

Technical Publications

GEHC DVMR HEC (LCS7397) Heat Exchanger Cabinet (HEC) Liquid Cooling System (LCS)

**GE Healthcare Part Number: 5161931
Lytron Manual Number 820-0190, Rev. R**

Installation & Service Manual



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1.0 SAFETY REQUIREMENTS

NOTICE This cooling system is designed to provide fluid cooling only as specified in this manual. If this cooling system is used in a manner other than as specified, the safety protection of the system may be impaired.

CAUTION Safety messages are posted throughout the manual. Read and follow these important instructions. Failure to observe these instructions might impair safety protection, void the warranty, and can result in permanent damage to the unit, significant property damage, personal injury, and/or death.

Be sure to read, understand, and follow all instructions and safety precautions listed in this manual before operating the unit. If there are any questions concerning the operation of the unit or the information in this manual, please contact our Applications Engineering Department at +1-781-933-7300.

- **Never place the unit in a location where excessive heat, moisture, or corrosive materials are present.**
- **The unit must be properly grounded at the power source.**
- **Do not connect the PROCESS (GC or PE) SUPPLY or RETURN fitting to building potable water supply or any pressurized source.**
- **Performance of installation, operation, or maintenance procedures other than those described in this manual or the related service manual may result in a hazardous situation and may void the Lytron warranty.**
- **Transport the unit with care. Sudden jolts or drops can damage the unit.**
- **Observe all warning labels. Never remove warning labels.**
- **Do not operate damaged or leaking equipment.**
- **Do not operate the unit without fluid in the reservoir.**
- **Always turn the unit "OFF" and properly isolate or disconnect cabinet power before performing any service, maintenance procedures, or before moving the unit.**
- **Do not operate equipment with damaged power cords.**
- **A qualified technician should perform service and repairs.**
- **This is not an outdoor cooling system. It must be operated inside a building.**

2.0 **CUSTOMER SERVICE SUPPORT**

24 hours / 7 days service hotline

Lytron has 24 hours per day, 7 days per week service hotline to help with questions on the startup and operation of the HEC (LCS7397) liquid cooling system.

Lytron is committed to servicing the customer, both during and after the sale.

If you have any questions concerning the operation of your unit, please contact:

LYTRON INC.
55 Dragon Court
Woburn, Massachusetts 01801, USA
+1-781-933-7300

To facilitate your call, please have the **model number** and **serial number** of the unit available at the time of the call. The model number and serial number can be found on the Lytron Nameplate, located on the floor of the cabinet, in the lower left hand corner.

Safety Requirements

All units returned for warranty claims must have an RMA (Returned Material Authorization) number on the outside of the container. Call Lytron Customer Service at +1-781-933-7300 for an RMA number. Refer to the end of manual for the system warranty.

3.0 COMPLIANCE STANDARDS

The DVMR HEC (LCS7397) is in agreement with the following standards:

US/CAN

Safety

US - UL 61010A-1 - Laboratory & Testing and Measurement Equipment

CAN - CSA 22.2, No. 1010.1 - Laboratory & Testing and Measurement Equipment

EMC

FCC Part 15 - Unintentional Radiators

CE/EU

Safety

EN61010-1- Laboratory & Testing and Measurement Equipment

EMC

EN61326 - Radio and Conductive Emissions



DECLARATION OF CONFORMITY**DECLARATION OF CONFORMITY**

Product Description: Liquid Cooling System

Model Number: LCS7397G3

We, Lytron Incorporated, 55 Dragon Court, Woburn, Massachusetts, 01801, USA, declare that the product described above is in conformity with the relevant EU Directives listed below using the relevant section of the following EU standards and other normative documents.

LOW VOLTAGE DIRECTIVE 2006/95/EC

Essential health and safety requirements relating to electrical equipment designed for use within certain voltage limits

EN61010-1:2001

Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements

EMC DIRECTIVE 2004/108/EC

Essential health and safety requirements relating to electromagnetic compatibility

EN 61326:1997/A1:1998/A2:2001/A3:2003

Class A, Conducted Emissions, 150kHz to 30MHz
Class A, Radiated Emissions, 30MHz to 1GHz

EN 61326:1997/A1:1998/A2:2001/A3:2003

EN61000-4-2:1995/A1:1998/A2:2001 – Electrostatic Discharge, 8kV Direct Air, 4kV Direct and Indirect Contact
EN61000-4-3:2002/A1:2002 – Radiated RF Immunity, 80 MHz-1000MHz, 10V/m, 80% AM 1kHz
EN61000-4-4: 2004 – EFT, 2kV Direct to Power Leads, 1.0 kV to I/O
EN61000-4-5:1995/A1: 2001 – Surge Immunity, 2kV Common Mode
EN61000-4-6:1996/A1: 2001 – Conducted RF Immunity, 150kHz-80MHz, 3Vrms, 80% AM 1kHz
EN61000-4-11:2004 – Voltage Dips and Interruptions

This product has been qualified in accordance with the requirements established above and is manufactured in compliance with Lytron's registered EN ISO 9001:2000; BS EN ISO 9001:2000; ANSI/ASQ Q9001:2000 Quality System.


Authorized Lytron Representative

10/6/08
Date

55 Dragon Court / Woburn, MA 01801 USA / Tel 781-933-7300 / Fax 781-935-4529 / www.lytron.com



F4.03.36 Rev A 10/02/08

5.0 REVISION HISTORY

REV	REASON FOR CHANGE	APPROVED BY/ DATE
A	INITIAL RELEASE	A. LUPIEN 10/20/06
B	REVISED PER ECN# 15890	N. GRUNDY 10/08/08
C	REVISED PAGES 15, 17 PER ECN# 16335	N. GRUNDY 04/10/09
D	REVISED PAGES 15, 23 PER ECN# 16391	N. GRUNDY 5/12/09
E	REVISED PER ECN# 16473	N. GRUNDY 8/17/09
F	REVISED PER ECN# 16655	N. GRUNDY 9/18/09
G	REVISED PER ECN# 16676	N. GRUNDY 9/24/09
H	REVISED PER ECN# 17198	N. GRUNDY 6/24/10
J	REVISED PER ECN# 17582, UPDATED 830-0184 SCHEMATIC.	N. GRUNDY 12/9/10
K	REVISED PER ECN# 17645, SIGNAL BOX SCHEMATIC.	N. GRUNDY 1/18/11
L	REVISED PER ECN# 17777. UPDATES TO TRANSPORTATION, DRAINING, ELECTRICAL LOCKOUT REQUIREMENTS, AND SAFETY SYMBOLS.	G. DUCHARME 04/21/11
M	REVISED PER ECN# 17845. CUSTOMER SUPPLIED CHANGES.	M.GOLINI 6/23/11
N	REVISED PER ECN# 17985 ADDED PAGE 3 OF 200-2243, ADDED ELECTRICAL REQUIREMENTS TO PARAGRAPH 11.2 AND 11.3, UPDATE LYTRON WARRANTY WITH REV G.	NG 11/17/11
P	REVISED PER ECN# 18101. REVISED WORDING OF ELECTRICAL REQUIREMENTS IN 11.2, PLUMBING REQUIREMENTS IN 11.3, ADDED PICTURE OF PRICE PUMP AND CORRECTED WORDING IN 12.1, INSERTED PUMP STYLE IDENTIFICATION SECTION AS 15.1, ADDED VFD CHIP TO FRU LIST IN 15.2, ADDED PUMP SPEED TROUBLESHOOTING TO 18.0.	G. DUCHARME 02/01/12
R	REVISED PER ECN# 18410. REVISED RECOMMENDED FACILITY FLUID TEMPERATURE RANGE IN 6.0 AND 11.4, UPDATED FIGURE 1 IN 7.1, ADDED G-CAT LABEL IN 8.1, UPDATED IMAGES IN 10.0, UPDATED FIGURE 4 IN 12.1, REVISED VFD COLOR MARKING IN 15.1, ADDED SECTION 15.3, UPDATED TABLE IN 15.2, AND UPDATED SCHEMATICS IN 16.1, 16.2, AND 16.3	G. DUCHARME 02/27/13

6.0 HEC (LCS7397) SPECIFICATIONS

Subject	Specifications
Overall Dimensions	35" (89 cm) wide x 35" (89 cm) deep x 75" (191 cm) high
Shipping Crate Dimensions	45-1/4" (115 cm) wide x 45-1/4" (115 cm) deep x 81" (206 cm) high
Weight (empty, no fluid)	1000 pounds (454 kg)
Shipping Weight (empty, no fluid)	1085 pounds (492 kg)
Center of Gravity (empty, no fluid)	Approximately 48" (122 cm) from floor, centered in cabinet.
GC Tank Volume	18 gallons (68 liters)
PE Tank Volume	18 gallons (68 liters)
GC Pump Capacity	8.2 GPM (31L/min @ 82.8 PSI (5.7 Bar)
PE Pump Capacity	25 GPM (94.6L/min @ 80 PSI (5.5 Bar)
Recommended Process Fluid – Gradient Coil & Power Electronics	GEHC DVMR Coolant with resistivity between 2.5 KOhm-cm and 1000 KOhm-cm
Recommended Facility Fluid ¹	Water with 0% to 40% propylene glycol by volume for intake by the HEC (LCS7397) under the following conditions: 6.0 to 12.0°C PH: 6.5 to 9 Hardness: Less than 200 PPM calcium carbonate Suspended Matter: <10 mg/L; 150-micron particle size
Process Fluid Connections	GC Supply - 1" SAE 37° JIC flare GC Return - 1" SAE 37° JIC flare PE Supply - 1" SAE 37° JIC flare PE Return - 1" SAE 37° JIC flare
Facility Fluid Connections	Facility Supply – 1 1/2" FPT (Female NPT) Facility Return – 1 1/2" FPT (Female NPT) Cryo Supply – 1/2" SAE 37° JIC flare Cryo Return – 1/2" SAE 37° JIC flare
Electrical Requirements	480 Volt (± 10% daily variation; ±14% up to 200 msec.), 3 phase, 60 Hz (± 3 Hz variation) 380 Volt, 400 Volt, or 415 Volt (± 10% daily variation; ±14% up to 200 msec.), 3 phase, 50/60 Hz (± 3 Hz variation)
Recommended Circuit Breaker	The power from the DVMR main disconnect panel to the mains terminal blocks in the HEC (LCS7397) electrical box must be in accordance with local code, and from a dedicated circuit that provides protection against excessive current draw.
Ambient Temperature – Non-Operating	-40 to 70°C with a maximum positive/negative rate of change of 20°C/hr

¹ The Recommended Facility Coolant temperature limits are determined by the chilled-air temperature setpoint of the system as follows:

Chilled-air temperature setpoint of system (°C)	Min coolant temperature (°C)	Max coolant temperature (°C)
14	7	10
18	6	12

Humidity – Non-Operating	Between 5% and 100%, condensing, with a positive/negative rate of change of 30%/hr
Altitude – Non-Operating	30.5 m below sea level to 5200 m above sea level. Non-operating conditions cover air transport of the cooling cabinet
Magnetic Field – Non-Operating	50 Gauss
Ambient Temperature – Operating	10 to 35°C with a maximum positive/negative rate of change of 10°C/hr. Maximum allowable temperatures may be reduced for high altitude operation (greater than sea level) by a factor of 1.5°C per 1000 m.
Humidity – Operating	Between 30% and 75%, non-condensing, with a maximum allowable positive/negative rate of change of 5%/hr
Altitude – Operating	30.5 m below sea level to 2500 m above sea level. Non-operating conditions cover air transport of the cooling cabinet
Magnetic Field – Operating	50 Gauss
Elevation Above MR System	5 m
Elevation Below MR System	5 m
Power Cord Requirement for mains power	Temperature Rating: 65°C minimum The power cord supplying power to the system must be in accordance with local code and from a circuit that provides protection against excessive current draw.

