



# ZERO ZONE

## COLDLOOP™ SECONDARY SYSTEMS GLYCOL

INSTALLATION MANUAL





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# INTRODUCTION

## IMPORTANT USER INFORMATION

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All rights reserved. No part of the contents of this manual may be reproduced, copied, or transmitted in any form or by any means including graphic, electronic, or mechanical methods or photocopying, recording, or information storage and retrieval systems without the written permission of the publisher, unless it is for the purchaser's personal use.

The information in this manual is subject to change without notice and does not represent a commitment on the part of Zero Zone. Zero Zone does not assume any responsibility for any errors that may appear in this manual. In no event will Zero Zone be liable for technical or editorial omissions made herein, nor for direct, indirect, special, incidental, or consequential damages resulting from the use or defect of this manual.

The information in this document is not intended to cover all possible conditions and situations that might occur. The end user must exercise caution and common sense when installing, using, or maintaining Zero Zone products. If any questions or problems arise, call Zero Zone at 800-708-3735.

Any change to a Zero Zone product made during the installation, startup, or at any other time must be submitted in writing to Zero Zone for approval and approved by Zero Zone in writing prior to commission. The product warranty is voided when any unapproved change is made to a Zero Zone product.

## MANUFACTURER

**Zero Zone, Inc.**  
**Refrigeration Systems Division**

6151 140th Avenue NW • Ramsey, MN 55303 • 800-708-3735 • Fax: 763-398-1998 • [www.zero-zone.com](http://www.zero-zone.com)

## INTENDED USE

Zero Zone products are intended to be installed and used as described in this manual and other related Zero Zone literature, specifications, drawings, and data. Always install Zero Zone products on a level surface.

The information contained in this manual pertains to the Zero Zone ColdLoop Glycol Secondary System.

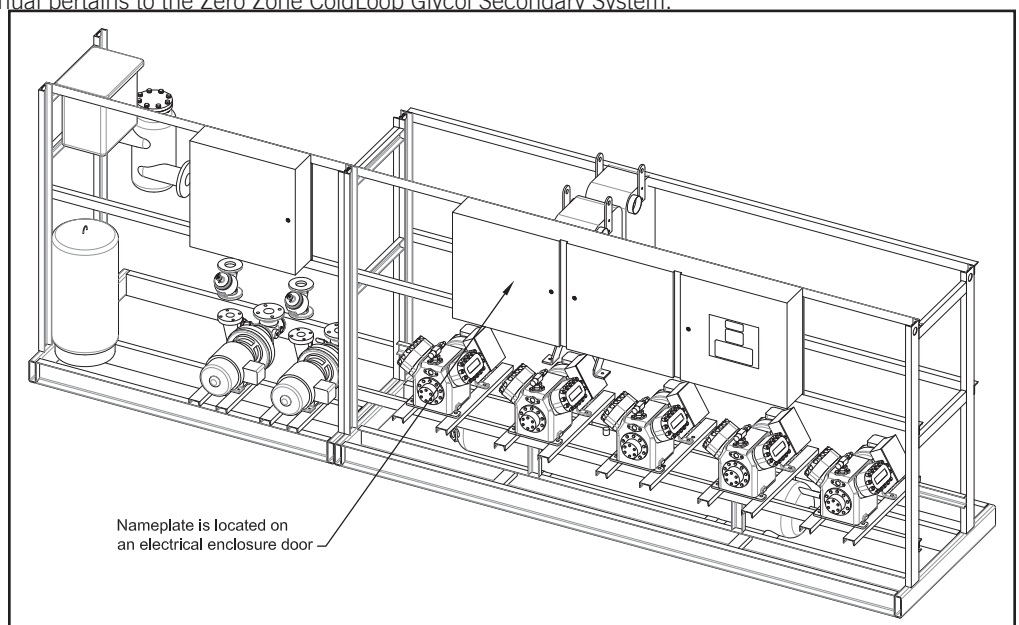
## NAMEPLATE

Refer to the ColdLoop System nameplate (**Figure 1**) for the model number, serial number, electrical service requirement, and contact information. The nameplate is always located on an electrical enclosure door.

## ZERO ZONE

## WARRANTY

**Figure 1 — Nameplate Location**



## LIMITED WARRANTY

Zero Zone, Inc. (Seller) hereby warrants that any products manufactured by it and sold are warranted to be free from defects in material and workmanship, under normal use and service for its intended purpose, for a period of one (1) year from the date of original installation (not to exceed 15 months from the date of factory shipment). The obligation under this warranty shall be limited to repairing or exchanging any part, or parts, without charge, FOB Factory, and which is proven to the satisfaction of Zero Zone's service department to be defective. Zero Zone reserves the right to inspect the job site, installation, and reason for failure. This limited warranty does not cover labor, freight, or loss of food or product, including refrigerant loss. This warranty does not apply to motors, switches, controls, lamps, driers, fuses or other parts manufactured by others and purchased by the seller unless the manufacturer of these items warrants the same to the seller and then only to the extent of such manufacturer's warranty to the seller. Any products sold on an "AS IS" basis shall not be covered by this warranty.

## EXTENDED WARRANTIES

In addition to the standard limited warranty, for further consideration, the Company will extend to the original purchaser, a limited extended warranty on the compressor only, following expiration of the standard warranty. The seller agrees to repair or exchange, at its option, or provide reimbursement for such exchange as directed, less any credit allowed for return of the original compressor, of a compressor of like or similar design and capacity, if it is shown to the satisfaction of Zero Zone that the compressor is inoperative due to defects in factory workmanship or material under normal use and services as outlined by Zero Zone in its "Service and Installation" instructions.

## LENGTH OF EXTENDED WARRANTY

Any compressor warranty may be extended for an additional four (4) years but such extension must be purchased prior to shipment to be effective. This warranty is only for the compressor and not for any other associated parts of the refrigeration system.

## PRODUCT NOT MANUFACTURED BY THE SELLER

The written Warranty, if any, provided by the manufacturer of any part of the refrigeration unit sold by Seller to Buyer, but not manufactured by Seller, is hereby assigned to the Buyer. However, Seller makes no representation or Warranty regarding the existence, validity or enforceability of any such written Warranty.

## LIMITATION AND EXCLUSION OF WARRANTIES

THE WARRANTIES SET FORTH HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES AND REMEDIES WHATSOEVER, INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE.

# SAFETY

## CONVENTIONS



THIS ICON SIGNIFIES INFORMATION THAT DESCRIBES AN UNSAFE CONDITION THAT MAY RESULT IN DEATH, INJURY, OR DAMAGE TO THE EQUIPMENT. WARNING LEVELS ARE DEFINED BELOW.



**Danger!** A condition that can result in death or serious injury.



**Warning!** A condition that can result in serious injury or damage to equipment.



**Caution!** A condition that can result in injury or damage to equipment or product.

## GENERAL SAFETY INFORMATION

Do not work on or operate the ColdLoop System without reading and understanding this section which contains important information and warnings. Ignoring these warnings can result in death, serious injury, or damage to the system and product.

### DOORS AND COVERS

The doors and covers on the ColdLoop System protect against the hazards behind them. Operation without these safety devices in place creates hazards that the doors and covers are intended to render safe. It is your responsibility to make sure that the doors and covers are fastened in place at all times.

### LOCKOUT

Machine lockout places the ColdLoop System into a zero energy state and prevents accidentally energizing electrical circuits during maintenance periods. Always follow the Lockout Procedure described in this section before cleaning, maintaining, or repairing the ColdLoop System. Consult your company for specific lockout tagout requirements.



**Danger!** Accidental application of power, while working on the ColdLoop System, can result in serious injury or death. Comply with the Lockout Requirements below and to the site lockout and tag-out regulations.

### Lockout Requirements

1. Every power source that energizes any element of the ColdLoop System must be shut off and locked out at the closest possible power source.
2. After energy sources are locked out, circuits must be tested to insure that they are de-energized.

### Lockout Procedure

Personnel authorized to lockout equipment must have the necessary locks to perform the lockout.

1. Physically disconnect all electrical power to the ColdLoop System or lockout the appropriate circuit breaker or disconnects.
2. Test for power by attempting a start with the machine controls.
3. Identify the Lockout Condition with a tag on the electrical disconnect.
4. When the work is complete, remove all tags and restore the system to its working state.



