates the required facility and system grounding requirements. Two 8-foot (2.44-meter) copper-clad steel rods of $\frac{3}{4}$ inch (20 mm) diameter should be driven into the earth as near as possible to the vacuum cubicle. These rods should be approximately 6 feet (1.85 meters) apart. After they are driven into the ground, the resistance between them should be measured with an accurate volt-ohm meter. The maximum allowable resistance is 3 ohms. If the resistance is greater than that value, pouring salt water or copper sulfate down the sides of the rods may lower the resistance to the required level.

To ensure a low-impedance path to ground, the rods must be connected to each other and to the vacuum chamber by a length of 3-inch (76-mm) wide copper strap. For runs of less than 60 feet (18.3 meters), this strap should be 0.035 to 0.050 inches (0.9–1.3 mm) thick. For runs longer than 60 feet, consult Temescal for specifications. The strapping should be silver-soldered to one of the rods and secured to the other mechanically, so that the grounding strap can be disconnected later to allow retesting of the resistance between the rods. The other end of the grounding strap should be connected with a grounding lug or bolt to the evaporation system's central grounding point, an area of clean bare metal on the vacuum cubicle wall or frame.

If the equipment is to be installed on the upper floors of a building, the system can be grounded by connecting the vacuum chamber to the steel structure of the building. This connection should also be made with 3-inch (76-mm) copper strapping of the gauge specified above. Figure 2-1 also shows this alternative method.

CAUTION

Do not use braided wire for any ground connections.

CAUTION

Do not rely on water pipes to establish the system ground connection. Multiple plumbing joints, each with tape and/or sealing compounds, make such a ground unreliable.

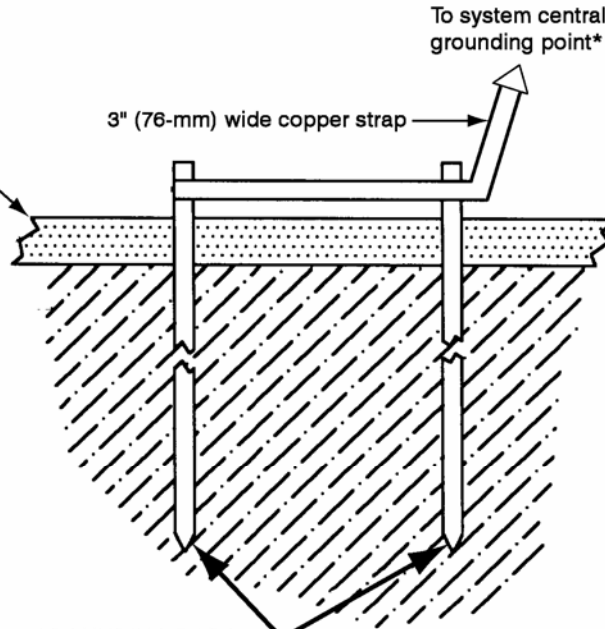
Figure 2-1 Facility and System Grounding Requirements

PREFERRED METHOD

1. As shown at right, sink two grounding rods through the floor of the building and into the earth, approximately six feet apart. The location chosen for these rods should be as close as possible to the vacuum cubicle. The rods must be copper-clad steel, 8 feet in length, and their top ends should extend approximately 6 inches above the surface of the floor.
2. Measure the resistance between the rods. If the resistance is greater than 3 ohms, try lowering it by pouring salt water or copper sulfate down the sides of the rods. If the resistance is still greater than 3 ohms, consult Temescal.
3. When you have verified that the resistance between the two grounding rods is 3 ohms or less, silver solder the copper strap connected to the system central grounding point to each of the rods.

NOTE

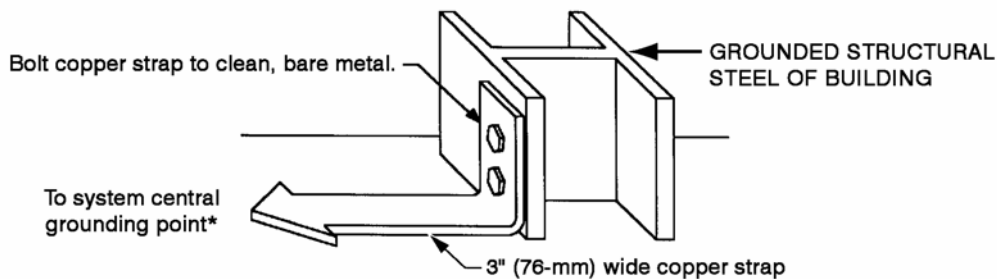
Do NOT rely on mechanical connections between the copper strap and the grounding rods.



- GROUNDING RODS
- Copper-clad steel
 - Diameter: 3/4" (20 mm)
 - Length: 8' (2.44 m)
 - Distance apart: 6' (1.85 m)

*Distance from system central grounding point to facility low-Z grounding point	Required size of connecting copper strap
0-60 ft. (0 -18.3 m)	3 in. (76 mm) wide x .035 -.050 (0.9 -1.3 mm) thick
>60 ft.	Consult Temescal