7.0 HEC (LCS7397) DIMENSIONS

7.1 Overall Dimensions

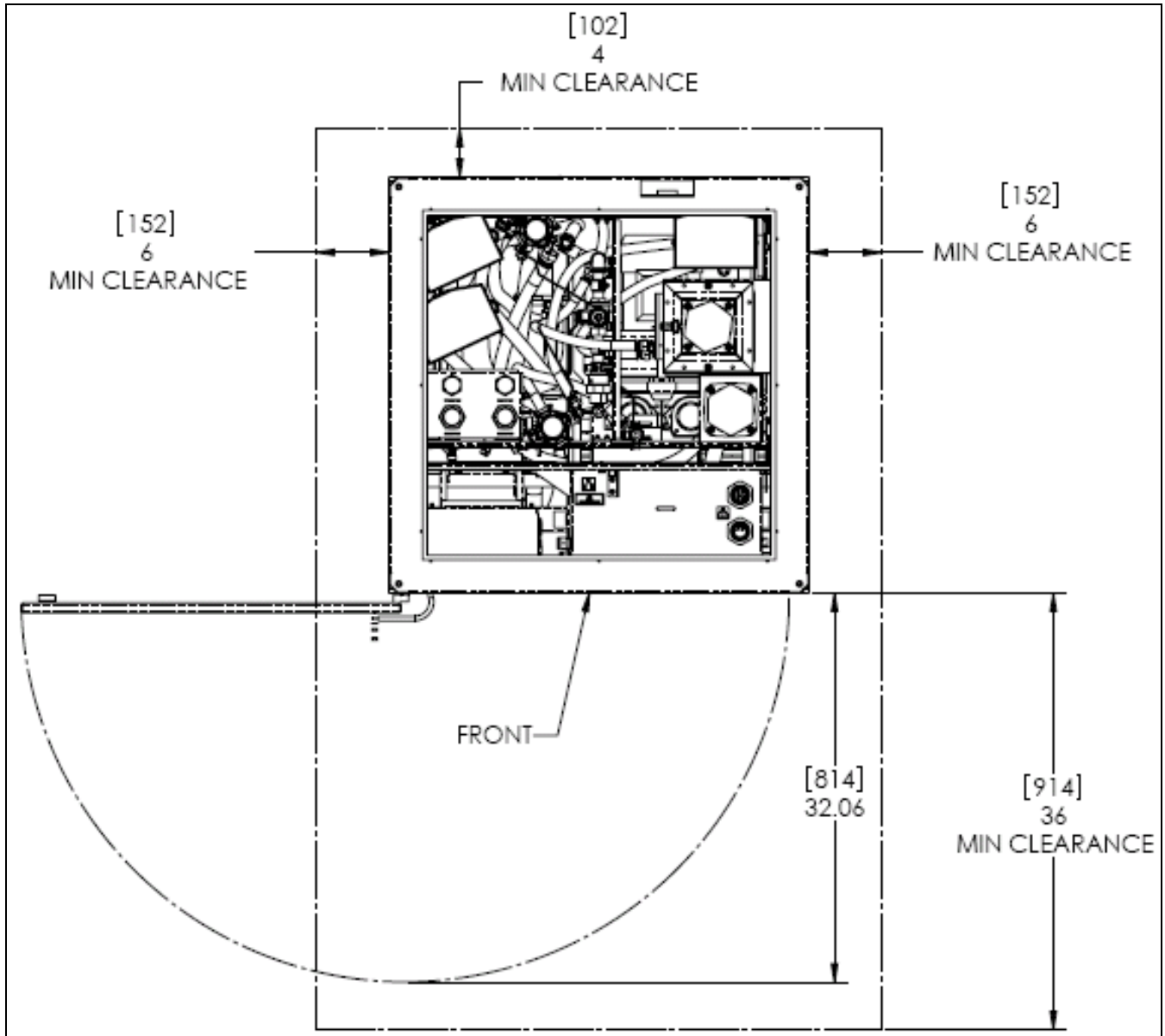


Figure 1: Floor Space Requirement

8.0 SAFETY LABELS AND MARKINGS



The Protective Earth (ground) Terminal.
La borne de mise a la masse



This symbol certifies that the system conforms to the EMC Directive and all applicable directives at the time of marking.
Ce symbole certifie que le refroidisseur de liquide conforme a la directive EMC et a tous directives a l'heure de l'inscription.



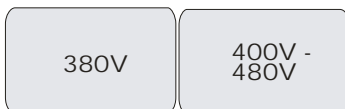
Agency compliance and approval product conforms to standards.
La conformite d'agence et l'approbation de produit se conforme aux normes



Attention: This symbol tells the user to consult accompanying documents before servicing equipment.
Ce symbole indique a l'utilisateur de consulter des documents d'accompagnement avant d'enteretenir l'equipment.



High Voltage: This symbol is to alert the user to disconnect power before servicing. Turn the 4 circuit breakers in the HEC (LCS7397) electrical box to the off position and disconnect power from the Mains Power Distribution Panel before servicing.
Debrancher toute alimentation electrique avant entretien



Frequency Toggle Switch, 380V~50Hz and 480V~60Hz
Interrupteur a levier de frequence

8.1 Product Identification Nameplate

SUPPLIER CODE XXXXXXXXXX		LYTRON <small>Heat Thermal Solutions</small>	PRODUCT OF USA 09/17/08	
65 DRAGON COURT, WOBURN, MA 01801-1039 For Service and Support World Wide Call: 781-933-7300 Or E-mail: service@Lytron.com				
MODEL NO.		SERIAL NO.		
[REDACTED]		XXXXXXXXXX		
VOLTS	HZ	PHASE	AMPS	Maximum Breaker Rating 50A
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	
PUMP TYPE		GEHC P/N & REV		
[REDACTED]		[REDACTED] X		
CERTIFICATION OF COMPLIANCE				
Approved by: [REDACTED]				

The Product ID Label identifies the Lytron model number and serial number, GEHC part number and latest revision, electrical information, and pump type. This label is located on the inside floor of the cabinet in the front side left hand corner.

G6001EN

The GEHC G-CAT label identifies the GEHC catalog number. This label is located on the inside floor of the cabinet in the front, left hand corner, in front of the Product ID Label.

9.0 RECEIVING & UNPACKING THE HEC (LCS7397)

9.1 Receiving the HEC (LCS7397)

The HEC (LCS7397) will be shipped from Lytron on a wooden pallet. This pallet and packaging material is designed to protect the cooling system from potential damage during transit. The shipping pallet is a custom wooden pallet that has been specifically engineered for the HEC (LCS7397). The HEC (LCS7397) will be bolted to the pallet via metal angle mounting brackets. All eight edges of the cabinet will be protected by cardboard angle and the entire cabinet shrink-wrapped.

The pallet is approximately 45-1/4" (115 cm) wide x 45-1/4" (115 cm) deep x 81" (206 cm) high. The overall height (unit on pallet) is approximately 80" (203 cm). See section 6.0 of this manual for more dimensional information.

The HEC (LCS7397) can be moved with a pallet jack with a capacity of ≥ 1500 lbs (680 kg) or with a fork truck with a capacity of ≥ 1500 lbs (680 kg). The forks should be centered underneath the packaging pallet.

9.2 Unpacking the HEC (LCS7397)

Begin unpacking the HEC (LCS7397) by removing the shrink-wrap and cardboard angles that surround the cabinet. Discard the shrink-wrap and cardboard angles.

Remove the two metal angle-mounting brackets from the HEC (LCS7397) base. The two metal angle-mounting brackets can remain screwed to the pallet.

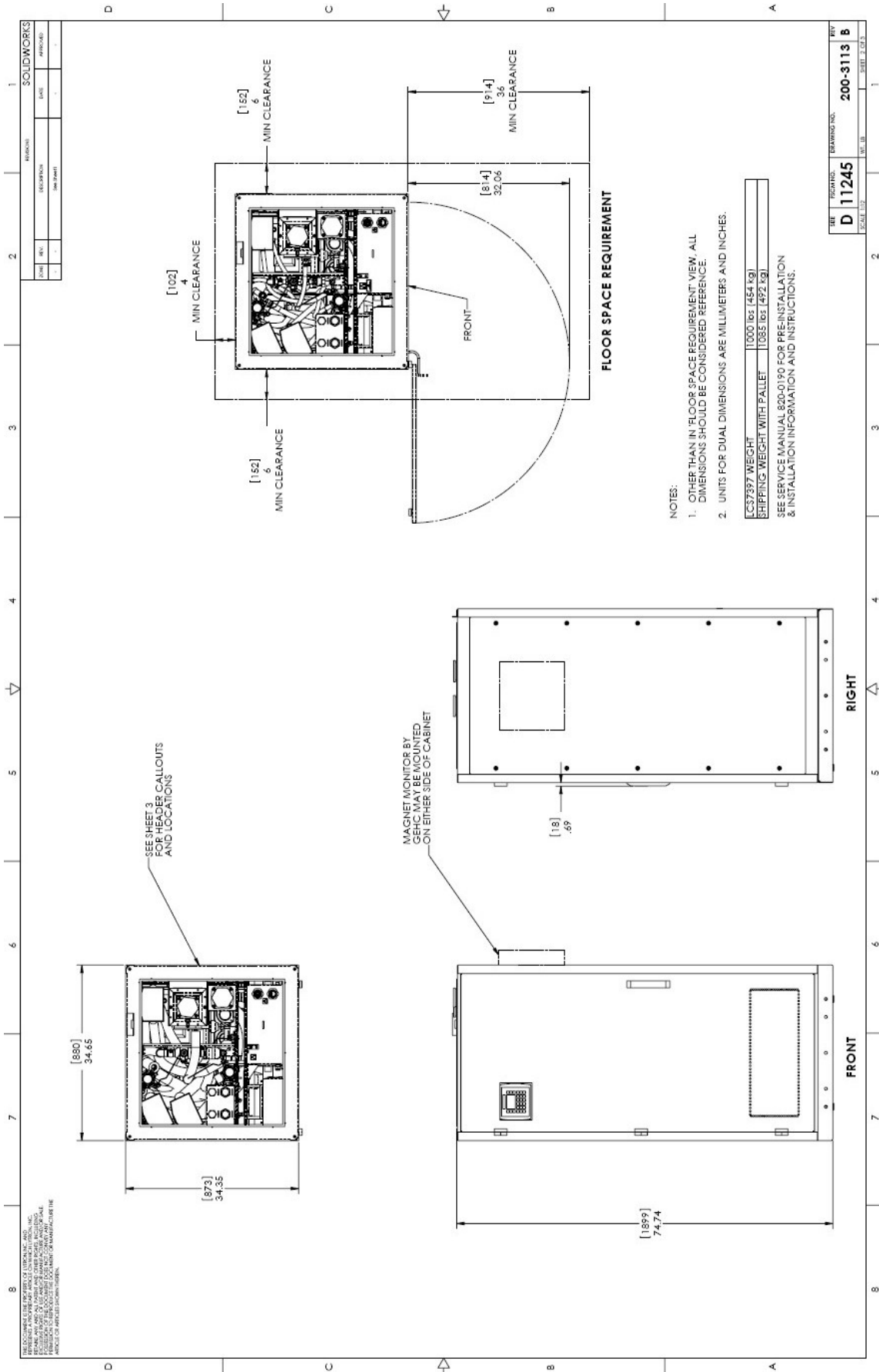
▲ CAUTION The HEC (LCS7397) should not be moved while still positioned on pallet if the metal angle mounting brackets have been removed. Doing so could result in permanent damage to the unit, significant property damage, personal injury, and/or death.