**Danger!** Electrical panels contain high voltage. Disconnect and lock out the power supply before working inside any electrical panels. Failure to lock out the power supply can result in death or injury.


# SAFETY

## SPECIFIC SAFETY INFORMATION


### INSTALLATION

Failure to comply with the following precautions can result in death, serious injury, or damage to property.


#### Personnel Safety

-  **Warning!** Always wear eye and ear protection. Failure to comply with this warning can result in serious injury.
- Always wear non-skid shoes (no leather soles) with steel tipped toes. Failure to comply with this warning can result in serious injury.
- Avoid wearing loose clothing with unbuttoned sleeves or shirt tails exposed. Comply with the following precautions:
- Avoid contact with moving machinery elements such as fans, compressor shafts, pulleys, etc. which can cause serious injury.
  - Wear long sleeved shirts to protect from hot compressor discharge lines and pipes.
  - Do not wear earrings, bracelets, and loose neck chains which present hazards.
  - Cover long hair with a cap. Failure to comply with this warning can result in serious injury.
- Always wear a hard hat when a potential for falling objects exists. Failure to comply with this warning can result in death or serious injury.

#### Step Ladder Use Safety

-  **Warning!** Always use a Type I UL approved, industrial heavy-duty ladder. Comply with the following precautions:
- Set step ladders on level surface with an incline no greater than one-foot-incline-per-four-foot-rise. If the ladder cannot be placed at a safe angle, use scaffolding.
  - Place the ladder on a clean, level surface. Clean beneath the ladder feet and sweep debris from the floor surface where the ladder will be placed before using.
  - Make sure that the ladder base cannot slip away from the wall. If necessary, install a temporary cleat to prevent slippage away from the wall or connect ropes from the ladder first rung to an anchor between the ladder base and the wall.
  - Place the top of the ladder against a flat surface. Make sure that the ladder top cannot slide. Use a rubber pad or similar accessory or tie the top rung to an anchor to stabilize the ladder top.
- Do not carry tools, refrigeration drums, and other heavy, bulky materials up a step ladder. Use a rope to hoist heavy, bulky materials to the work position.

#### Electrical Installation Safety

-  **Warning!** Before any component installation after connecting main power to the system, comply with the Lockout Procedure and disconnect all electrical power from the machine. Use a padlock and lockout all remote disconnects feeding power to the machine.
- Before working on any circuit after connecting main power to the system, check the circuit with a reliable volt meter. Never perform work on energized circuits.
- Installation of electrical components must only be done by qualified personnel.
- Wear appropriate safety equipment if working on an energized panel. Potential arc flash hazards exist.



# SAFETY

## SPECIFIC SAFETY INFORMATION

### MAINTENANCE AND STARTUP SAFETY

When installing, repairing, or performing maintenance on the ColdLoop System, follow the instructions below to prevent death, serious injury, or damage to equipment and loss of product.

#### General



#### Warning!

Always wear eye and ear protection.

Only qualified and trained personnel should perform maintenance or repair.

Never clean, perform maintenance, or repair the ColdLoop System when it is in operation.

Unauthorized alterations or modifications to the ColdLoop System are strictly forbidden.

Never reach into energized enclosures or touch energized electrical circuits.

#### ColdLoop System



#### Warning!

Always make sure that refrigeration pipes are not pressurized before performing any type of maintenance on the pipe or adjacent components.

Never vent refrigerant to the atmosphere.

Multiple pumps must run at the same speed.

Never expose a refrigerant to an exposed flame which may produce poisonous phosgene gas.

Make sure that the ColdLoop System is well ventilated.

Make sure that all personnel using or in contact with the secondary coolant fluid and the primary refrigerant read and understand all of the information contained in the Material Safety Data Sheets.

Make sure that all ColdLoop system relief valves and other safety devices function correctly.

Never operate the primary refrigeration system when the secondary coolant system is not running.

Multiple pumps operating in parallel must run at the same speed.

Variable frequency drives must operate at the same speed.

After water flushing, do not drain the system and leave it dry for longer than 24 hours.

All personnel using or in contact with the secondary coolant fluid must read and understand all of the information contained in the DOWFROST™ Material Safety Data Sheet or an alternate brand propylene glycol Material Safety Data Sheet. Failure to comply with this warning can result in serious injury!

Never expose pure DOWFROST™ (a propylene glycol fluid containing food grade inhibitors) to an open flame or spark. Failure to comply with this warning can result in fire. Other propylene glycol products may be acceptable. Please consult Zero Zone Refrigeration Systems Division.



#### Caution!

Never run the primary refrigeration system with the secondary coolant system off or with secondary coolant fluid flow interrupted. Failure to observe this caution will result in a ColdLoop System freeze-up which can cause significant damage.

Never mix DOWFROST™ with secondary coolant fluids from different manufacturers. Thermal transfer properties can be changed or an unpredictable or dangerous chemical reaction may result.



#### Caution!


Never mix any fluid other than water when diluting the secondary coolant. A loss of thermal transfer properties can result or an unpredictable or dangerous chemical reaction may result.

# SAFETY

## SPECIFIC SAFETY INFORMATION

### MAINTENANCE AND STARTUP SAFETY

#### Electrical Maintenance

-  **Warning!** Only qualified and trained personnel should perform electrical maintenance or electrical repair.
- Operating personnel must know the location of all disconnects and circuit breakers.
- Always make sure that circuits are de-energized before touching electrical components or performing work. Contact with energized electrical sources can result in serious injury or death. Arc flash hazards exist.
- Before performing maintenance, comply with the Lockout Procedure and disconnect all electrical power from the machine. Use a padlock and lockout all remote disconnects feeding power to the machine.
- Unauthorized alterations or modifications to electrical system are strictly forbidden.
- Never modify any electrical circuits. Unauthorized modifications can impair the function and safety of the ColdLoop System.

### ELECTRICAL CONNECTION SAFETY

#### Power Source

The electrical connection to the ColdLoop System must be made from a customer supplied remote disconnect that is a fused, grounded, lockable disconnect, correctly sized for the electrical load.


#### Grounding

The main power supply ground must be connected directly to an earth ground. Grounding the electrical circuits must comply with local regulations. Failure to comply with this warning creates a dangerous electrical hazard that can result in death or serious injury!

### FIRE SAFETY

Keep the ColdLoop System clean and free of scrap materials, oil, or solvents to prevent the possibility of fire. In the event of fire, use a fire extinguisher as follows.

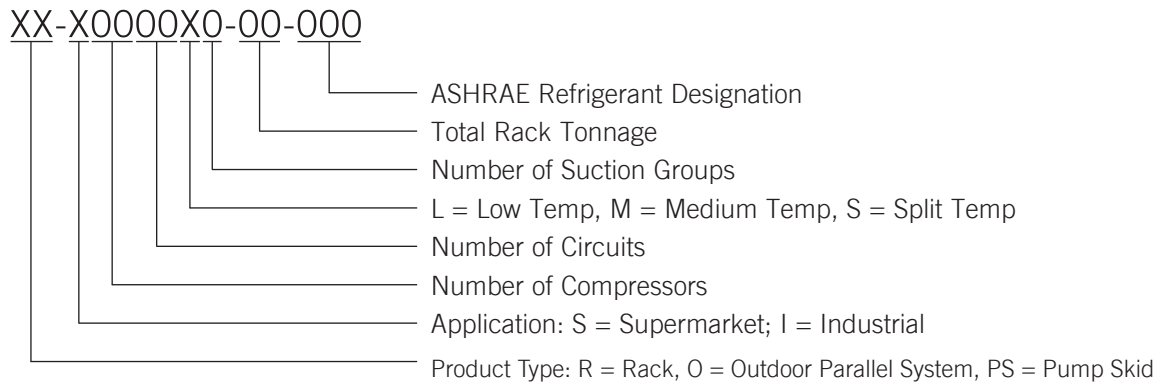
1. De-energize the machine immediately by disconnecting the power.
2. Extinguish the fire.

-  **Danger!** Always disconnect all power before extinguishing a fire. Attempting to extinguish a fire in a machine connected to electrical power can result in serious injury or death!