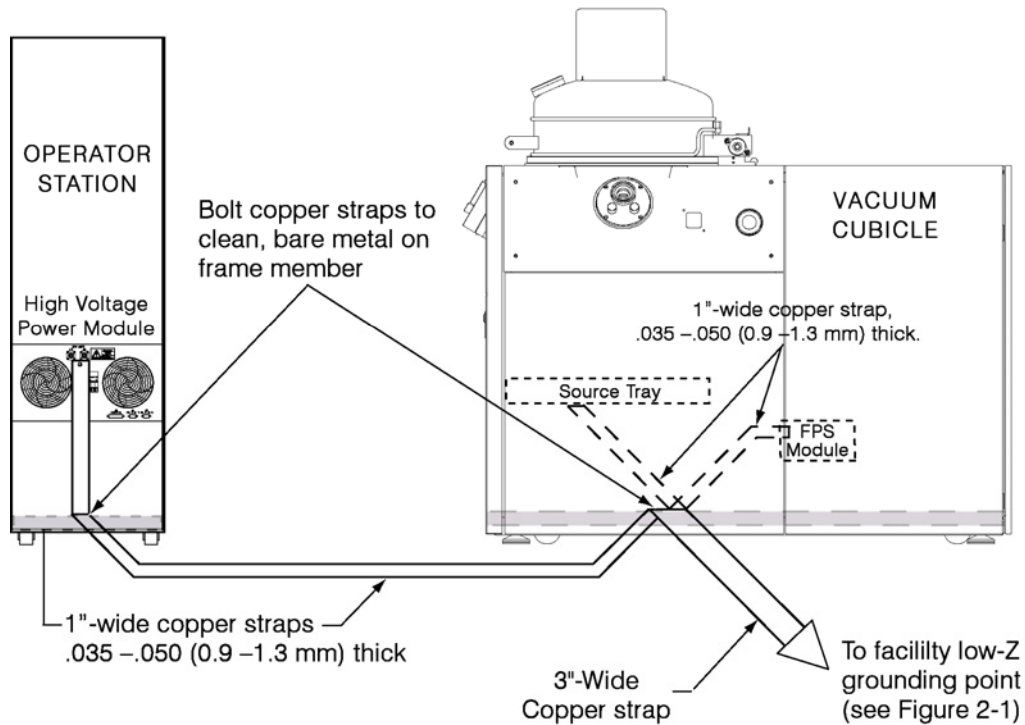
ALTERNATIVE METHOD



2.5.3 Low-Impedance Ground for the E-Beam Power Supply

Figure 2-2 illustrates the low-impedance grounding scheme required for the e-beam power supply. As that illustration shows, 1"-wide copper straps must connect:

- the grounding stud on the rear of the power module to a grounding point on the frame of the operator station
- the operator station's grounding point to the main grounding point in the vacuum cubicle
- the source tray to the vacuum cubicle's main grounding point.

Figure 2-2 Low-Z Grounding Requirements for the E-Beam Power Supply

Where copper straps are attached to frame members, the copper must be bolted to clean, bare patches of metal. The length of copper strap connected to the source tray must be securely bolted to a clean site on that part. The upper grounding stud on the FPS module must be connected to the vacuum cubicle's central low-Z grounding point by a length of 1"-wide copper strap (thickness: 0.035"–0.050"). The green #10 AWG wire grounds the lower FPS grounding stud to the vacuum cubicle's frame.

The high-voltage cable connecting the power module to the filament power supply is adequately grounded when the coaxial cable is plugged into the filament power supply.

2.5.4 Electron Beam Source Ground

To ensure a good ground between the electron beam source and the vacuum cubicle, the following conditions must be met:

- The base of the source and the surface on which it is mounted (usually the upper surface of the source tray) must be clean and free of evaporated material.
- The mounting surface must be made of nonmagnetic material.
- The source must be securely bolted to the mounting surface.
- Inside the vacuum cubicle
- Inside the right-hand door of the operator station

2.5.2 Grounding Hooks

Grounding hooks are provided inside the vacuum cubicle and inside the right-hand door of the operator station.

3

Unpacking and Installation

This section provides information and guidance about what to do with your new system when it has arrived on site, but prior to installation.

The customer is responsible for unpacking and preparing the site, as outlined in sections 3.1 and 3.2.

Temescal is responsible for making equipment interconnections and for energizing and testing the equipment prior to acceptance, as described in section 3.3.

This section contains the following subsections:

- 3.1 Unpacking by Customer
- 3.2 Customer Site Preparation Responsibilities
- 3.3 Temescal Installation Responsibilities
- 3.4 Installation Drawings

3.1 Unpacking by Customer

3.1.1 Uncrating

The equipment described in this F& I Guide and listed in the shipping documents was released to the carrier in good condition and properly packed. It is essential to all concerned that the contents of the shipment be examined carefully when it is unpacked, to make sure that no damage has occurred in transit. First check the materials received against the packing list to be certain that all elements are accounted for. Then check each component for damage.

Normally, the major components of the system as shipped will be:

- Vacuum cubicle
- Operator station
- Power distribution box
- Mechanical (i.e., roughing) pump
- Cryopump compressor
- Optional blower pump
- Other accessories as specified

CAUTION

Many smaller items are packed separately, as indicated on your packing list. These items may include ionization gauge tubes, cables, substrate carrier, piping, and fittings. In discarding packing materials, take care to avoid losing any such parts. Wait to discard packing materials until after the initial system startup procedure.

WARNING

The system is shipped under vacuum. On delivery, verify that it is still under vacuum by attempting to open the vacuum chamber door. If the door can be opened easily, there is no vacuum. If that is the case, it is highly likely that some damage has occurred.

3.1.2 Loss or Damage.

If any loss and/or damage is claimed:

1. Notify the carrier or the carrier's agent to request inspection of the loss or damage claimed.
2. Keep all shipping containers until it is determined whether they are needed to return the equipment to Temescal.
3. If it is difficult to determine the extent of damage or whether damaged equipment can be repaired in the field, contact a Temescal service representative for appraisal.

3.2 Customer's Site Preparation Responsibilities

NOTE

The customer's responsibility for installation ends when: (a) all system components are in place; (b) customer-supplied service lines are ready to be connected to the system; and (c) power Drops #1 and #2 are properly connected at the power distribution box. To avoid loss of the warranty that applies to a new system and its equipment, do not apply power to the system. Instead, call for a Temescal service representative to make the service connections, approve the installation, energize the system, and demonstrate that it performs as designed.

3.2.1 Equipment and Personnel Required.

Figure 3-2 shows the dimensions of the system's major components, including door swings. The following workers (with their tools) will be required to install the system:

1. Mechanical technicians (or movers) will remove any bracing and shipping hardware.
2. Movers will place the vacuum cubicle in its permanent position and level it.
3. An electrician will install service Drops #1 and #2 and connect both service drops to the power distribution box. The electrician will also establish the grounding points for the required low-impedance ground (see section 2.5) and connect the vacuum cubicle to that ground. Temescal will oversee the connection of Drop #2 to the HV power supply.
4. A plumber will lay out lines for cold (and optional hot) water, compressed air, vent gas, optional process gas, and the mechanical pump exhaust. The plumber may connect these lines at the facility end, but connections to the system may be made only by or under the supervision of a Temescal service representative, unless the customer has made arrangements to the contrary.

3.2.2 Placing the Vacuum Cubicle In Position

Figure 3-1 shows the vacuum cubicle's height and width. Figure 3-2 provides a plan view, indicating its depth and the radius if its door swings. The following steps must be completed before the vacuum cubicle is placed in its permanent position:

1. Remove all packing material from around and under the cubicle.
2. Remove any skids or pallets.
3. If the cubicle has leveling legs, unlock the locking nuts for the legs and extend them so that the distance from the bottom of the footpad to the top of the skirt panel is 1.5 inches (38 mm).