Removing the HEC (LCS7397) from pallet:

The recommended method for removing the cabinet from the pallet is by the use of cabinet dollies.

In determining the final location for HEC (LCS7397), follow the recommendations provided in the Floor Space Diagram.

10.0 FLOOR SPACE REQUIREMENT



11.0 FACILITY REQUIREMENT

11.1 Ambient Conditions and HEC (LCS7397) Location

Ambient Conditions: The local ambient temperature should be between 10 to 35°C with a maximum positive/negative rate of change of 10°C/hr. Maximum allowable temperatures might be reduced for high altitude operation (greater than sea level) by a factor of 1.5°C per 1000 m. The humidity level should be between 30% and 75%, non-condensing, with a maximum allowable positive/negative rate of change of 5%/hr. The HEC (LCS7397) should not be operated at an elevation greater than 16.5 ft (5m) above or below the MR system

Location: The HEC (LCS7397) should be installed in a location that allows airflow around the unit. The HEC (LCS7397) must have at least 4 inches (102 mm) of clearance at the rear of the cabinet, 6 inches (152 mm) of clearance at each of the sides of the cabinet, and 36 inches (914 mm) of clearance at the front of the cabinet (the front is defined as the side with the hinged door. The rear is opposite the front side). This space must be provided for proper airflow. Space above the HEC (LCS7397) should be considered for all electrical and plumbing connections.

11.2 Electrical Requirements

Power to the HEC (LCS7397) shall be received from the DVMR main disconnect panel. The HEC (LCS7397) requires 480 volt (+/- 10% daily variation; +/- 14% up to 200 msec.), 3 phase, 60 Hz (+/- 3 Hz variation) or 380v, 400v, 415v (+/- 10% daily variation; +/- 14% up to 200 msec.), 3 phase, 50/60 Hz (+/- 3 Hz variation)

The power cord delivering power from the DVMR main disconnect panel to the mains terminal blocks in the HEC (LCS7397) electrical box must be rated for 65°C minimum, be in accordance with local code, and from a dedicated circuit that provides protection against excessive current draw.

The Power Box in the HEC is on slides and hinged so it can be swung out for access to the components behind it. Make sure to include a service loop for the incoming power and the power cable to the Cryo-Cooler.

See GE installation documents for further details.

Ground - a main power ground stud is provided inside of the electrical box. An appropriate ground wire must be installed to the ground stud provided.

NOTICE Do not cycle the 5 circuit breakers off and on in rapid fashion. The VFD units for the blower and pumps must de-energize for at least 4 minutes after power has been turned off. Energizing them before they have completely de-energized may cause premature equipment failure.

11.3 Plumbing

Customer is to provide and install liquid coolant, pipe/hoses, filters and connectors to HEC cabinet.

Customer shall also provide a flow meter to display coolant flow.

See GE installation documents for further details.

Refer to section 6.0 for a call out of all required plumbing connections.

NOTICE Use a back-up wrench on the stationary header fittings to ensure headers within the cabinet do not turn. Failing to do so could cause a fluid leak within the system.

When making plumbing connections to Parker SAE flare fittings, manufacturer assembly recommendations should be followed. As a general rule, Parker recommends hand tight, then ¼-turn with a wrench for their flare connections.

When making plumbing connections to NPT fittings, Lytron recommends Real-Tuff or equivalent (Hercules Chemical Company, Inc.) for use as a thread sealant. Follow the Real-Tuff application recommendations.

11.4 Facility Fluid (customer supplied coolant)²

The customer supplied coolant must meet the following conditions:

Water with 0% to 40% propylene glycol by volume for intake by the HEC (LCS7397).

PH: 6.5 to 9

Hardness: Less than 200-PPM calcium carbonate

Suspended Matter: <10 mg/L; 150-micron particle size

Minimum flow rate of 114 L/min (30 GPM) for 40% propylene glycol water coolant.

Maximum facility coolant supply pressure shall be 6 bar (87 PSI) measured at the inlet of the cooling cabinet.

The maximum facility coolant temperature is 12°C (53.6°F) for 40% propylene glycol.

The minimum facility coolant temperature is 6°C (42.8°F).

11.5 Process Fluid Requirements (coolant for GC & PE plumbing circuit)

There are two independent process water circuits that are designed to cool the Gradient Coil and the Power Electronics.

² The Recommended Facility Coolant temperature limits are determined by the chilled-air temperature setpoint of the system as follows:

Chilled-air temperature setpoint of system (°C)	Min coolant temperature (°C)	Max coolant temperature (°C)
14	7	10
18	6	12

(GC) Gradient Coil Circuit – DVMR Coolant with resistivity between 2.5 KOhm-cm and 1000 KOhm-cm (at 25°C)

(PE) Power Electronics Circuit – DVMR Coolant with resistivity between 2.5 KOhm-cm and 1000 KOhm-cm (at 25°C)

12.0 TRANSPORTATION, DRAINING AND ELECTRICAL LOCKOUT REQUIREMENTS

12.1 Draining Procedure

⚠ WARNING Always disconnect power to HEC (LCS7397) when performing service. Turn the 5 circuit breakers in the HEC (LCS7397) electrical box to the off position and lock and tag out (LOTO) power at HEC Main power Distribution Panel per documented service procedure. "LOTO for Heat Exchanger Cabinet". Failure to do so could result in damage to the equipment, personal injury and/or death.

NOTICE It is extremely important to completely drain the HEC (LCS7397) when not in use for extended period of time, shipping outside of its current location, during certain repairs, and for scheduled fluid maintenance. Not following this procedure may result in extensive damage to the HEC (LCS7397).

⚠ CAUTION A container should be available to hold the fluid removed from the HEC (LCS7397). This container should be labeled in accordance with OSHA rules and regulations concerning handling of the fluid being removed from the HEC (LCS7397). Reference the MSDS sheet for the fluid being removed from the HEC (LCS7397) for further handling, storage, and disposal instructions. Disposal of fluid removed from the Lytron cooling system should be in accordance with all Local and Federal disposal laws. Failure to do so could result in personal injury.

There are 6 drain ports located on the HEC (LCS7397) cooling system. Each of the 6 connections will have to be utilized to properly drain the system.

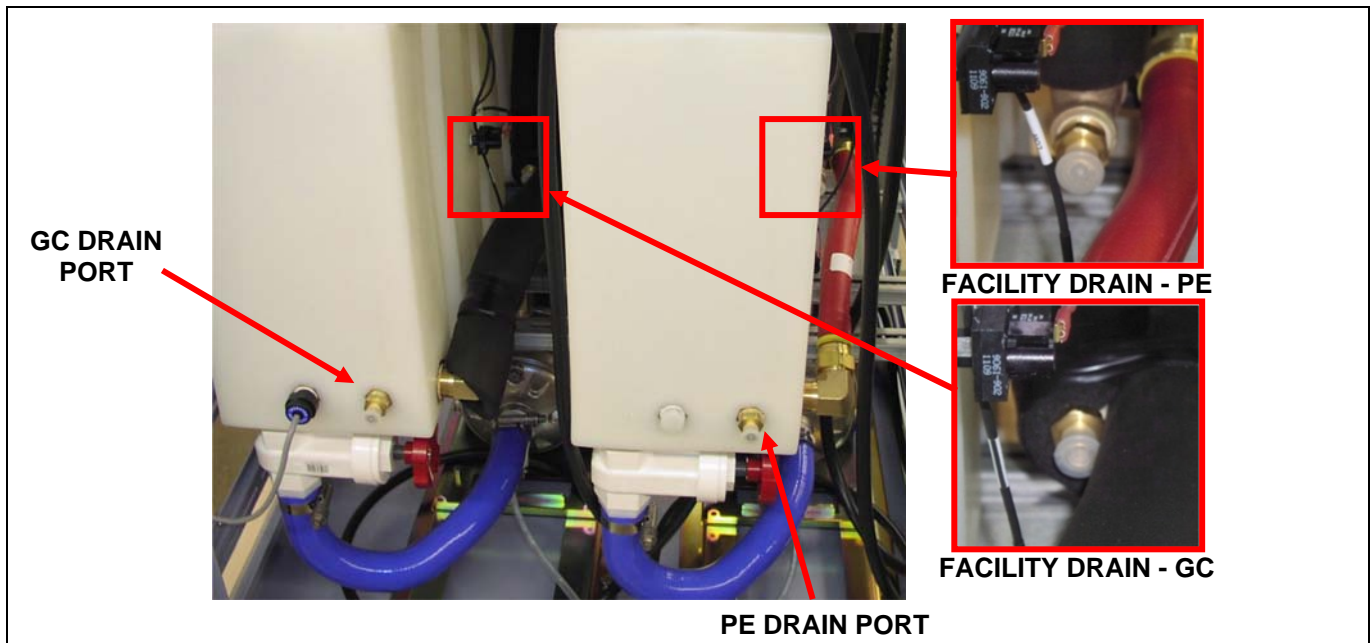


Figure 2: System Drain Ports

NOTE: Older models will have the drain on the side of the tank

Figure 2 shows both the heat exchanger drain Quick Disconnect (QD) and the tank drain. Each of the two heat exchangers and each of the two tanks have a drain.