# DESCRIPTION

## PRODUCT DESIGNATION NOMENCLATURE

The Zero Zone Medium Temperature ColdLoop Secondary System product-number nomenclature is described below.



## MEDIUM TEMPERATURE COLDLOOP SYSTEM DESCRIPTION

### PRIMARY REFRIGERATION SYSTEM

The Zero Zone Medium Temperature ColdLoop System is a high energy-efficient secondary loop refrigeration system that uses a non-ozone-depleting refrigerant. **Figure 2** below shows the elements of a typical Zero Zone medium temperature ColdLoop Secondary System.

The Zero Zone system minimizes the environmental impact by:

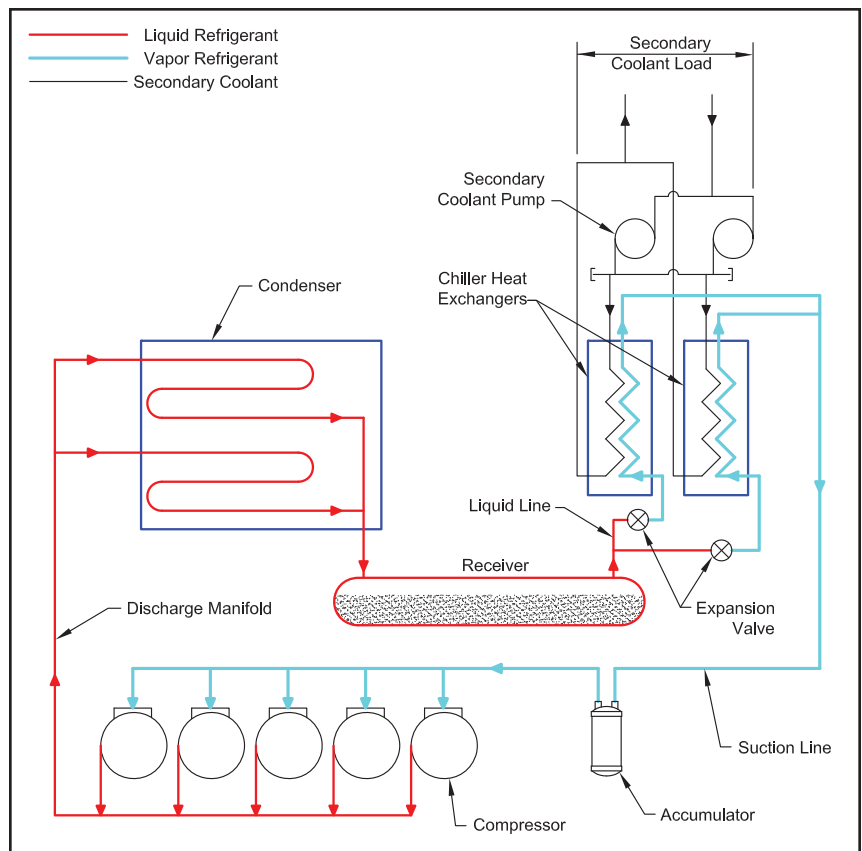
- Reducing ozone-depleting and greenhouse gas refrigerant emissions.
- Reducing the required system primary refrigerant volume.
- Reducing the energy required to operate the system.

Unlike direct expansion refrigeration systems where liquid refrigerant is piped directly to each refrigeration fixture, the Zero Zone system has a secondary coolant system that chills the refrigeration fixtures.

1. A chilled, secondary fluid (in this case a propylene glycol and water mixture), is pumped between the primary refrigeration system heat exchanger and the refrigerated fixtures (display cases, walk-in coolers, etc.). All of the secondary loop refrigeration and liquid chilling is located in a central space (machine room).

- Compressors
- Receiver
- Mechanical subcoolers
- Secondary coolant pumps

**Figure 2 — Typical Medium Temperature ColdLoop System**



# DESCRIPTION

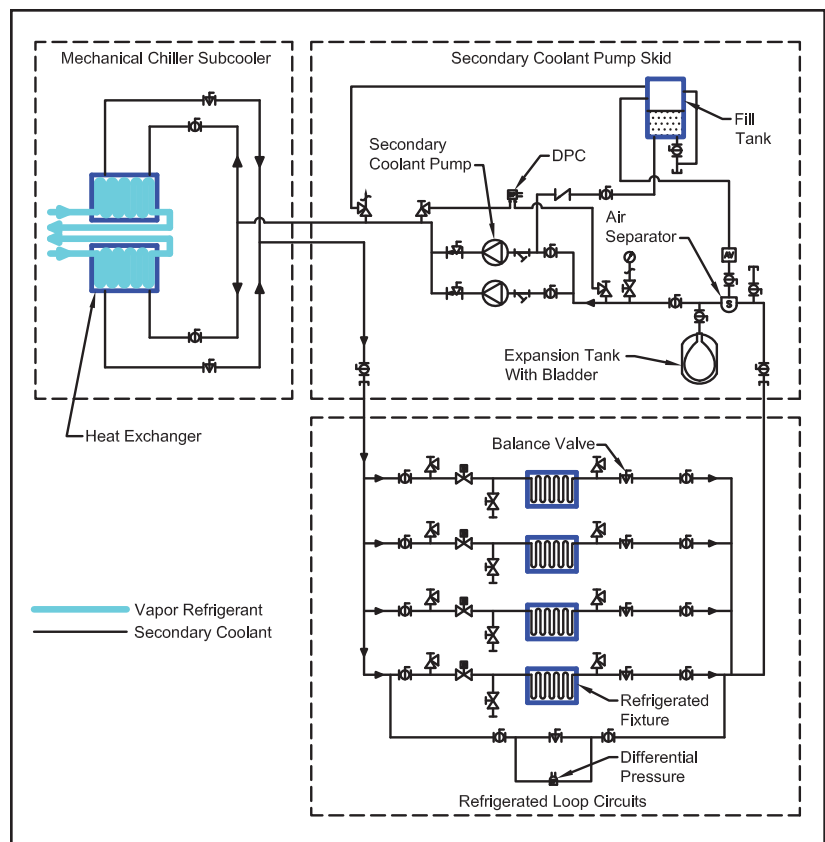
## MEDIUM TEMPERATURE COLDLOOP SYSTEM DESCRIPTION

- Multiple compressors connect to common suction and discharge manifolds located on a skid in the machine room. The skid houses all piping, control valves, and electrical controls.
- Suction line pressure determines how many compressors operate at any time. The compressor stages of unloading control the saturated evaporator temperature which controls the chilled secondary coolant fluid supply temperature. Multiple compressor use allows refrigeration capacity to mirror changing operating conditions, resulting in better secondary coolant temperature control and lower compressor energy-use during light load conditions.
- Hot, compressed primary refrigerant vapor, pumped by the compressors, passes through a condenser where the refrigerant vapor transforms into a cooled liquid. The liquid refrigerant accumulates in a receiver and flows into a heat exchanger. The cooled liquid flashes into a cool vapor as it flows through an expansion valve in the heat exchanger which connects to the secondary coolant system.

## SECONDARY COOLANT SYSTEM

- Secondary coolant pumps force the secondary coolant fluid through a heat exchange where the cool liquid vapor refrigerant chills the secondary coolant fluid.
- The secondary coolant fluid continues through a closed loop system to the refrigerated loop circuits that feed cold coolant fluid to multiple refrigerated fixtures and then back to the coolant pumps.
- A pressurized expansion tank compensates for liquid coolant and other volume changes caused by glycol temperature changes and leaks in various piping circuits. The expansion tank maintains a positive pressure on the suction side of coolant pumps preventing impeller cavitation.
- Balance valves maintain optimum flow through the refrigerated loop circuits.
- Coolant fluid is forced through the loop circuit refrigerated fixtures into common return pipes and the coolant pump suction manifold.
- Air ingested into the secondary coolant system is removed by the air separator.

Figure 3 — Typical Secondary Coolant System



# DESCRIPTION

## COMMON DEFINITIONS

The following are definitions of important terms used in this manual.