Now the vacuum cubicle can be placed. To do so:

1. Using a forklift, lower the vacuum cubicle to the floor near the spot where it is to be permanently located. Figure 3-4 shows the precise locations of the vacuum cubicle's casters, leveling feet, and seismic brackets. Referring to Figure 3-2, verify that there are adequate clearances for the other equipment that will be installed nearby. Take care to allow enough space so that all doors or maintenance panels can be opened fully. If you are installing the vacuum cubicle through a clean-room wall, make sure that that wall does not obstruct the opening of the vacuum cubicle's doors and maintenance panels or prevent them from opening all the way.
2. Roll the vacuum cubicle on its casters to its permanent position.
3. Level the cubicle as necessary. Some systems have leveling legs that can be screwed down to accomplish this task.

3.2.3 Positioning the Operator Station

The operator station will normally be placed immediately to the right of the vacuum cubicle, as shown in Figure 3-2. The operator must have ready access to the system controls and be able to open and close the bell jar lid in an unobstructed fashion.

3.2.4 Installing the Power Distribution Box (PDB)

The PDB is normally mounted on a nearby wall. To ensure unobstructed access as cables are being fed through the bottom of the box, it should be mounted at least 12 inches (305 mm) above any obstructions. The recommended distance from the floor to the bottom of the box is 32 inches (815 mm). Figure 3-3 shows the PDB's dimensions and its mounting hole locations. Mounting hardware for the PDB is customer supplied.

On systems supplied with 208-V ac power, the PDB will weigh approximately 176 lbs. (80 kg). On systems supplied with 400-V ac power, a transformer will be included in the PDB, increasing its weight to approximately 300 lbs. (136 kg). Such systems also include a step-down transformer external to the PDB. Perform the following procedure when installing this transformer:

1. Remove the step-down transformer from its packaging.
2. Place the transformer on the floor in its mounting location, which must be within 6 feet of the PDB. If required to do so by local codes, secure the transformer to the floor, using customer-supplied hardware.
3. Connect power Drop #1 to the input of the transformer.
4. Using the Temescal-supplied cables, connect the transformer's output to the input for Drop #1 in the power distribution box.

In nominal 208 V ac installations, connect both Drop #1 and Drop #2 to the PDB, as shown in Figure 3-6. In nominal 400 V ac installations, connect power Drop #2 directly to the PDB (see Figure 3-7). Before the facility power is actually connected to the PDB, make sure the main power switch on the box is locked in the OFF position. That switch must remain locked in that position until the system is ready to be energized by (or under the supervision of) the Temescal service representative.

NOTE: Do NOT energize the system or any of its components at this time.

3.2.5 Installing the E-Beam Power Supply

1. Install power Drop #2 and connect it to the power distribution box, but do not connect the HV power supply to that drop. The Temescal service representative will oversee connection of the power supply to Drop #2.

3.2.6 Installing the Mechanical Pump

With the vacuum cubicle in place and leveled within specifications, install the mechanical pump (with blower, if this option is included in your system) and install and connect the roughing line and the mechanical pump exhaust. To do so:

1. Loosen the clamps connecting the flexible hose to the mechanical pump.
2. Release the bolts that hold the mechanical pump to the system frame during shipment, allowing the pump to rest on the floor.
3. Retighten the clamps on the flexible hose to isolate the vacuum cubicle from the pump's vibration.
4. Remove the blank flange from the roughing port.
5. Install the roughing pump and blower, if included in the system.
6. Check the oil level in the mechanical pump and the blower, if any.

Note: Electrical connections to the mechanical pump must be made by the Temescal service representative.

3.2.7 Making Service Connections

The customer is responsible for providing the utility lines specified below and for connecting these lines at the facility end. The customer may lay out these service lines (see Figures 3-6 and 3-7) so they are properly routed all the way to their connection points at the system (see Figure 3-5). However, service connections to the system may be made only by or under the supervision of a Temescal service representative, unless the customer has made specific arrangements to the contrary.

Water:

- Cold water supply #1: Vacuum cubicle water
- Cold water supply #2: Cryopump compressor
- Optional hot water supply for vacuum cubicle

Compressed Gases (supplied to vacuum cubicle):

- Vent gases (CDA or N₂)
- Pneumatic air
- Optional process gases

Exhaust Gases:

- Vacuum cubicle to facility exhaust
- Mechanical pump to facility exhaust

Electrical Connections:

- In 208-V installations, connect Power Drops #1 and #2 to the power distribution box. In 400-V installations, connect Drop #1 to the step-down transformer and Drop #2 to the power distribution box.

NOTICE

Equipment power connections and pump rotation checks shall be performed only by or under the supervision of an on-site Temescal service representative. Please refer to the terms of your warranty.

3.3 Temescal Installation Responsibilities

3.3.1 Helium Circuit Recharging

During shipment, all cryopump lines are charged with Helium at 250 psig (17.24 torr) to protect the integrity of the system, particularly the cryopump, from contamination. However, if the system must be air-shipped during any part of the transit, the Helium pressure must be reduced to a maximum of 15 psig (1.03 torr) prior to shipment, in accordance with U. S. Federal Aviation Agency regulations. During the installation of any such Temescal system, the Temescal service representative will be responsible for recharging and decontaminating the Helium lines and the cryopumps. Thereafter, the customer will be responsible for maintaining the integrity of the system.

In such cases, the cryopump must be recharged with 99.999% pure Helium to 250 psig. Such customers should therefore have on hand at least one standard bottle of 99.999% pure Helium. The Temescal service representative will have the required equipment and tools, as specified in Table 2 of CTI Cryogenics' *On-Board® Cryopump Installation and Maintenance Instructions* (Helix document 8040491, Revision 102, dated 2/3/04). Helium recharging and decontamination procedures must be performed in strict accordance with the instructions in Chapter 4 of that manual.

3.3.2 Making the Remaining Service Connections

An authorized Temescal field service technician must make the connections specified below. For approximate line-routing layouts, see Figures 3-8 through 3-10.

DANGER: HIGH VOLTAGE

Before connecting power lines to any system components, service personnel should ensure that all switches and controls are in the OFF position.

Electrical Power :

- Connections between the PDB and
 - Vacuum cubicle
 - Operator station
 - Mechanical pump and blower, if any
 - Cryopump compressor

Control/Data Cables:

- Operator station to vacuum cubicle
- Operator station to remote monitoring system (optional)

High Voltage Cables:

- HV cable from power module (in operator station) to vacuum cubicle

Copper Grounding Strips:

- As required for low-impedance grounding

3.3.3 Energizing the Electrical Circuits

The customer is responsible for routing all cables and lines per applicable codes. However, all electrical connections between the PDB and the vacuum cubicle, the operator station, the mechanical pump(s), and the power supplies shall be made by or under the supervision of the Temescal service representative. Once all connections are

properly made, the Temescal service representative is responsible for energizing the system or for supervising the customer in doing so.