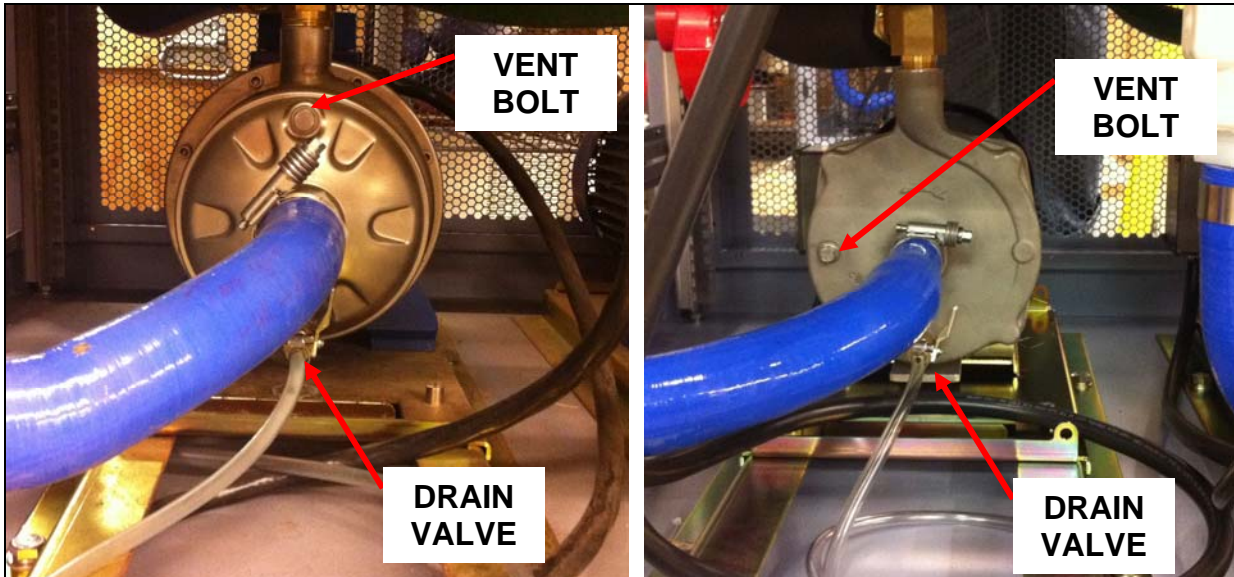


Figure 3: Pump Drain Port

Figure 3 shows the pump drain. Each of the two pumps has a drain.

To drain the heat exchangers and the tanks, the drain hose supplied with the water removal kit, 5269683, will be needed and the approved container for the fluid.

To Drain the Pump-only circuit:

- Ensure pump is off and power to the cabinet is locked out.
- Shut off gate valve at bottom of reservoir.
- Unwind hose from located at bottom of pump – direct hose into suitable container.
- Open drain ball valve located at the pump.
- Remove the bolt on the face of the pump to allow vent the pump and allow the fluid to drain.

To Drain GC & PE plumbing circuit:

- Begin by following the procedure above on draining the pump-only circuits and opening the shut off gate valve at bottom of reservoir. While the pump is draining, remove the tank fill cap from both tanks to allow tank to vent. Begin by draining the GC circuit from the tank drain quick disconnect fitting located on the front (or on older models on the right side) of each tank (Figure 2).
- The tank will be sufficiently drained when fluid stops running from drain hose. Remove the drain hose from the QD.
- The remainder of the GC circuit will be sufficiently drained when fluid stops running from pump drain hose. Close the pump drain ball valve.
- To drain the PE plumbing circuit, perform the same steps as described for the GC draining procedure.

To Drain Facility plumbing circuit:

- Before draining the facility plumbing circuit, the facility water supply must be isolated from the cooling system. To isolate the facility water supply, close the 1-1/2" ball valves on the facility supply and return headers.

- Facility water is drained from the HEC (LCS7397) through the two brass quick disconnects located on the bottom of the PE and GC heat exchangers (Figure 2).
- Important: Determine where the fluid from the HEC (LCS7397) will be contained prior to attaching the drain hose to the QDs.
- Using the drain hose supplied with the water removal kit, 5269683, connect to the brass QD fitting on either of the two heat exchangers. Crack open Cryo filter housing shown in Figure 4 (Reference GE coolant draining procedure for further details). This is done by opening the valve handle halfway (the handle should be at a 45° angle) and partially opening the large hex cap on the top of the valve. The facility fluid will be sufficiently drained when fluid stops running from drain hose. After one heat exchanger is drained, move drain hose to the other heat exchanger and allow draining.

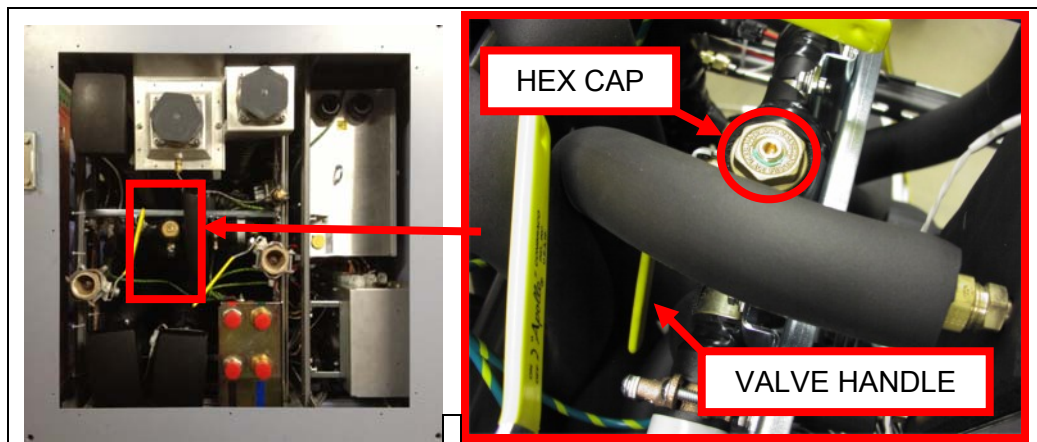


Figure 4: Filter Valve Location

12.2 Electrical Lockout

To de-energize the HEC (LCS7397) system, turn the 5 circuit breakers in the electrical box of the HEC (LCS7397) to the off position. Lock and tag out (LOTO) power at the HEC (LCS7397) main disconnect panel per documented service procedure. “LOTO for Heat Exchanger Cabinet.”

NOTICE Do not energize the mains breakers in the HEC (LCS7397) unit for at least 4 minutes after turning them to the off position. The VFD units must de-energize completely before restarting. Failure to do so could result in damage of the equipment.

13.0 SHIPPING

Whenever the cooling system is going to be transported it should be packaged on the original shipping skid. The following should be followed when shipping the HEC (LCS7397):

Center the HEC (LCS7397) on the skid. The HEC (LCS7397) should be bolted to the skid via the angle mounting rails as shown in the photo:



Figure 5: System Mounted on Shipping Skid

After bolting the cabinet to the skid, 4 vertical corners and 4 horizontal corners at the top of the cabinet should be lined with angle cardboard for protection. The entire cabinet can be wrapped with plastic shipping wrap as shown in photo below:



Figure 6: System Packaged for Shipment

This skid is designed to protect the cooling system from potential damage during transit. The shipping crate is a custom wooden pallet that has been specifically engineered for the HEC (LCS7397). The overall shipping dimensions are approximately 45-1/4" (115 cm) wide x 45-1/4" (115 cm) deep x 81" (206 cm) high. If the original packaging is unavailable, contact Lytron's Service Department for shipping instructions prior to shipping this unit.



Shipping this product using anything other than its original packaging could result in personal injury and/or damage to the equipment.

14.0 COOLING SYSTEM START-UP AND OPERATION

14.1 Electrical Power

The electrical power requirements are specified in section 11.2 of this manual.

Prior to hooking up the main power, verify that the 5 circuit breakers are in the "DOWN" position.

Main power will be supplied, by facility, to the cabinet through the strain relief located in the top of the HEC (LCS7397) electrical box. The three power wires should be brought to the terminal strip inside the electrical box and connected to the terminal strip as shown on the Electrical Wiring Diagram (Lytron Drawing #830-0185). There is a ground stud provided for the ground lead.

Prior to starting the HEC (LCS7397) it is extremely important to identify what voltage the HEC (LCS7397) will be run at (380V, 400, 415, or 480V). See Table 1 below. Figure 7 shows the 380/400-480V switch.

TABLE 1	
Nominal Input Voltage (VAC)	HEC Switch Position
380V	380V
400V, 415V, 480V	400V - 480V

NOTICE Failure to switch the 380/400-480V switch to the correct operating voltage could result in irreversible damage to the HEC (LCS7397) control system.



Figure 7: System 380/400-480V Switch

After the main power has been connected and positioning the 380/400-480V switch, install electrical box cover.

14.2 Filling the HEC (LCS7397)

The HEC (LCS7397) has three separate fluid requirements. Facility Fluid, GC Fluid, and PE Fluid. The specification for each are described in section 11.4 & 11.5.

Directions to fill the HEC (LCS7397):

Process Circuits:

1. Verify the gate valve located in the suction line of the pump is fully “OPEN” (turned fully counter-clockwise).
2. Verify that both pump drains are “CLOSED”. The pump drain is a ball valve located at the bottom-front of the pump housing.
3. The GC (Gradient Coil) plumbing circuit is located on the left hand side of the cabinet when looking at the cabinet from the hinged door. The PE (Power Electronics) plumbing circuit is on the right hand side of the cabinet. Remove the fill port caps from both tanks.
4. Fill the GC tank with DVMR coolant as specified in section 11.5 of this manual. The initial volume required to fill the GC tank will be approximately 18 gallons.
5. Fill the PE tank with DVMR coolant as specified in section 11.5 of this manual. The initial volume required to fill the PE tank will be approximately 18 gallons.
6. Replace caps on each tank.

NOTE: More fluid will be required to “top-off” the tank later in the start-up procedure after the pumps have been run and the process fluid headers are filled.

Facility Circuits:

The facility side will self-fill upon opening the 1 ½” valves at the top of the cabinet and initiating proper flow from the chiller or facility coolant supply.

14.3 Powering the Signal Box, GC/PE Pumps, Blower, & Cryo Compressor

There are 5 circuit breakers located in the electrical box. They are shown in the photo below:

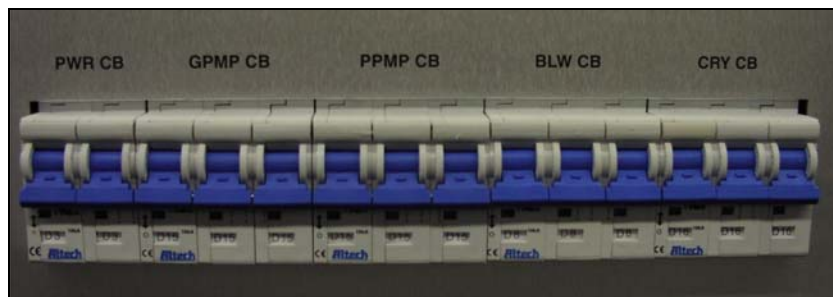


Figure 8: System Circuit Breakers





To power the devices protected by these circuit breakers, the breaker needs to be switched to the “up” position. The devices protected by the circuit breakers are from left to right – “PWR CB” = 115V power to the Signal Box, “GPMP CB” = power to the GC (Gradient Coil) VFD & pump, “PPMP CB” = power to the PE (Power Electronics) VFD & pump, “BLW CB” = Power to the Blower, “CRY CB” = power to the Cryo Compressor.