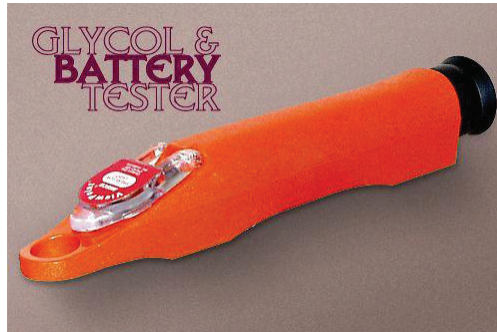
Air Separator .....	A device used in the secondary coolant system to remove entrained air from the coolant fluid. In this case, the Zero Zone system uses a coalescing style air separator that works by slowing the movement of coolant fluid through a large cross-section of the air separator tank allowing slow-moving micro air bubbles to rise to the top of the air separator, where they are vented from the system through an automatic air vent.
Balance Valve.....	Valve that maintains or limits the design fluid flow rate in a secondary coolant fluid circuit.
Burst Point .....	Temperature where glycol becomes a solid.
ColdLoop Secondary Heat Exchanger.....	A heat exchanger where cold primary refrigerant liquid vapor removes heat from the secondary coolant fluid. In this case, the heat exchanger is the equivalent of a direct expansion refrigeration system evaporator.
Condenser.....	Removes heat from hot, high-pressure refrigerant vapor that flows from the compressor, converting the refrigerant vapor into a cool liquid.
Compressor.....	Motor driven device that converts low-pressure, low temperature refrigerant vapor into a hot, high-pressure refrigerant vapor.
Discharge Manifold.....	Piping that receives compressed primary refrigerant vapor from the compressor bank and connects to the oil separator.
Expansion Tank .....	A small tank in closed loop system, charged with a compressed gas, that allows the secondary fluid volume to expand and contract.
Freezing Point .....	The temperature at which a substance, such as a secondary coolant fluid, begins changing state to a solid (in the case of the 35% DOWFROST™ and water, +2°F).
Greenhouse Gas.....	Various gaseous compounds (as carbon dioxide, CFC) that absorb infrared radiation, trap heat in the atmosphere, and contribute to the greenhouse effect.
Header.....	A pipe or vessel into which a number of smaller pipes connect.
Liquid Line .....	Components that allow cooled, liquid refrigerant to flow from the condenser to the expansion valve. These can be manifolds, filters, driers, valves, sight glasses, etc.
Medium-Temperature Secondary Coolant.....	A fluid, in the case of the ColdLoop Secondary system a mixture of propylene glycol, water, and corrosion inhibitors, designed to operate above 0°F, that transfers heat from the heat source to the primary refrigerant.
Ozone Depleting Gas .....	A gas that contributes to the catalytic destruction of ozone by atomic chlorine and bromine. The main source of these halogen atoms in the stratosphere is photo dissociation of chlorofluorocarbon (CFC) compounds, commonly called freons, and of bromofluorocarbon compounds known as halons.
Primary Refrigerant.....	A multi-phase fluid that is capable of phase changes (liquid-to-vapor and vapor-to-liquid) and removes heat (reduces temperature) from the secondary coolant fluid.
Receiver .....	Accumulates liquid primary refrigerant as the expansion valve responds to changing load requirements and adjusts primary refrigerant flow from the condenser to the heat exchange.

# DESCRIPTION

## COMMON DEFINITIONS CONT.

Refractometer.....An instrument that measures the light refraction index. Applied to a medium temperature secondary coolant such as a propylene glycol mixture, the light refraction index relates to the freezing point of the mixture which is directly related to the mixture specific gravity at a known temperature (normally measured at room temperature, 70°F).

**Figure 4 — Typical Refractometer**



Refrigerant .....A substance that transfers heat from one source to another and is capable of phase changes, liquid-to-vapor and vapor-to-liquid. See primary refrigerant.

Secondary Coolant.....A fluid (in this case, a mixture of propylene glycol and water) that transfers heat from the refrigerated fixtures, such as walk-in coolers and display cases and transfers it to a primary refrigerant in the heat exchanger.

Secondary Coolant Refrigeration System .....System where the product heat or load is removed with a secondary coolant fluid (in this case, a mixture of propylene glycol and water).

Specific Gravity.....The ratio of the density of a substance compared to the density of pure water at 4°C where both densities are obtained by weighing in air. Applied to a medium temperature secondary coolant such as a propylene glycol mixture, one cubic inch weighs 1.033 times as much as one cubic inch of water.

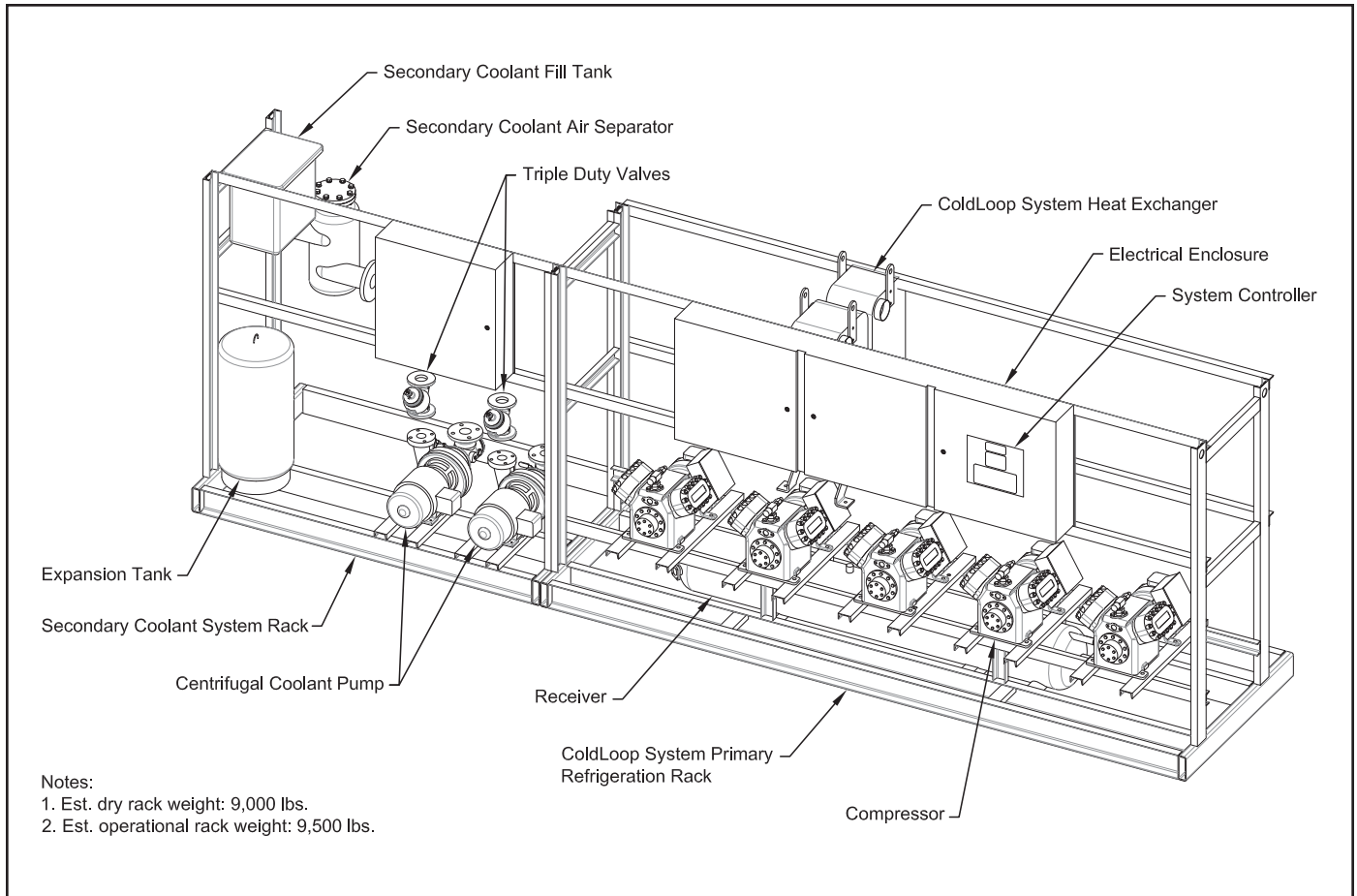
Suction Line .....Components that connect the heat exchangers with the compressors.