DANGER

Before operating the equipment, make sure that all service connections have been properly made. Until you have verified that that is the case, make certain that all circuit breakers remain OFF.

3.3.4 Pump Rotation Check

1. Verify that all service connections to the pump have been properly and securely made.
2. Check all e-beam sources to ensure that water and compressed gases are available at the proper pressures and flow rates.
3. Measure voltages at all TB1 terminals to verify that the required voltages are being supplied to the system (see the vacuum cubicle wiring diagram).
4. The correct direction for the pump's rotation is indicated by an arrow on the pump. Check its rotation direction by briefly switching on the pump's circuit breaker. If the pump is turning the wrong way, interchange any two hot lines at the pump motor. Switch the pump on again briefly to verify that it is now turning in the proper direction.

3.3.5 System Ready for Startup

System installation should be complete when:

- all system components are properly positioned
- all required service connections have been made and verified
- all necessary adjustments have been made.

The system is then ready for inspection and startup by a Temescal service representative.

3.4 Installation Drawings

The following drawings are provided to facilitate system installation.

Figure 3-1 Vacuum Cubicle Height and Width

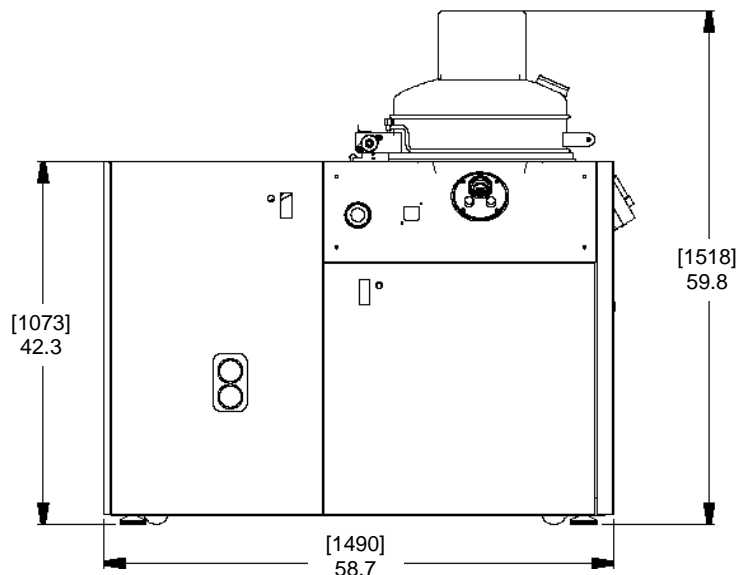
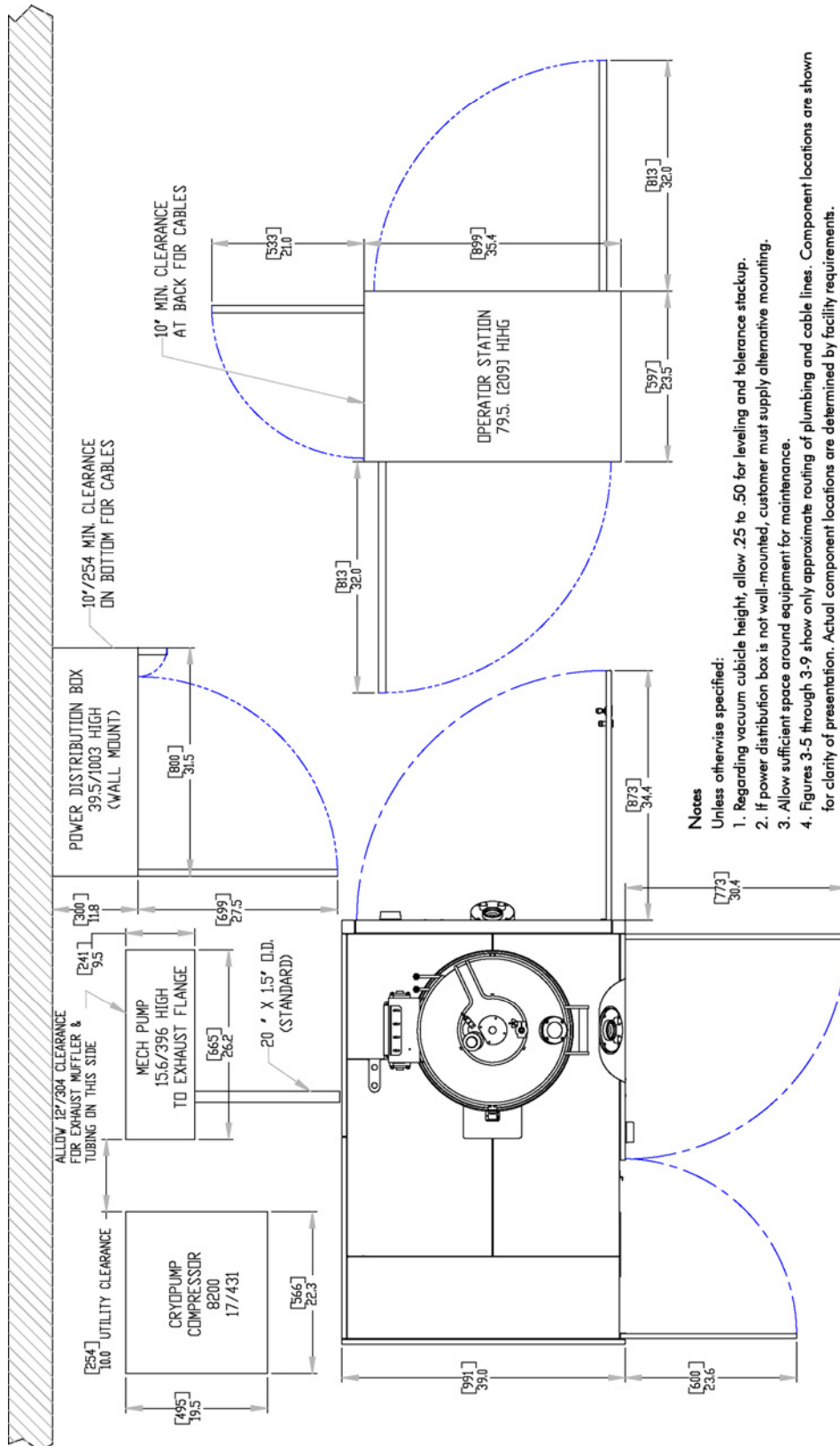


Figure 3-2 System Plan View, Showing Dimensions of Major Components



Notes

Unless otherwise specified:

1. Regarding vacuum cubicle height, allow .25 to .50 for leveling and tolerance stackup.
2. If power distribution box is not wall-mounted, customer must supply alternative mounting.
3. Allow sufficient space around equipment for maintenance.
4. Figures 3-5 through 3-9 show only approximate routing of plumbing and cable lines. Component locations are shown for clarity of presentation. Actual component locations are determined by facility requirements.
5. Customer is responsible for routing cables and lines per local codes.
6. If cryopump compressor is remote located, customer must supply water its lines.