NOTICE Make sure all GC and PE connections at the top of the cabinet have been made and all valve positions down stream are open prior to starting pumps. Failure to do so could result in damage to the equipment.

Operation of the GC pump, PE pump, Blower, and Cryo Compressor will be controlled by GE protocol via the host computer. Refer to GE documentation for instructions on controlling these devices.

NOTICE At initial start-up of the GC and PE pumps, volume in the tank will be used to fill the supply and return lines. Follow the instructions below to properly start the pumps. Failure to do so could result in damage to the equipment.

The GC and PE pumps should be run at increments of 10 seconds at initial start-up. After each start, stop the pump after 10 seconds of operation. Wait 4 minutes before restarting the pumps as fast cycling could cause damage to Variable Frequency Drives. Check the tank volume after each stop. If tank volume drops, “top off” tank with coolant as specified in 14.2.

Alternatively, the GC and PE coolant pumps can be started and stopped using the PLC keypad on the front of the system from any menu screen. Press the “UP” arrow key  and “F2”  at the same time will start or stop the GC coolant pump. Pressing the “UP” arrow key  and “F3”  at the same time will start or stop the PE coolant pump.

After the supply and return lines are full and the pumps are pumping fluid throughout the plumbing circuit the tank volume should remain at a constant level approximately 4 to 5 inches above the top level sensor on the side of the tank.

14.4 Maintenance

WARNING Disconnect power to cooling systems prior to servicing. Wear latex gloves and safety glasses when performing this service. Failure to do so could result in damage to the equipment, personal injury and/or death.

NOTE: Disposal of fluids removed from the HEC (LCS7397) and related plumbing circuits should be in accordance with all local and Federal disposal laws.

Deionizing and Filtering the Cooling system

To clean the Process (GC/PE) side of the cooling system and prevent algae growth within the fluid cooling system, GE recommends that the deionization and filtering procedure be followed per the planned maintenance cycle. Refer to GE documentation for instructions on performing the Deionization and Filtering procedure.

Cryo Strainer Replacement

Lytron recommends that the mesh filter element of the Cryo supply strainer (P/N 5269685) be cleaned or changed (clean by running clean water through filter every 6 months as part of a scheduled maintenance program.

(It is recommended that the element be serviced after the HEC (LCS7397) facility plumbing circuit is allowed to run for 1-2 weeks. This is due to a higher than normal load on the mesh screen due to particulate left in the water circuit during site commissioning)

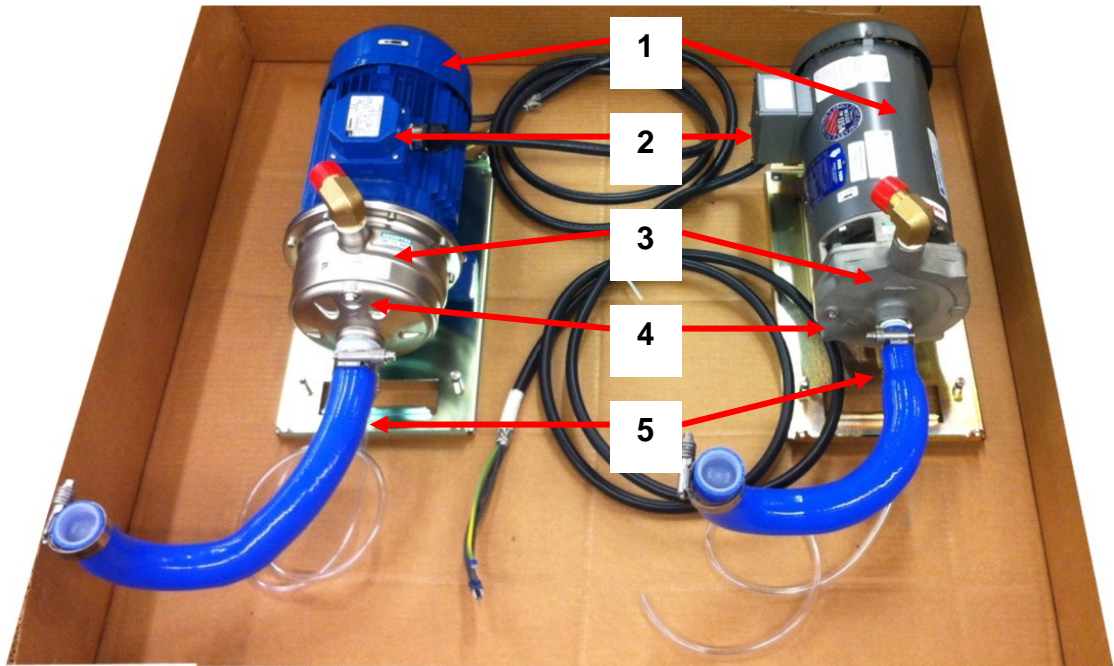
15.0 FIELD REPLACEABLE UNITS (FRUS) & SPARE PARTS

15.1 GC and PE Pump Style Identification

There are two styles of pumps that have been used in production of the HEC (LCS7397). HEC serial numbers through 837156 have used a pump manufactured by Ebara. All HEC serial numbers thereafter (including FRUs) have used a pump manufactured by Price Pumps. Due to their differing operating characteristics, the VFD needs to be programmed for the specific pump.

NOTICE It is imperative that the pump type be exactly matched with the correct VFD chip. An incorrectly matched pump and VFD chip will result in pressures/flows too high/low and potential damage to the equipment.

The following information should be used as identifying characteristics of the pump style and VFD programming chip:



Ebara Pump		Price Pump
Blue motor body.	1	Gray motor body.
Electrical junction box on top of motor.	2	Electrical junction box on left side of motor.
Bright, stamped stainless steel pump housing.	3	Dull, cast stainless steel pump housing.
Vent bolt on front of pump housing located at 12 o'clock.	4	Vent bolt on front of pump housing located at 9 o'clock.
Uniform suction hose diameter.	5	Reduction in suction hose diameter at the pump inlet.

See VFD Chip marking on next page.



Ebara VFD Chip

Plain colored chip with NO markings



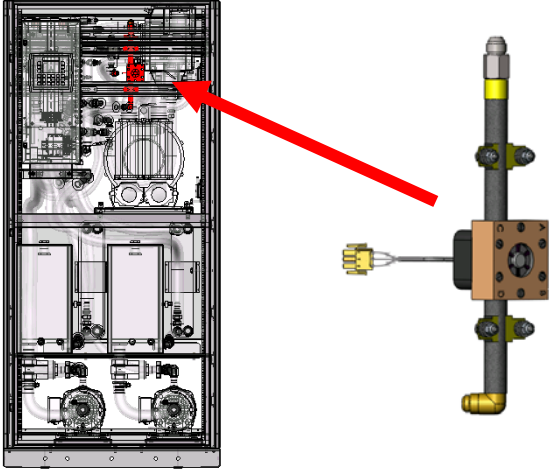
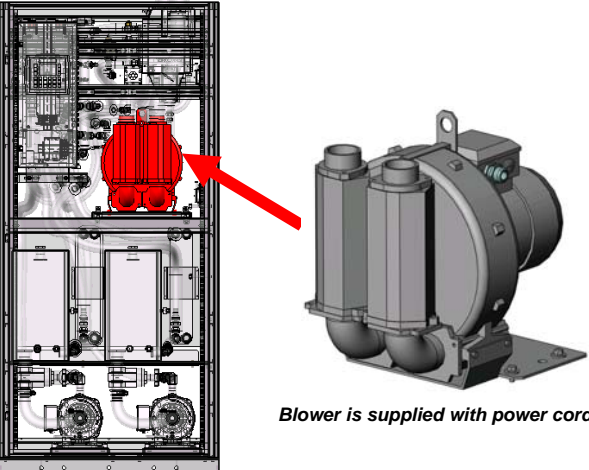
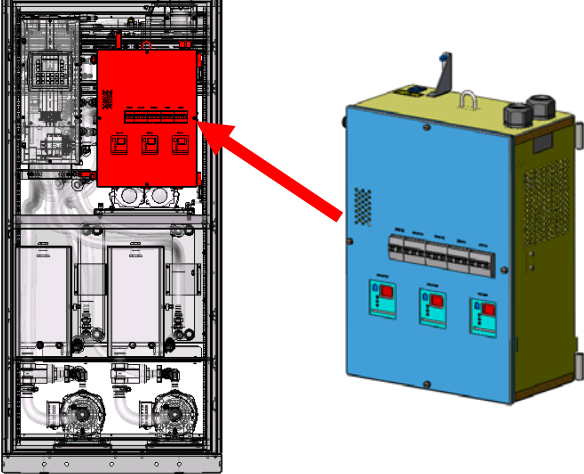
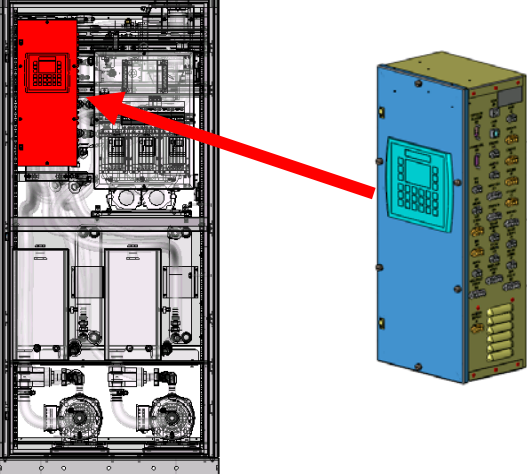
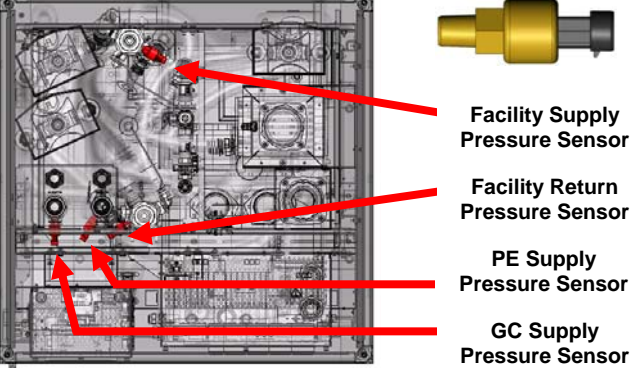
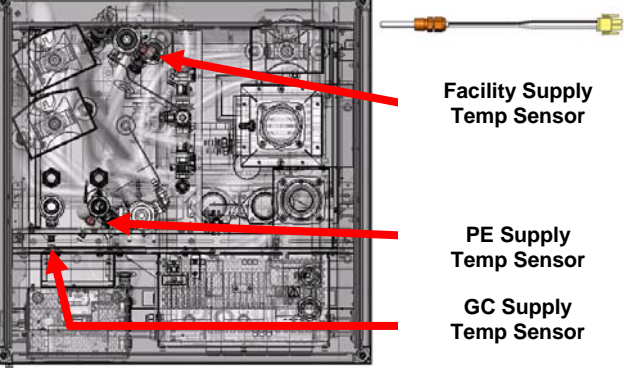
Price VFD Chip