Triple-Duty Valve.....A combination shut-off, center-guided non-slam check valve and calibrated balance valve in a single housing, installed at the secondary coolant pump discharge.

# DESCRIPTION

## MAJOR COMPONENTS

Figure 5 — Typical ColdLoop System Assembly Major Components



# DESCRIPTION

## COLDLOOP SYSTEM SPECIFICATIONS

Table 1 — ColdLoop System Specifications

	STANDARD	OPTIONAL
COMPRESSORS	<ul style="list-style-type: none"> <li>■ Combination up to 6 compressors               <ul style="list-style-type: none"> <li>■ Low Temp:                   <ul style="list-style-type: none"> <li>■ 2 to 13 HP Scroll</li> <li>■ 3 to 6 HP Semi-Hermetic</li> </ul> </li> <li>■ Medium Temp:                   <ul style="list-style-type: none"> <li>■ 2 to 13 HP Scroll</li> <li>■ 5 to 9 HP Semi-Hermetic</li> </ul> </li> </ul> </li> <li>■ Adjustable dual pressure controls</li> <li>■ Oil level protective controls</li> <li>■ Service valves</li> <li>■ Motor protection</li> <li>■ Liquid injection components for K4 scrolls</li> <li>■ Vapor injection components for KV scrolls (including subcooling components)</li> </ul>	<ul style="list-style-type: none"> <li>■ Modulating (digital) scroll compressors</li> <li>■ Cylinder unloaders for semi-hermetics</li> <li>■ Crankcase heaters</li> <li>■ Head cooling fans for semi-hermetics</li> <li>■ Mechanical sub-cooler components for low temp semi-hermetic systems</li> </ul>
CABINET	<ul style="list-style-type: none"> <li>■ Welded steel base and frame</li> <li>■ Powered ventilation (included with VFD)</li> <li>■ Sound dampening insulation</li> <li>■ Vibration isolation pads (shipped loose)</li> </ul>	<ul style="list-style-type: none"> <li>■ Hinged doors on front and sides</li> </ul>
PUMPS	<ul style="list-style-type: none"> <li>■ Parallel centrifugal pumps with on-off control</li> <li>■ Pump designed for 50% of the load</li> <li>■ Pump diffuser (suction straightening vanes)</li> <li>■ 3-way discharge check, stop and balance valve</li> </ul>	<ul style="list-style-type: none"> <li>■ Parallel centrifugal pumps with variable frequency drive speed control</li> <li>■ Warm fluid defrost</li> <li>■ 100% pump capacity with 1 standby pump</li> </ul>
ELECTRICAL	<ul style="list-style-type: none"> <li>■ Front-accessible electrical panel</li> <li>■ Microprocessor rack controller</li> <li>■ I/O boards in electrical panel</li> <li>■ Compressor on/off switches</li> <li>■ Compressor contactors and circuit breakers</li> <li>■ Power distribution block</li> <li>■ Control power circuit breaker</li> <li>■ Phase monitor</li> <li>■ Remote power distribution panel for electric defrost</li> </ul>	



# DESCRIPTION

## COLDLOOP SYSTEM ELECTRICAL CONTROLS



### Danger!

Always read and understand the Safety information from page 7 to page 10 before installation, operation, or before performing maintenance. Failure to comply with this warning can result in serious injury or death!

## COLDLOOP SYSTEM OPERATOR CONTROLS

Operator controls are listed below.

- MAIN DISCONNECT ..... (Optional) — placing into the on position turns on main power and enables the compressor controllers.
- CONTROL MODULE ON..... *Green-lighted, on-off toggle switch* — enables compressor control.
- PUMP(s) ..... *Three-position selector switch:*
- HAND — enables control power to coolant pump control relay.
  - OFF — disables the coolant pump control circuit.
  - AUTO — enables automatic coolant pump control.
- ALARM RESET(s)..... *LARGE Non-illuminated momentary pushbuttons* — manually resets the alarm relay after a freeze fault is corrected.
- FREEZE STAT(s) ALARM..... *Red, incandescent indicator light* — illuminates when the coolant pump fluid temperature sensor detects a low temperature condition on the discharge side of the heat exchanger.
- PUMP FLOW ALARM RESET ..... *Non-illuminated momentary pushbuttons* — resets the alarm relay after a coolant pump differential pressure flow fault is corrected.
- PUMP FLOW ALARM..... *Red, incandescent indicator light* — illuminates when the coolant pump fluid pressure differential sensor detects a high or low pressure differential condition across the inlet and discharge side of the coolant pumps.

## COMPRESSOR CONTROL

Compressors are controlled by a programmable controller.

- Compressor operations are controlled by controller I/O located inside the control cabinet.
- Control switch modules have LEDs which indicate output status.

## PUMP CONTROL

Coolant pumps are controlled by a programmable controller.

- Coolant pump operations are controlled by controller I/O located inside the control cabinet.
- Switches on the pump control panel allow manual control or automatic control by the logic controller.

# DESCRIPTION

## COLDLOOP SYSTEM ELECTRICAL

### COMPRESSORS

- The rated current load for each compressor is displayed on the compressor's motor nameplate.
- A circuit breaker protects each compressor motor against over-current conditions.
- A motor contactor starts and stops each compressor motor. Auxiliary contacts in the contactor connect to other devices in the system.
- All compressor motors have thermal overload protection.

### COLDLOOP SYSTEM SAFETY CONTROLS

Main Power Phase Monitor..... A multifunctional monitoring relay for three-phase main power phase sequence, phase loss, overvoltage, undervoltage, and phase unbalance.

Compressor High Pressure Control.... A pressure controller, with a set point that interrupts compressor operation when actuated.

Compressor Low Pressure Switch..... Turns the compressors off when the primary refrigerant suction pressure approaches the corresponding coolant fluid freezing point — the pressure setting should relate to 2 to 3°F above the coolant fluid freezing point.

Compressor Oil Level Switch..... An oil level sensor that interrupts compressor operation when actuated.

Coolant Low Temp Thermostat..... Otherwise known as Freeze Stat, turns the compressors off when the secondary coolant fluid temperature approaches the freezing point — set point should be about 5°F above the coolant fluid freezing point (in this case, DOWFROST™ at a 35% solution is 2°F, so the set point should be 7°F).

Pump Differential Pressure Switch..... Turns the compressors and coolant pumps off when there is low coolant pump differential pressure — the set point should be 5 psi-differential below the operating differential pressure.

Low Pump Suction Pressure..... Alarms when the pump suction drops below a preset level. Typically, this indicates a loss of coolant. The set point should be 10 psi below the operation suction pressure. A mechanical switch is supplied to stop the pump if the pressure drops to 0 psig.

# DESCRIPTION

## COLDLOOP SYSTEM ELECTRICAL

### COLDLOOP SYSTEM WIRING

#### GENERAL

- All factory wiring complies with the UL Standards 1995 and 508 for the equipment.
- All field wiring is the responsibility of the installing contractor and must comply with local electrical regulations.
- The standard SCCR rating is 10,000 amps. For SCCR requirements higher than 10,000 amps, contact Zero Zone Refrigeration Systems Division.

#### Main Power

- Circuit voltage and current requirements are listed on the control panel nameplate and on the Electrical Data Sheet.
- Main power conductors must be sized based on the MCA. Minimum conductor size is listed by incoming power connection.
- Sizing of all conductors is the responsibility of the installing contractor. The contractor must always follow National Electric Code guidelines when sizing conductors.

#### Ground Conductors

- Ground conductors must be sized based on the system Maximum Over-current Protection Device and comply with the National Electrical Code.
- Minimum conductor size is labeled by incoming power connection point.
- Grounding the Distributed System electrical circuit is the responsibility of the installing contractor.

#### Testing

- All control panels are tested for continuity and short circuits.
- All wiring is function tested to insure that factory wiring is completed accurately.