Figure 3-3 Mounting Hole Locations for System Power Distribution Box

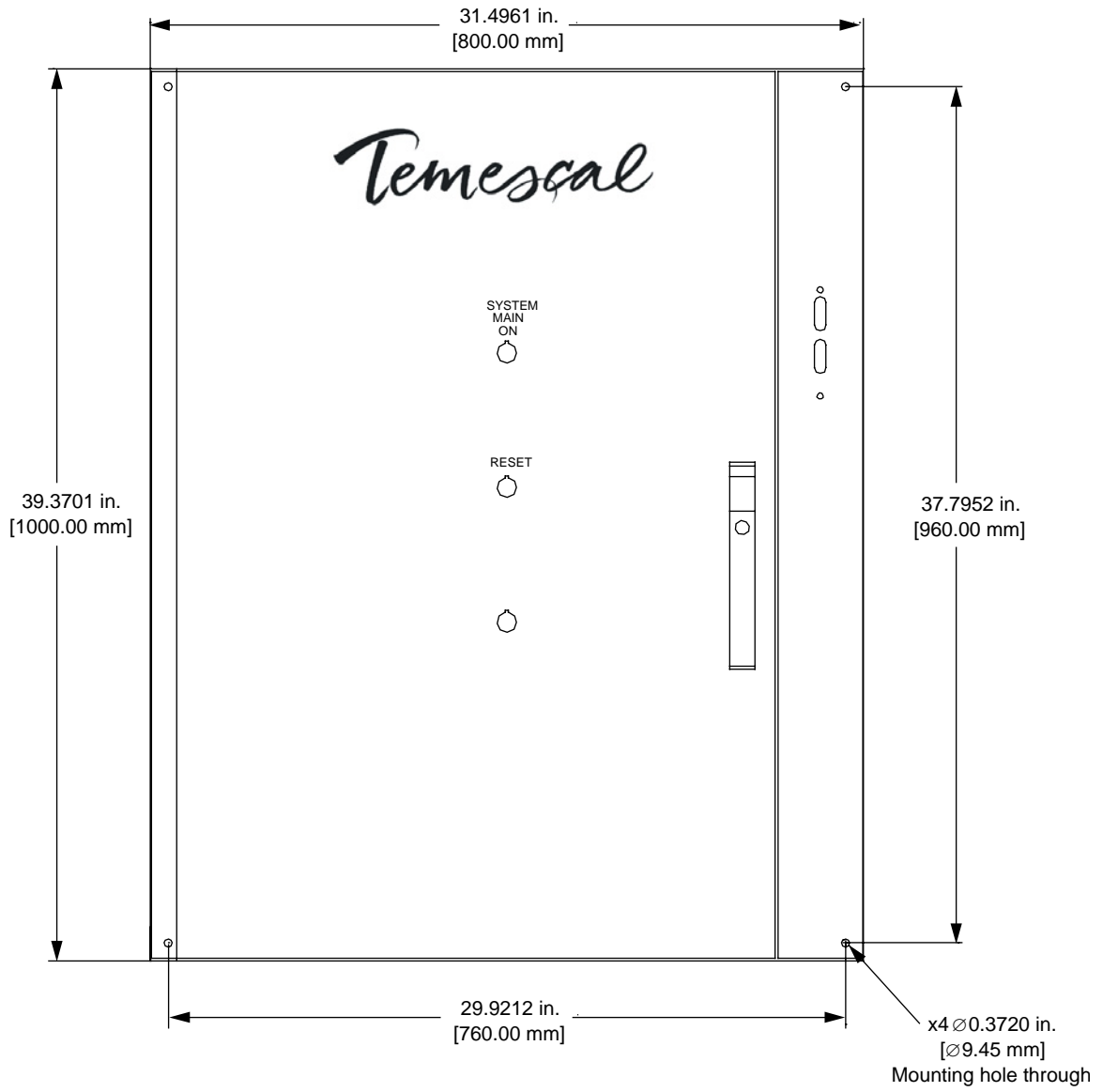


Figure 3-4 Vacuum Cubicle Footprint, Showing Precise Locations of Casters, Leveling Feet, and Seismic Brackets