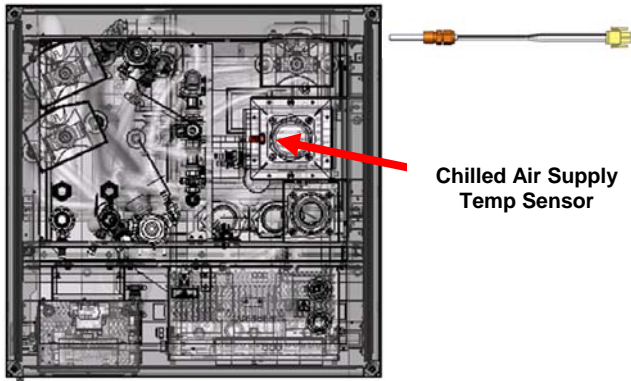
White colored chip marked "P"

15.2 FRU Assemblies (images follow)

Lytron P/N	GE P/N	Part Description
205-0116	5264701	DVMR DI Kit FRU Filter and Chemicals
205-0121	5156316	Cryogen Compressor Flow Meter Kit
205-0121-04	5156315	3hp Blower Kit
205-0121-05	5156319	Power Box Kit
205-0121-06	5269691	Signal Box Kit
205-0121-07	5267643	Liquid Pressure Sensor Kit
205-0121-08	5268665	Liquid Temperature Sensor Kit
205-0121-10	5269689	Air Temperature Sensor Kit
205-0121-11	5267644	Level Switch Kit
205-0121-12	5267649	Resistivity Sensor Kit
205-0121-13	5269685	Cryogen Compressor Filter Kit
205-0121-15	5269683	Coolant Removal Kit
205-0121-16	5266827	FRU, Fuse kit, DI and Transformer
205-0121-17	5262029	Support Tube, HDV EQ Room
205-0121-18	5357155	Cryo Compressor Fitting Kit
205-0121-19	5376555	Cryo Supply Header Kit
205-0121-20	5400660	HEC HX Brass Bushing Kit
205-0121-25	5156321	3HP Price Pump Kit
205-0121-27	5443037	VFD EPM Chip for Price Pump
205-0121-30	5156318	Mixing Valve Kit for Gradient Coil and Power Electronics Cabinet Cooling Loops
205-0121-31	5156320	Mixing Valve Kit for Chilled Air Blower
MN7519G1	5224090	DVMR DI Kit (Service tool, not orderable as FRU)
N/A	5372868	Ball Valve LOTO Device
* Part warranty is 90 days or remainder of system, whichever is greater.		

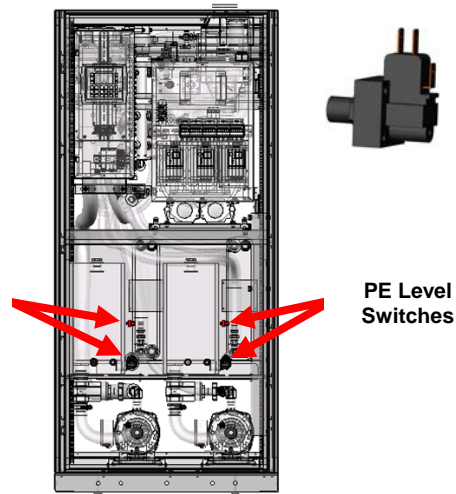
15.3 FRU Locations within the HEC

 <p>GEHC P/N 5156316 Cryogen Compressor Flow Meter Kit (Power Box Not Shown for Clarity)</p>	 <p>Blower is supplied with power cord</p> <p>GEHC P/N 5156315 3hp Blower Kit (Power Box Not Shown for Clarity)</p>
 <p>GEHC P/N 5156319 Power Box Kit</p>	 <p>GEHC P/N 5269691 Signal Box Kit</p>
 <p>Facility Supply Pressure Sensor</p> <p>Facility Return Pressure Sensor</p> <p>PE Supply Pressure Sensor</p> <p>GC Supply Pressure Sensor</p> <p>GEHC P/N 5267643 Liquid Pressure Sensor Kit Qty 1 Sensor per Kit</p>	 <p>Facility Supply Temp Sensor</p> <p>PE Supply Temp Sensor</p> <p>GC Supply Temp Sensor</p> <p>GEHC P/N 5268665 Liquid Temperature Sensor Kit Qty 1 Sensor per Kit</p>



**Chilled Air Supply
Temp Sensor**

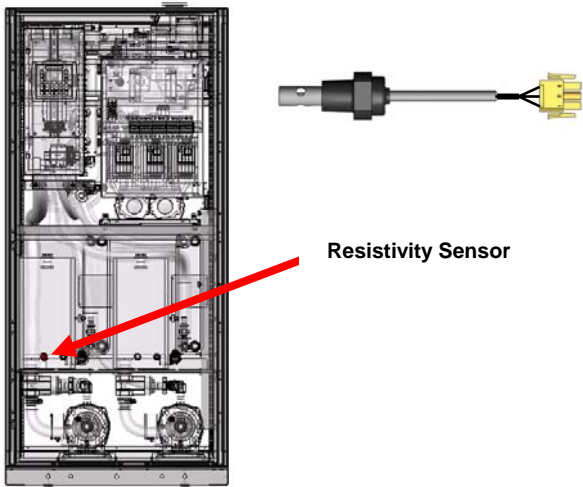
GEHC P/N 5269689
Air Temperature Sensor Kit
Qty 1 Sensor per Kit



**GC Level
Switches**

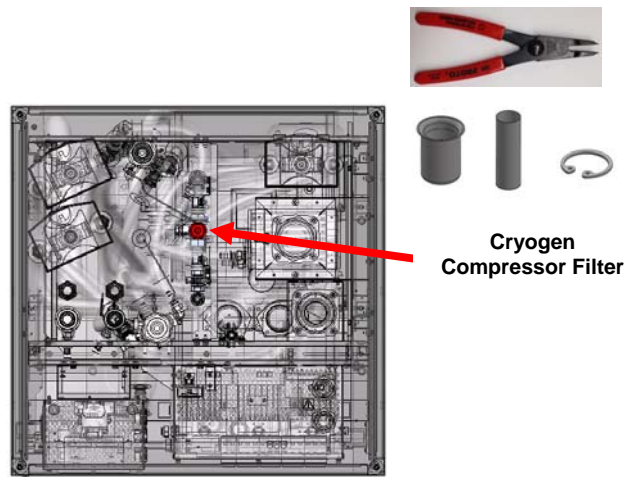
**PE Level
Switches**

GEHC P/N 5267644
Level Switch Kit
Qty 1 Sensor per Kit



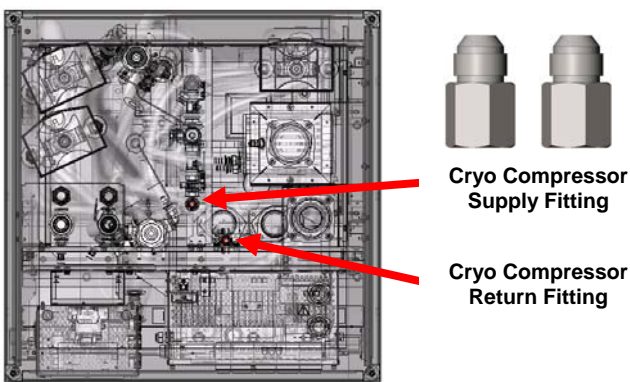
Resistivity Sensor

GEHC P/N 5267649
Resistivity Sensor Kit
Qty 1 Sensor per Kit



**Cryogen
Compressor Filter**

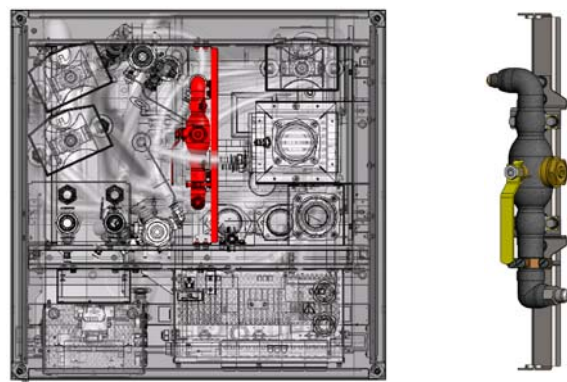
GEHC P/N 5269685
Cryogen Compressor Filter Kit



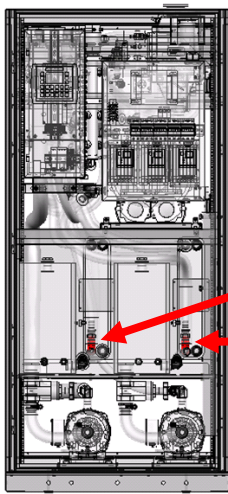
**Cryo Compressor
Supply Fitting**

**Cryo Compressor
Return Fitting**

GEHC P/N 5357155
Cryo Compressor Fitting Kit
Qty 2 Fittings per Kit



GEHC P/N 5376555
Cryo Supply Header Kit

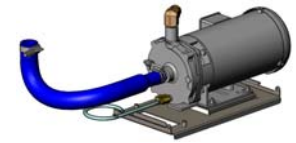
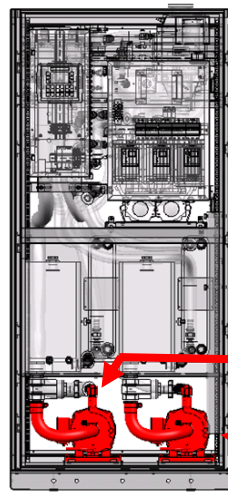