#### Wiring Color Codes

- All factory wiring has color coded, numbered wire.
- This numbering is shown on electrical diagrams with letter/number designations, with the first digit indicating color of wire.
- The following table appears on all wiring diagrams:

Table 2 — Wire Number and Color

WIRE NUMBER	WIRE COLOR	WIRE NUMBER	WIRE COLOR
0-9	Black	100-109	Yellow/Stripe
10-19	Blue		Purple/Stripe
20-29	Red	130-139	Brown/Stripe
30-39	Yellow	140-149	Pink Stripe
40-49	Purple	150-159	Light Blue/Stripe
50-59	Orange	160-169	Red/Stripe
60-69	Brown	170-179	Yellow/Number
70-79	Pink	180-189	Orange/Number
80-89	Light Blue	190-199	Purple/Number
90-99	Blue/Stripe	200-209	Brown/Number

# DESCRIPTION

## COLDLOOP SYSTEM SCHEMATIC

### COMPONENT LIBRARY

AC .....	Auxiliary Contact	DSTAT.....	Discharge Stat
ACC.....	Accumulator	DSV .....	De-Superheat Valve
AI .....	Analog Input	DTC.....	Discharge Temp Control Valve
AO.....	Analog Output	DTV .....	Dual Temp Valve
ASBCL.....	Ambient Subcool	DV .....	Defrost Valve
ASR.....	Ambient Subcool Relay	EEPR.....	Electronic Evaporator Pressure Regulator
ASTAT.....	Aquastat	EFAN.....	Evaporator Fan
ASV .....	Ambient Subcool Valve	EFC .....	Evaporator Fan Contactor
BLV.....	Bleed Valve	EPR .....	Evaporator Pressure Regulator
BPC.....	Bypass Contactor (Condenser)	ER .....	Exhaust Relay
BPR.....	Bypass Relay	ES.....	End Switch
BV .....	Ball Valve	EV.....	Economizer Valve
BVSCH .....	Ball Valve with Schraeder	EVAP .....	Evaporator
CB .....	Circuit Breaker	FB .....	Fuse Block
CC .....	Compressor Contactor	FD .....	Fan Delay / Klixon
CCH.....	Crank Case Heater	FDF .....	Frequency Drive Filter
CF .....	Control Fuse	FLR .....	Flow Loss Relay
CFAN.....	Condenser Fan	FRR.....	Forward Run Relay
CFC .....	Condenser Fan Contactor	FS.....	Fire Stat
COMP.....	Compressor	G1-C1 +/- .....	Group 1 Comp 1 (+/- temp)
COND.....	Condenser	GFCI.....	Ground Fault Circuit Interrupter (receptacle)
CP .....	Charging Port	HDF.....	Head Fan
CPCB.....	Control Power Circuit Breaker	HF .....	Heater Fuse
CRC.....	Circ Pump Contactor	HGBV .....	Hot Gas Bypass Valve
CSR .....	Current Sensing Relay	HLB.....	High / Low Bypass Pressure Control
CV .....	Check Valve	HLBV.....	High / Low Bypass Pressure Valve
DC.....	Defrost Contactor	HM .....	Hour Meter
DCL .....	Defrost Clock	HPC.....	High Pressure Control
DCM .....	Demand Cooling Module	HRAIR.....	Heat Reclaim Air
DDPR .....	Discharge Differential Pressure Regulator	HRH2O.....	Heat Reclaim Water
DHV.....	Discrete Header Valve	HRR .....	Heat Reclaim Relay
DI .....	Digital Input	HRV.....	Heat Reclaim Valve
DLT.....	Discharge Line Thermostat	HTODV .....	High Temp Oil Drain Valve
DM .....	Discharge Muffler	IC .....	Immersion Heater Contactor
DO.....	Digital Output	IFR .....	Inverter Fault Relay
DPC.....	Dual Pressure Control	IR .....	Intake Relay
DRV .....	Dual Relief Valve	IPR .....	Inlet PSI Regulator
DRVRD.....	Dual Relief Valve with Rupture Discs	IT.....	Interval Timer
DSHV.....	DeSuperheat Valve	LDPR.....	Liquid Differential Pressure Regulator

# DESCRIPTION

## COLDLOOP SYSTEM SCHEMATIC

### COMPONENT LIBRARY CONT.

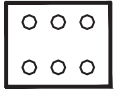
LER .....	Liquid Enable Relay	PR .....	Pump Relay
LFD .....	Liquid Filter Drier	PT .....	Pressurize Tap
LICT.....	Liquid Injection Cap Tube	PV .....	Pressurize Valve
LIV.....	Liquid Injection Valve	PXD.....	Pressurize Transducer
LLV .....	Liquid Line Valve	RAR.....	Rack Alarm Relay
LOR .....	Lock Out Relay	RBP.....	Receiver Bypass
LPC .....	Low Pressure Control	REC.....	Receiver
LTODV .....	Low Temp Oil Drain Valve	REV .....	Relief Valve
LV .....	Loader Valve	RL .....	Rotolock
3MBV .....	3-Way Motorized Ball Valve	RLR.....	Refrigerant Level Relay
MLO .....	Main Lug Only	RPR.....	Run Proof Relay
MBV .....	Motorized Ball Valve	RSR.....	Rack Shutdown Relay
MHGR .....	Main Hot Gas Relay	RV .....	Refrigeration Valve
MHGV.....	Main Hot Gas Valve	SBR.....	Subfloor Relay
MOL .....	Motor Overload	SBV .....	Subcool Valve
MSR .....	Mechanical Subcool Relay	SCR.....	Split Condenser Relay
MSBCL.....	Mechanical Subcool	SCV .....	Split Condenser Valve
MSV.....	Mechanical Subcool Valve	SFV.....	Subfloor Valve
MV.....	Metering Valve	SG .....	Sight Glass
OAT .....	Outside Ambient Temp	SOL .....	Solenoid
ODV.....	Oil Drain Valve	SS-EPR.....	Evaporator Pressure Regulator w/Suction Stop
OFC.....	Oil Failure Control	STR .....	Strainer
OFR.....	Oil Failure Relay	SUCF.....	Suction Filter
OHV.....	Oil Header Valve	SW.....	Switch
OILF .....	Oil Filter	TD .....	Time Delay
OLC .....	Oil Level Control	TDR.....	Time Delay Relay
OP.....	Oil Pump	TF.....	Transformer Fuse
OPR.....	Outlet PSI Regulator	TS.....	Temperature Sensor
OR.....	Oil Reservoir	TVLV .....	Transducer Valve
ORF.....	Orifice	TXV.....	Thermostatic Expansion Valve
ORR .....	Override Relay	ULV .....	Unloader Valve
OS .....	Oil Separator	VE.....	Vibration Eliminator
OV .....	Oil Valve	VEF.....	Ventilation Exhaust Fan
PC .....	Pressure Control	VFC .....	Variable Frequency Contactor (Condenser)
PDB.....	Power Distribution Block	VFD .....	Variable Frequency Drive
PFR.....	Phase Fail Relay	VID .....	Ventilation Intake Damper
PM .....	Phase Monitor	VSTAT .....	Ventilation Thermostat
POV.....	Pump Out Valve	XFMR .....	Transformer
PPC.....	Process Pump Contactor		