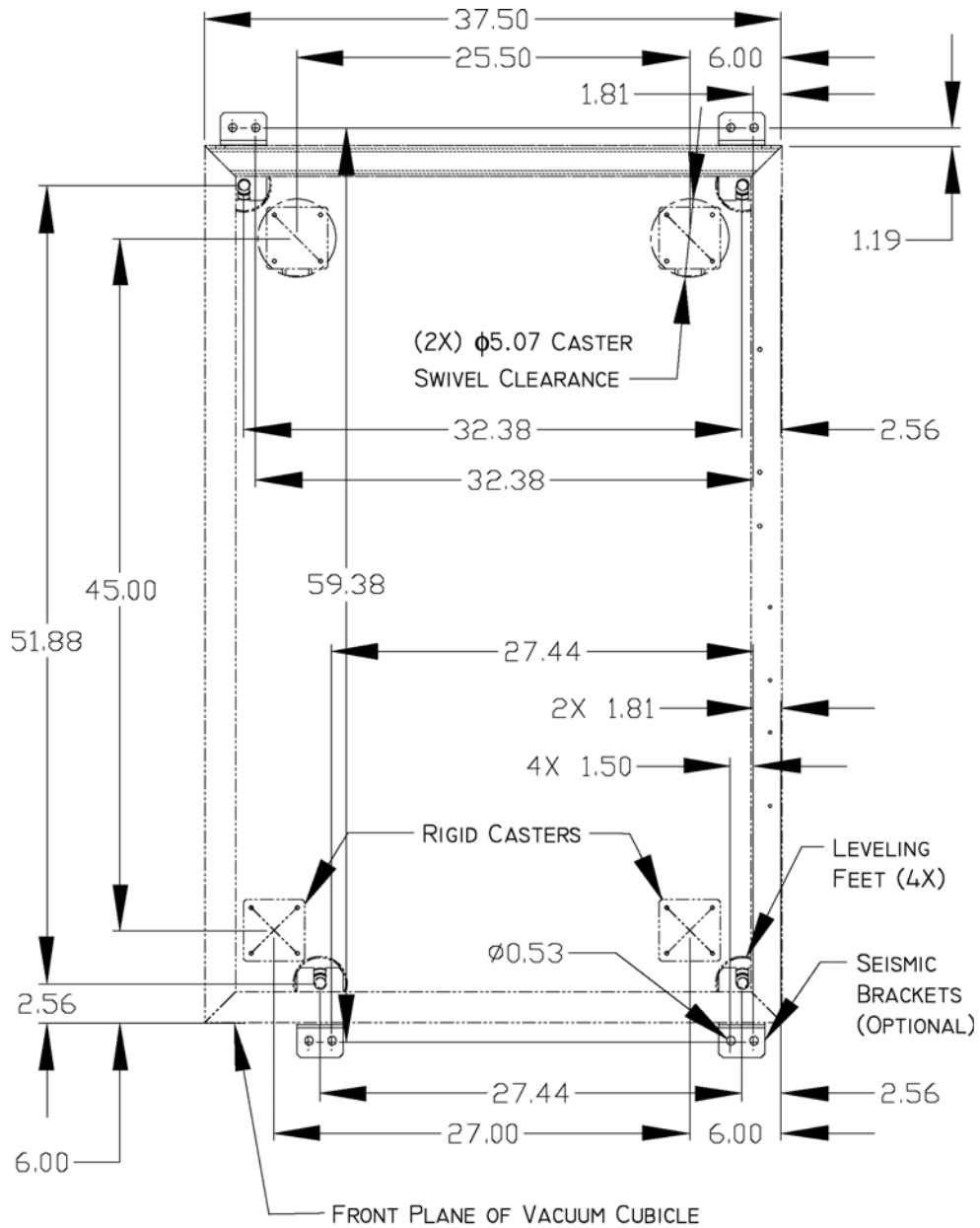


Figure 3-5 Utility Connection Points on Rear of Vacuum Cubicle

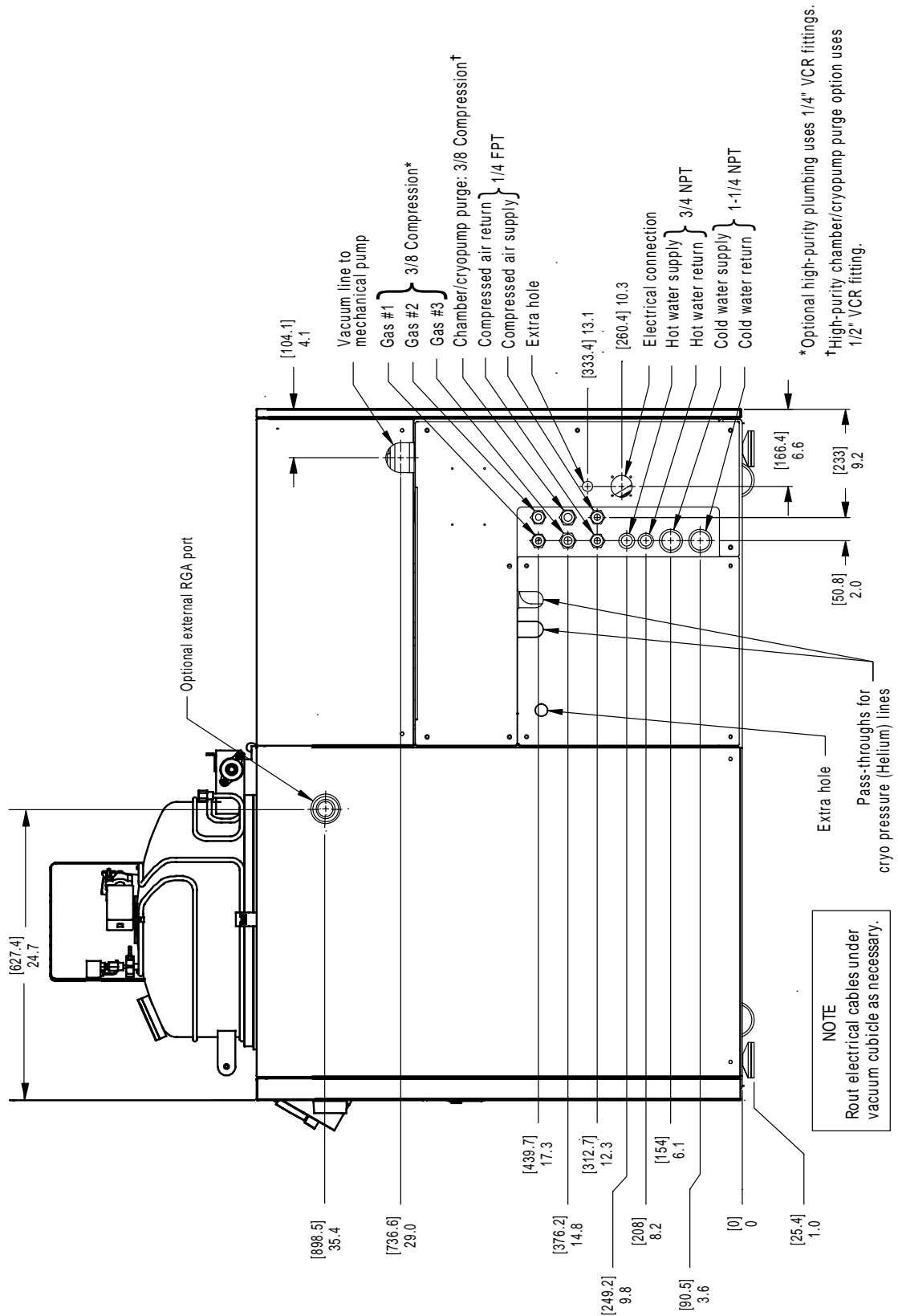


Figure 3-6 Routing of Customer Supplied Utility Lines in 208-V Installations

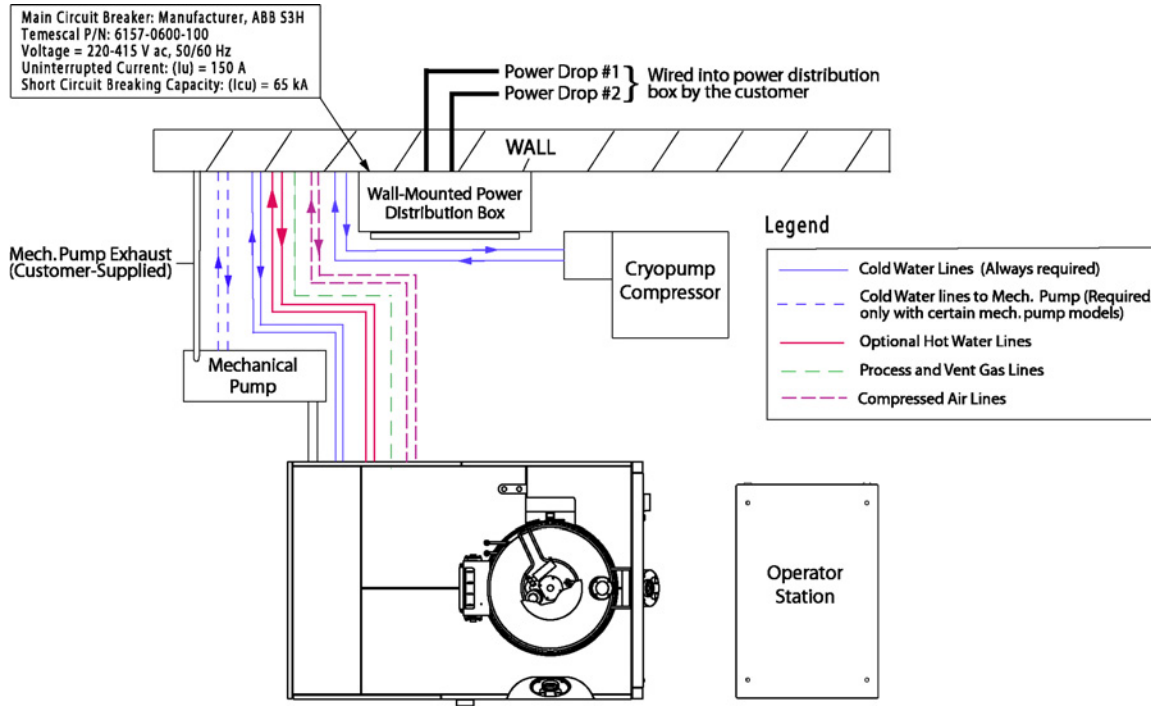