**GC HEC HX
Brass Bushing**

**PE HEC HX
Brass Bushing**

GEHC P/N 5400660

HEC HX Brass Bushing Kit / Facility Tee with QD



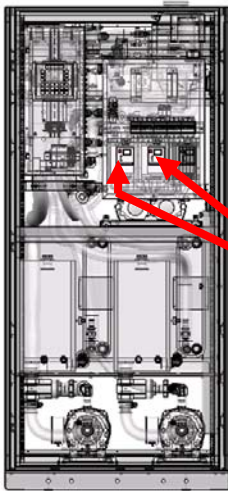
Pump is supplied with power cord

**GC 3HP
Price Pump**

**PE 3HP
Price Pump**

GEHC P/N 5156321

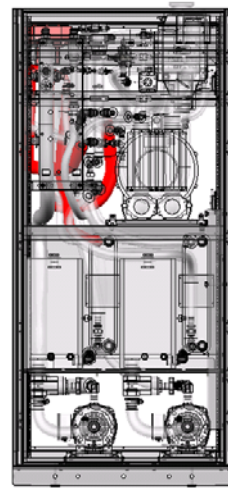
3HP Price Pump Kit



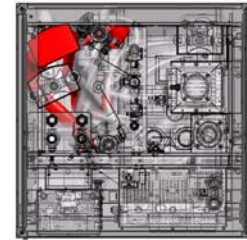
**VFD EPM Chip for
Price Pump**

GEHC P/N 5443037

**VFD EPM Chip for Price Pump Kit
Qty 1 EPM Chip per Kit**

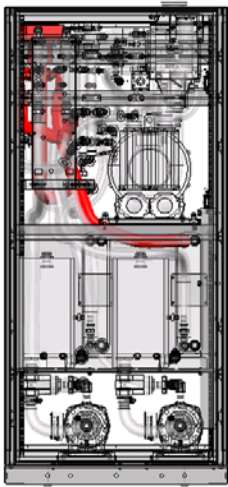


*Kit includes fuses to
upgrade G6000EN
Signal Boxes*

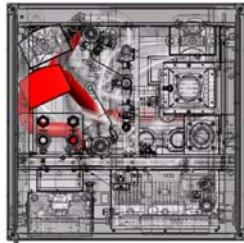


GEHC P/N 5156318

**Mixing Valve Kit for Gradient Coil Cooling Loop
(Signal and Power Boxes Not Shown for Clarity)**

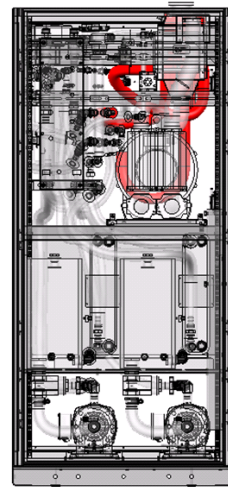


*Kit includes fuses to
upgrade G6000EN
Signal Boxes*

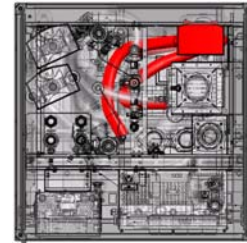


GEHC P/N 5156318

**Mixing Valve Kit for Power Electronics
Cabinet Cooling Loop
(Signal and Power Boxes Not Shown for Clarity)**



*Kit includes fuses to
upgrade G6000EN
Signal Boxes*

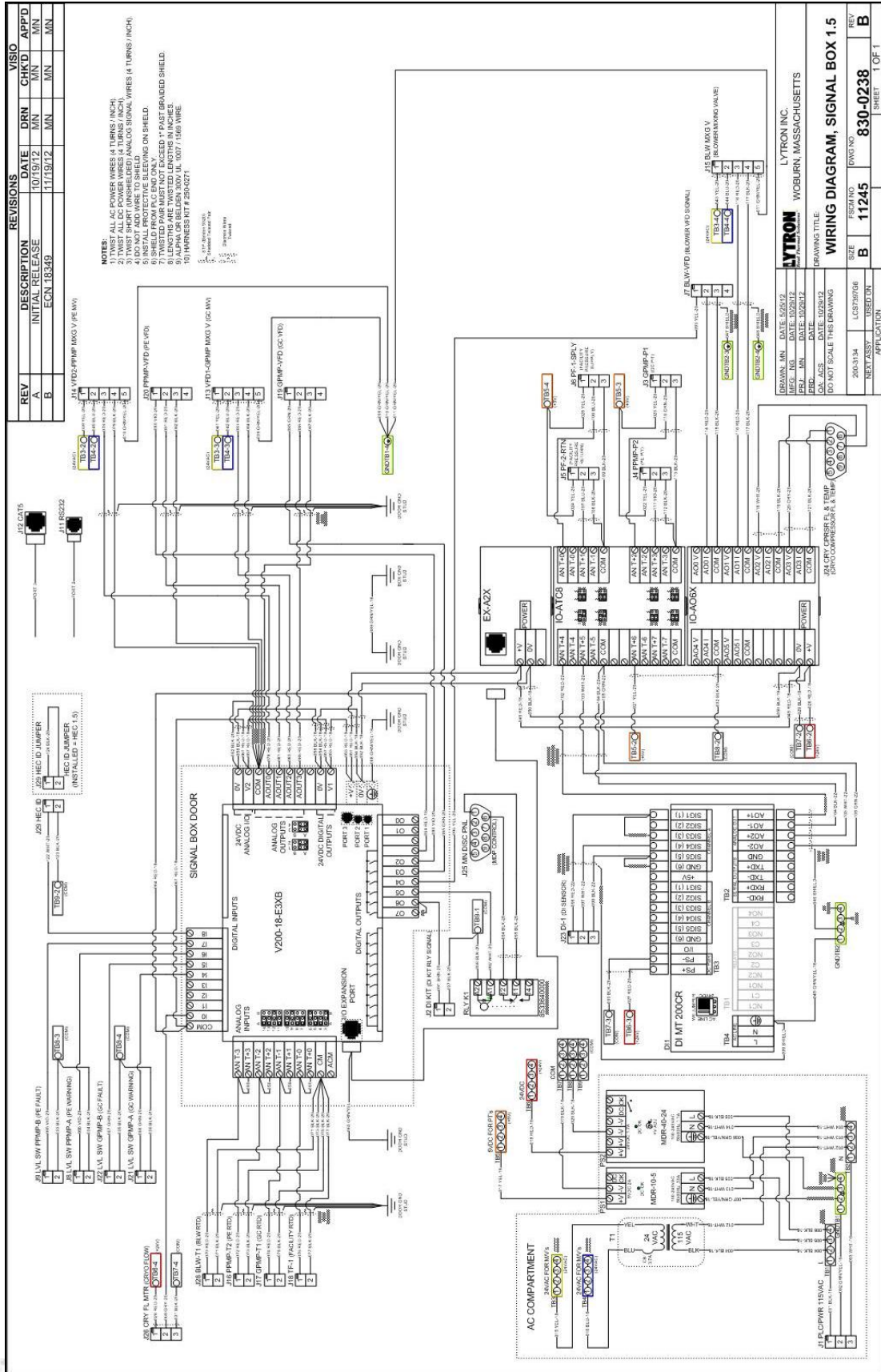


GEHC P/N 5156320

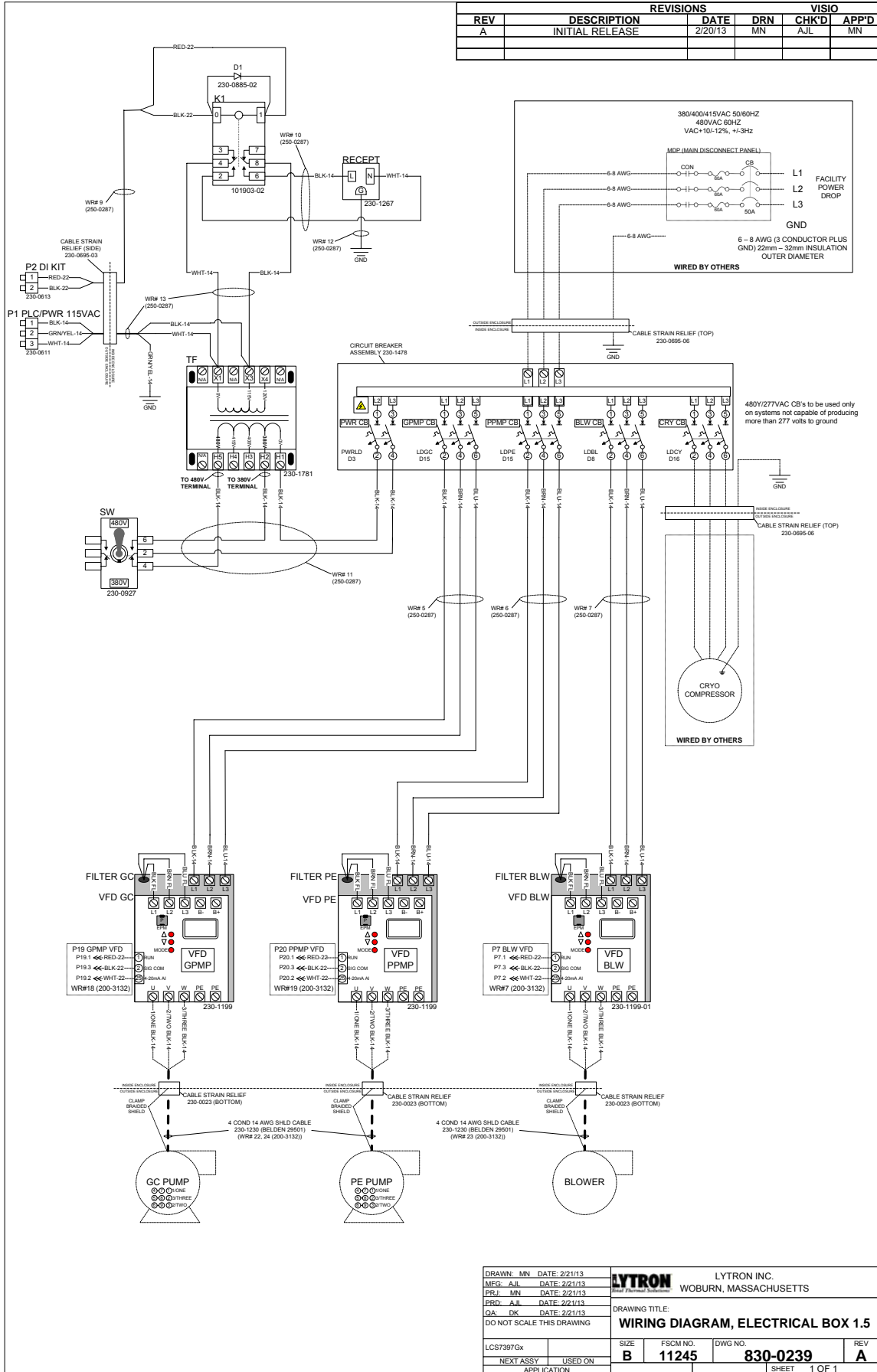
**Mixing Valve Kit for Chilled Air Blower
(Signal and Power Boxes Not Shown for Clarity)**