Figure 3-7 Routing of Customer Supplied Utility Lines in 400-V Installations

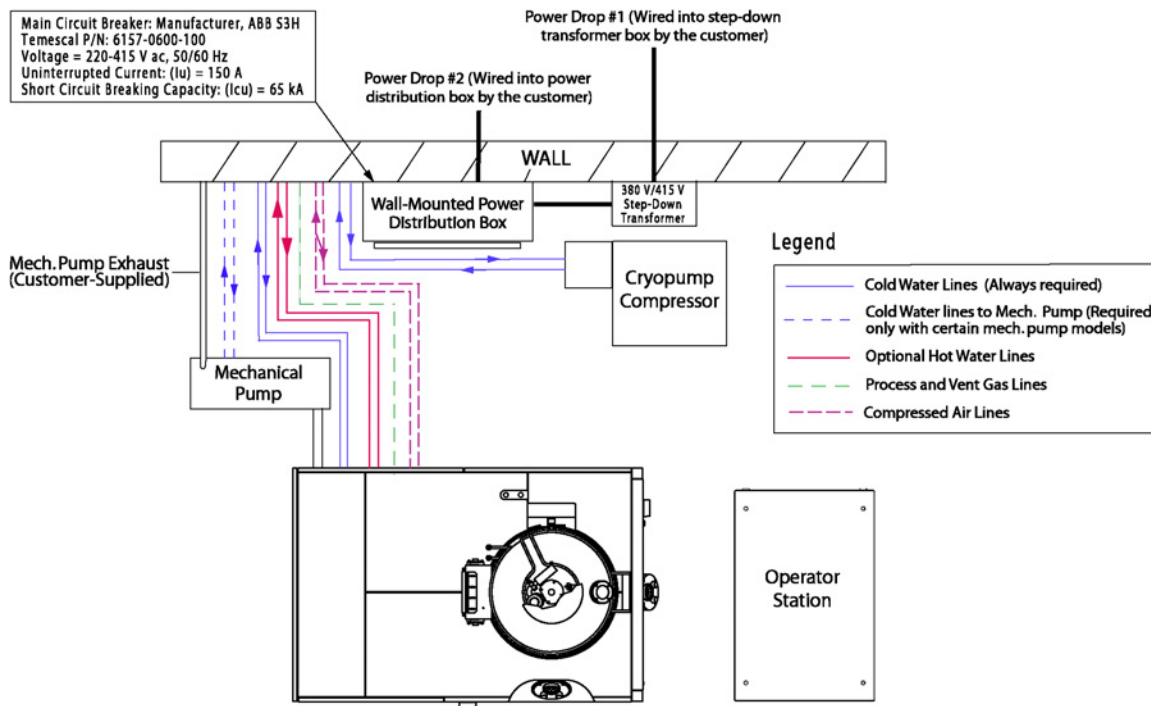


Figure 3-8 Routing of Helium Lines (Temescal Supplied)

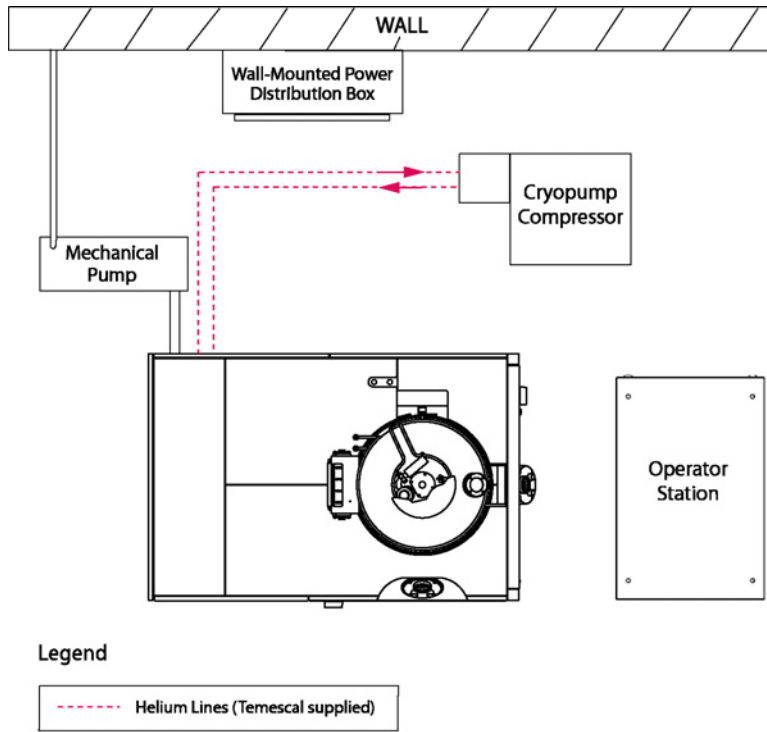


Figure 3-9 Routing of EMO Cables and Copper Grounding Straps (Temescal Supplied)

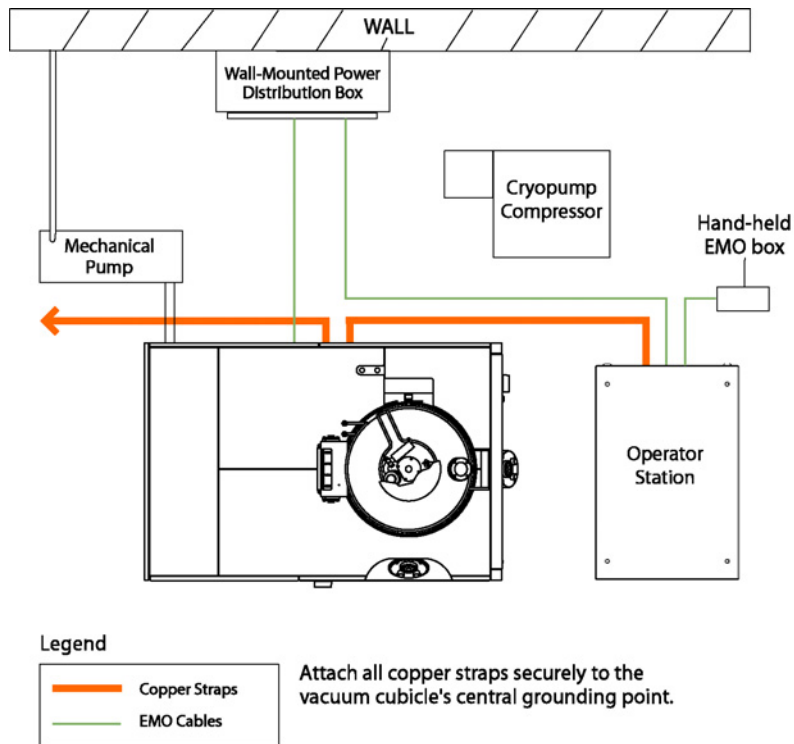
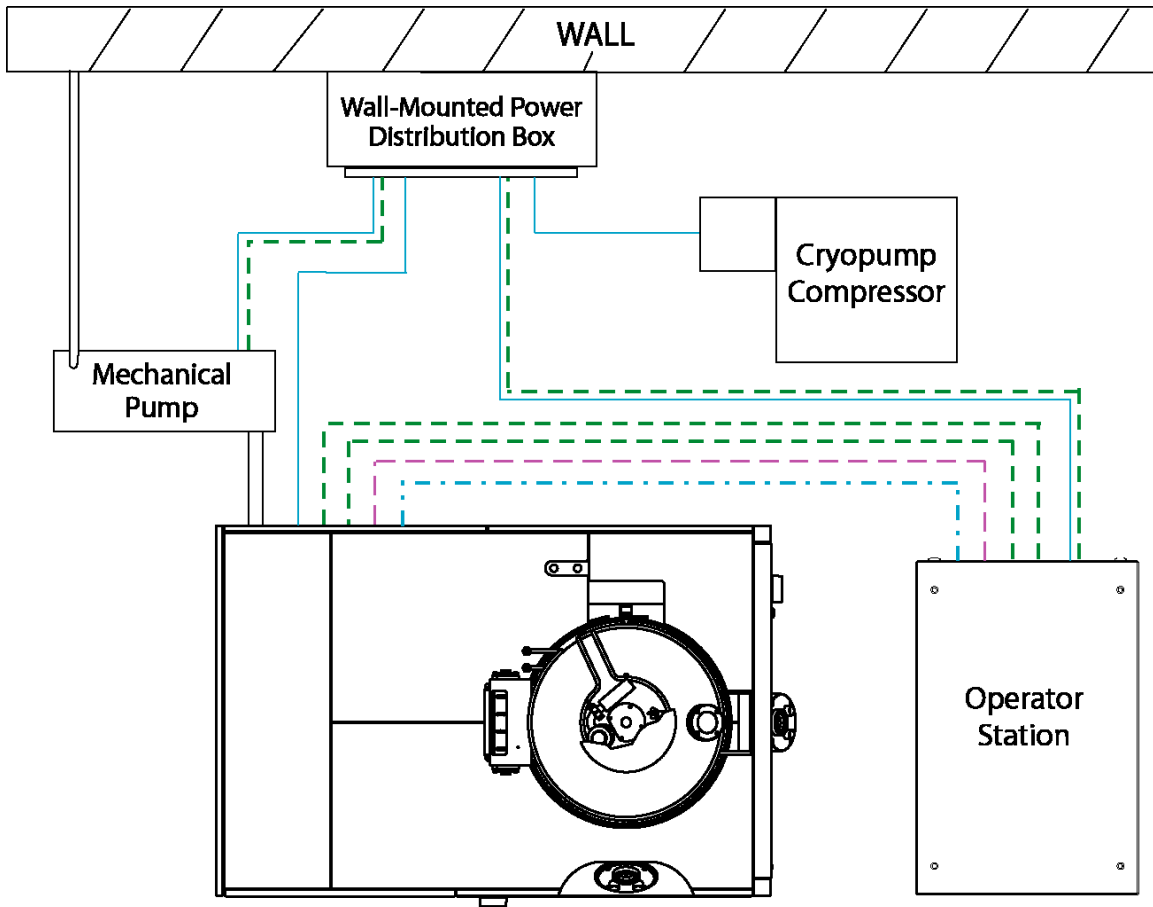


Figure 3-10 Routing of Power and Control/Data Cables (Temescal Supplied)



Legend

	Electrical power cables, carrying either 110 V ac or system input power (either 208 V or 400 V ac)
	Control/data cables
	Cable bundle containing 110 V power cable and control/data cables
	High-Voltage Coaxials
	Filament Current Cable