16.0 SCHEMATICS & DIAGRAMS

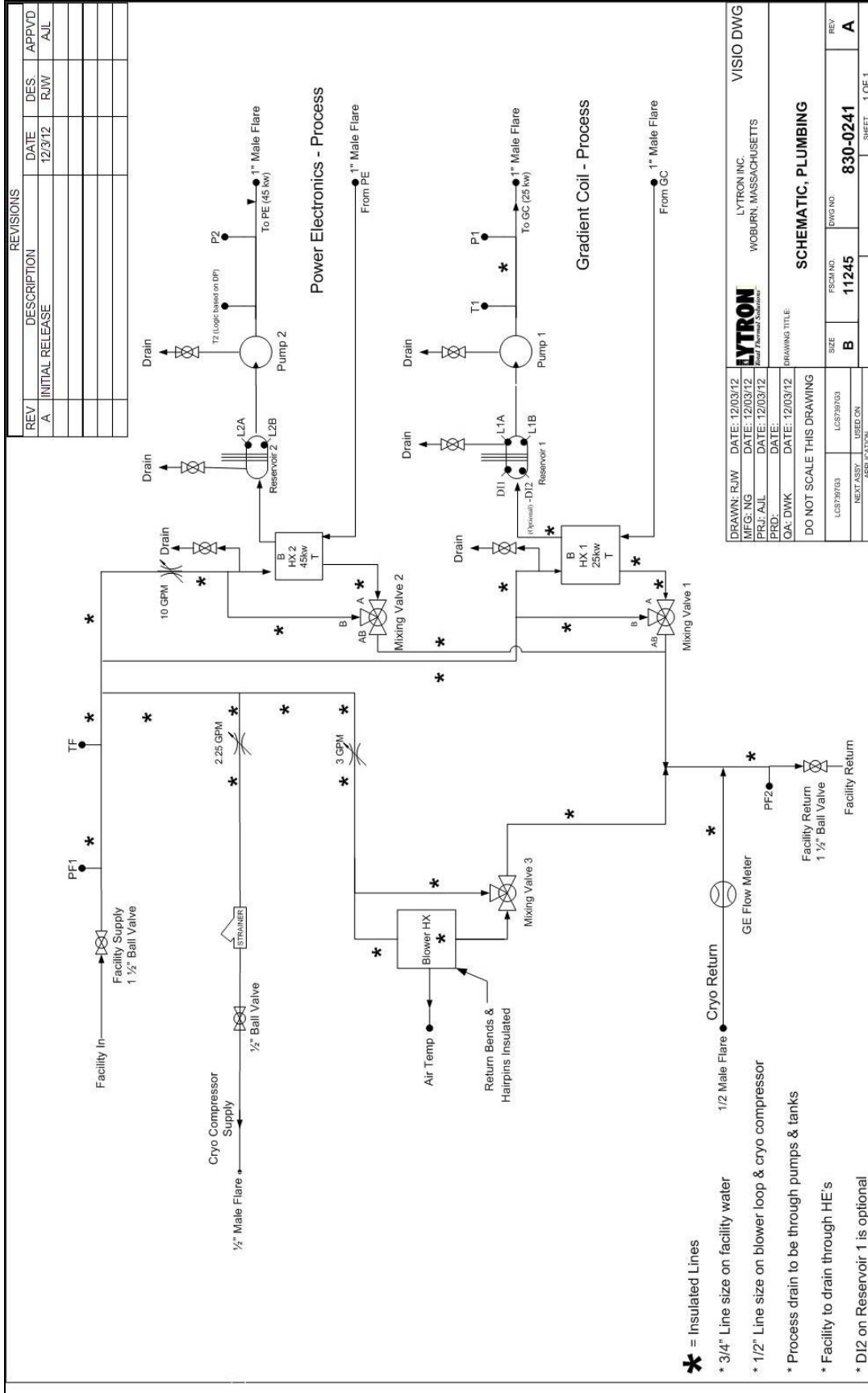
16.1 Electrical – Signal Box Wiring Schematic



16.2 Electrical Box Schematic



16.3 Plumbing Schematic



DRAWN: RJW	DATE: 12/03/12	LYTRON	LYTRON INC.	WOBURN, MASSACHUSETTS	VISIO DWG
PRJ: AJL	DATE: 12/03/12	LYTRON	LYTRON INC.	WOBURN, MASSACHUSETTS	
PRD:	DATE:	LYTRON	LYTRON INC.	WOBURN, MASSACHUSETTS	
QA: DWK	DATE: 12/03/12	DRAWING TITLE: SCHEMATIC, PLUMBING			
DO NOT SCALE THIS DRAWING					
LC5720703	LC5720703	SIZE	FSCH NO.	DWG NO.	REV
		B	11245	830-0241	A
		NEXT ASSY.	USED ON		SHEET
					1 OF 1

17.0 SERVICE POLICY

Lytron's cooling systems are the product of over 40 years of thermal engineering and manufacturing experience. We designed them to provide superior reliability, easy maintenance and worry-free operation. However, occasionally a system may need repair. To ensure your process is back up and running quickly, Lytron has implemented the following cooling system service policy.

17.1 **Diagnostic Consultation**

At no cost, Lytron will attempt to diagnose the problem over the phone. Our service department can be reached by calling +1-781-933-7300 and following the menu. Service technicians are available 24 hours/7 days for consultation. Lytron strongly encourages customers to take advantage of this service. Often a problem with a system can be fixed quickly in-house or is an application problem.

Replacement Parts:

Replacement parts can be ordered through GEHC. Parts being returned from systems under warranty should be returned using a Lytron issued RMA number. If the parts are found to be defective and the claim is within the warranty period, the part will be repaired or replaced at the discretion of Lytron. If the parts are not defective or indicate abuse or damage, a quotation will be generated for repair or replacement. Lytron will not cover the incremental cost of air shipment of replacement parts, regardless of warranty status.

Please check with Lytron's service department for details.

17.2 **FRU Instructions**

Service procedures are included with each spare part kit.

⚠ WARNING Always disable and lock out power to equipment per section 12.2 prior to performing any service, maintenance procedures or before moving the system. Failure to do so could result in damage to the equipment, personal injury and/or death.

⚠ WARNING Before performing any service on the system, shut down power by switching the 5 circuit breakers in the electrical box to the off position and Lock and tag out (LOTO) power at the HEC (LCS7397) Main Distribution Panel to remove power from the HEC (LCS7397), per the documented service procedure "LOTO for Heat Exchanger Cabinet". Failure to do so could result in damage to the equipment, personal injury and/or death.

NOTICE Follow draining procedure per section 12.0 of this manual. Failure to do so could result in damage to the equipment.

Form F4.3.25 Rev D, 7/21/04

18.0 TROUBLESHOOTING

Problem	Possible Cause	Recommended Remedy
Power off	The Mains Disconnect Panel was manually switched to the OFF position.	Determine the reason the power was manually turned off before switching back to the on position.
	Circuit breaker tripped due to an overload condition.	Determine what caused high current and repair the condition.
Low coolant level	Coolant level dropped when air purged from plumbing lines or the coolant has evaporated.	Fill coolant per instructions in section 14.2.
	Leak in cooling line or HEC (LCS7397) system	Verify drain valve on pump is closed. Find source of leak and fill per section 14.2.
Coolant temp not stable / Set point cannot be achieved	Facility coolant flow too low.	Verify facility coolant flow.
	Facility coolant temperature and/or flow rate is out of specification.	See requirements in section 6.0.
	Mixing valve inoperative	<p>Confirm adequate clearance at top of HEC (LCS7397) Mixing Valve Stems. Confirm that nothing is pressing down on the white manual override stem button at top of mixing valve.</p> <p>Verify Mixing Valve operation by switching the connectors for the GC (J13) and PE (J14) mixing valves on the side of the signal box. This will result in a setpoint change to the valve and the position of the aluminum valve stem should move up or down.</p> <p>If problem continues with the valve, the valve is faulty. If the problem moves to the opposite valve, the signal box is faulty.</p>
GC or PE Pump is off or No Flow condition	Pump was manually locked-out through PLC.	Manually energize pump to verify operation
	Pump was automatically powered off as result of an alarm condition.	See related alarm conditions for possible causes and corrective actions.
	The one-way check valves were not installed properly.	Verify one-way check valve from "Supply" has arrow pointing away from HEC (LCS7397) (chilled coolant flowing away from (HEC LCS7397). Also verify that the check valve on "Return" hose has arrow pointed toward the HEC (LCS7397) (warm coolant flowing to HEC (LCS7397)
GC or PE pump pressure/flow is too high/low	Pump types are incorrectly matched with VFD settings.	<p>See Section 15.1 of this manual for information on how to properly identify pumps and VFD programming.</p> <p>Order VFD EPM Chip for Price Pump if a Price pump is operating on an Ebara chip, otherwise further troubleshooting information can be found in the GE Service Methods document "HEC Troubleshooting."</p>

Blower speed is in excess of 70Hz or low airflow velocity readings on MR system	Blower VFD has had a VFD EPM Chip for Price Pump installed in its VFD.	See Section 15.1 of this manual for information on how to properly identify pumps and VFD programming. Further troubleshooting information can be found in the GE Service Methods document "HEC Troubleshooting."
Blower is off	Blower was manually locked out through PLC	Manually energize blower to verify operation.

19.0 WARRANTY *

Lytron Inc. Standard Warranty

Lytron agrees that the apparatus manufactured by it will be free from defects in materials and workmanship for the warranty period under normal use and service and when properly installed. The warranty period for Kodiak[®] recirculating chillers is two years from date of shipment of such apparatus to the original purchaser, maintenance items excluded, and one year from date of shipment of such apparatus to the original purchaser for all other products Lytron sells. Lytron's obligation under this agreement is limited solely to repair or replacement, at its option, at its factories, of any part or parts thereof, returned to Lytron with transportation charges prepaid, which examination shall disclose to Lytron's satisfaction to have been defective. THE FOREGOING EXPRESS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. LYTRON'S OBLIGATION UNDER THIS WARRANTY IS STRICTLY AND EXCLUSIVELY LIMITED TO THE REPAIR OR REPLACEMENT OF DEFECTIVE COMPONENT PARTS AND LYTRON DOES NOT ASSUME OR AUTHORIZE ANYONE TO ASSUME FOR IT ANY OTHER OBLIGATION. LYTRON ASSUMES NO RESPONSIBILITY FOR INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES INCLUDING, BUT NOT LIMITED TO LOSS OR DAMAGE TO PROPERTY, LOSS OF PROFITS OR REVENUE, LOSS OF THE UNIT, LOSS OF TIME, OR INCONVENIENCE. Lytron's liability does not include any labor charges for replacement of parts, adjustments, repairs, or any other work done outside its factories and its liability does not include any resulting damage to persons, property, equipment, goods or merchandise arising out of any defect in or failure of its apparatus. Lytron's obligation to repair or replace shall not apply to any apparatus which shall have been repaired or altered outside of its factory in any way, or which has been subject to negligence, to misuse, or to pressures in excess of stated limits. On parts not of Lytron's manufacture, such as motors, controls, etc., Lytron extends only those warranties given to Lytron, Inc. to the extent Lytron can do so. Lytron's agreement hereunder runs only to the immediate purchaser from Lytron, Inc. and does not extend, expressly or by implication, to any other person.

Form F7.02.18 Rev G Effective September 6, 2011

* Please see Lytron order acknowledgement modifications to these terms.



GE Healthcare

GE Medical Systems

A General Electric Company, going to market as GE Healthcare

3200 N. Grandview Boulevard

Waukesha, Wisconsin 53188

USA