# DESCRIPTION

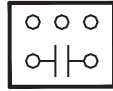
## COLDLOOP SYSTEM SCHEMATIC

### ELECTRICAL SCHEMATIC

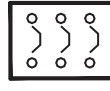
#### Common Electrical Symbols



Power Distribution Block



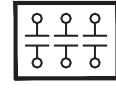
Power Phase Monitor



Circuit Breaker



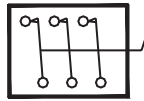
Fuse Block



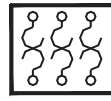
Contactor



Fusible Disconnect



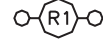
Non-fused Disconnect



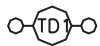
Motor Overload



Contactor Coil



Relay Coil



Time Delay Relay Coil



Relay Contact, Normally Closed



Relay Contact, Normally Open



Relay Contact, Time delay



Auxiliary Contact, Normally Open



Auxiliary Contact, Normally Closed



Switch



Temperature Switch, Close on Drop



Temperature Switch, Close on Rise



Flow Switch



Level Switch, Close on Drop



Timed Switch



Pressure Switch, Close on Rise



Pressure Switch, Close on Drop



Pilot Light, Door Panel



Pilot Light, Door and Solenoid Coil



Pilot Light, Solenoid Coil



Solenoid Coil



Panel Terminals



Electrical Heater



Ground Terminal



Fuse



Transformer



Transformer, Center Tap

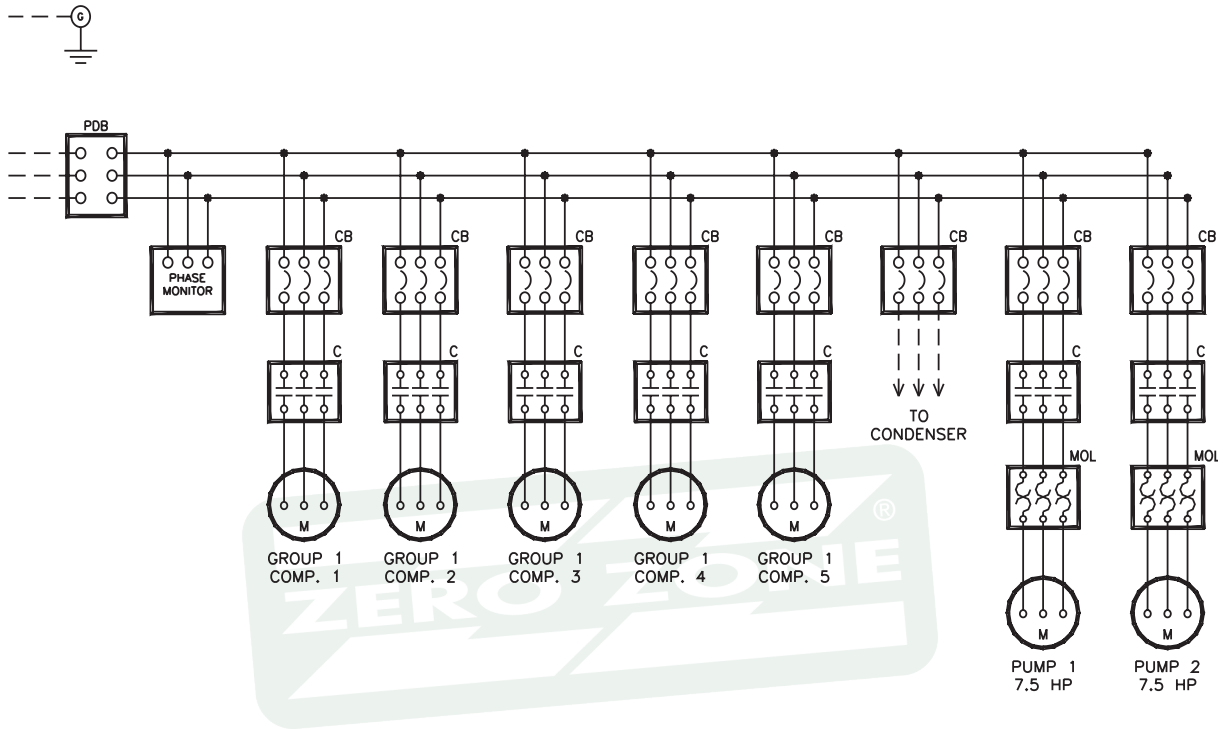


Motor

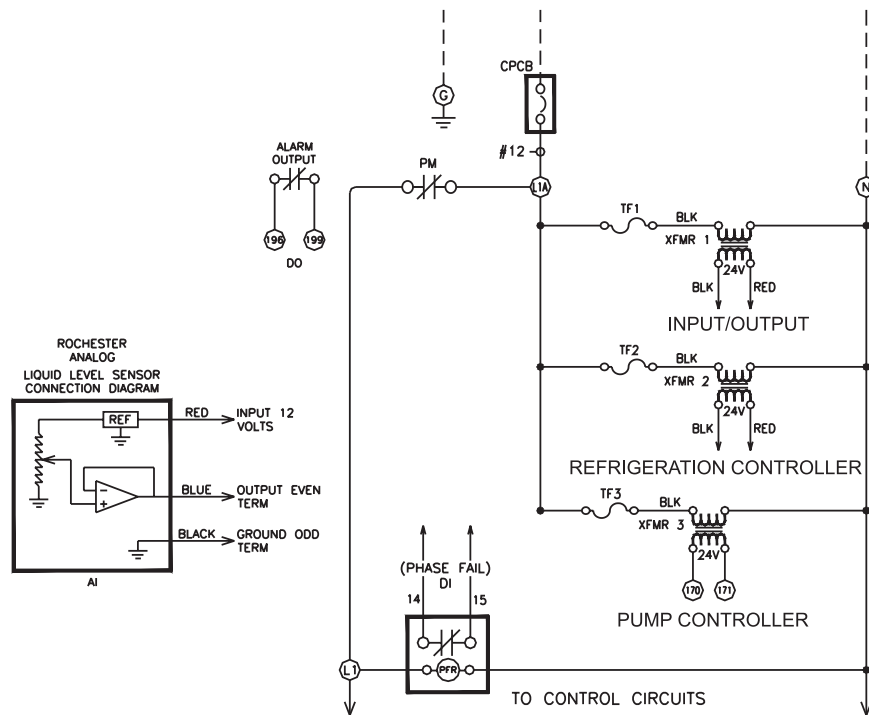
# DESCRIPTION

## COLDLOOP SYSTEM SCHEMATIC

### ColdLoop System Main Power Distribution



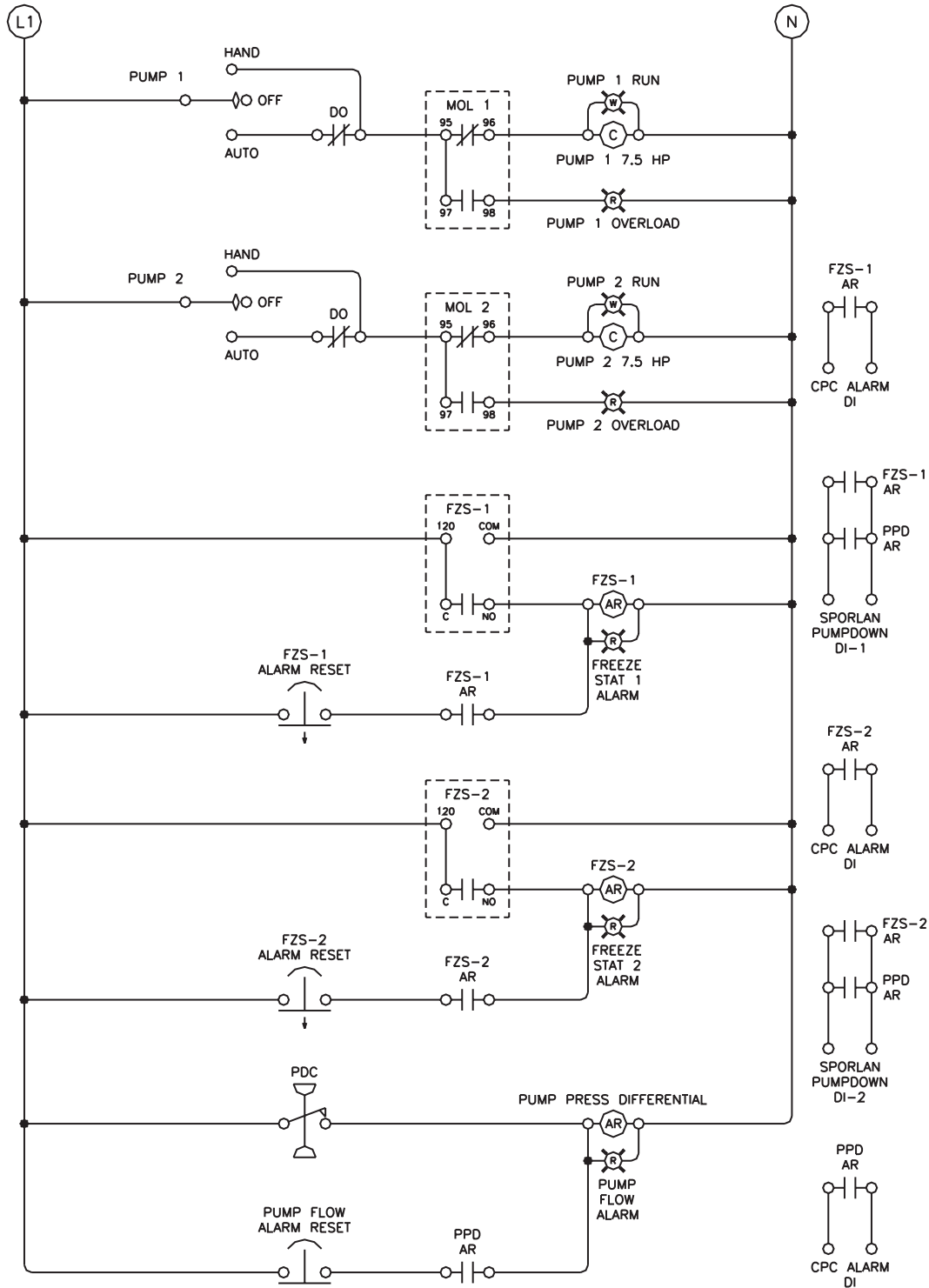
### Control Power



# DESCRIPTION

## COLDLOOP SYSTEM SCHEMATIC

### Coolant Pump Control Power



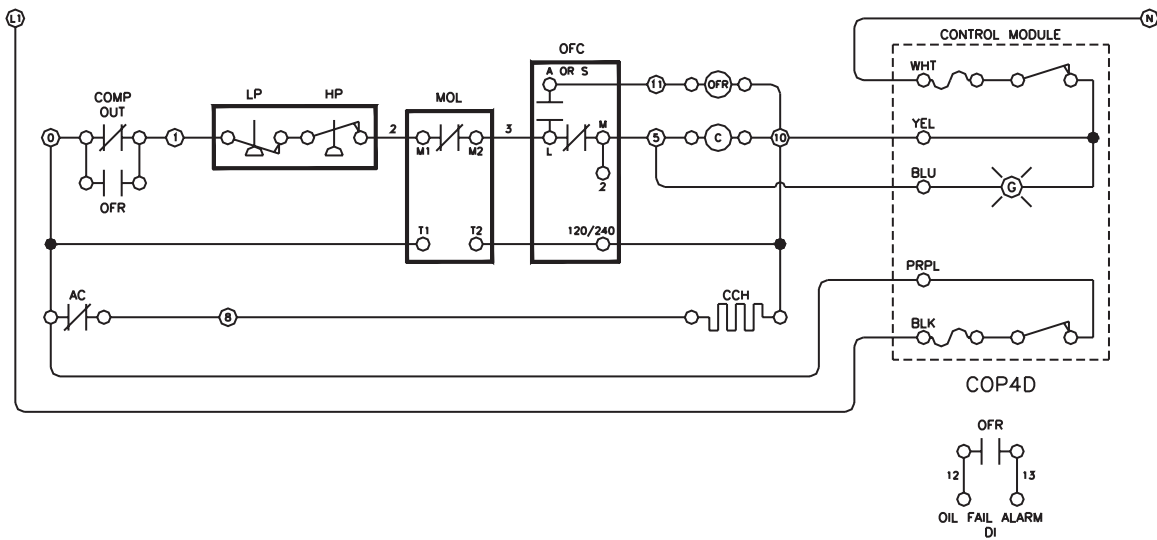


# DESCRIPTION

## COLDLOOP SYSTEM SCHEMATIC

### Compressor Control Power

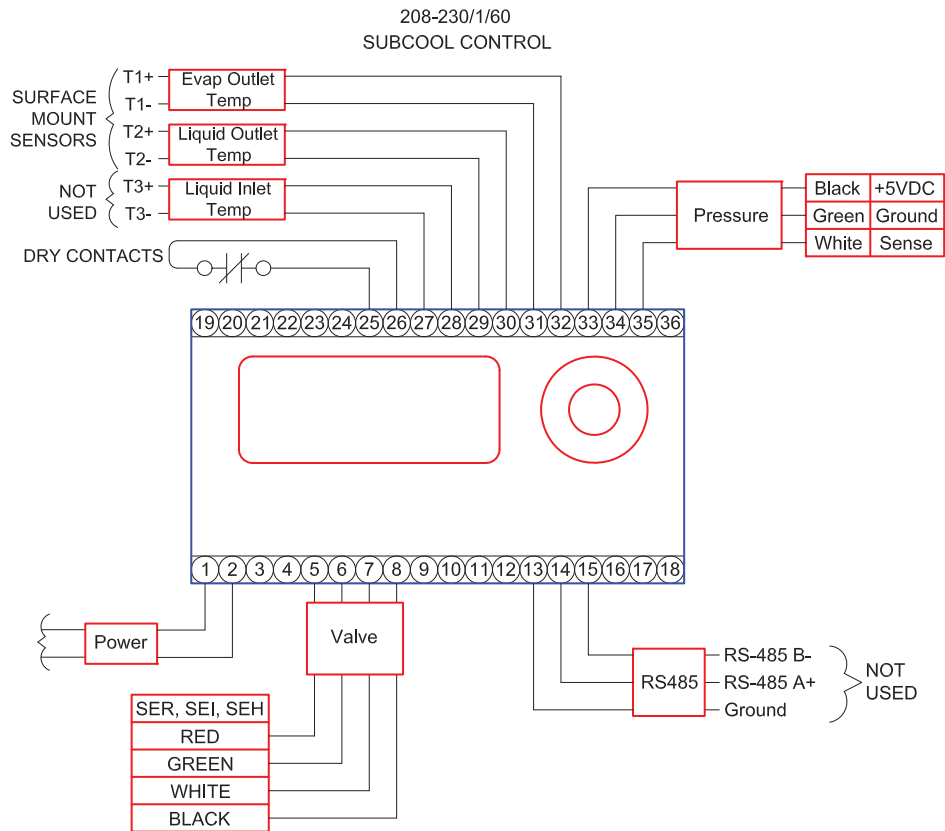
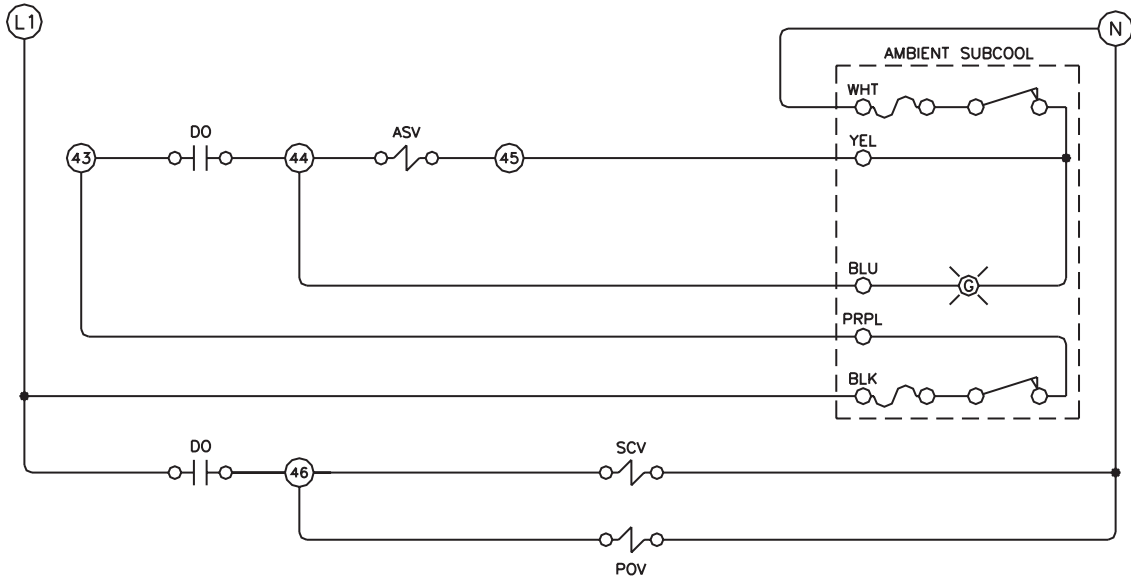
Comp	Dwg	Comp Out	C	OF Input	OFR
G1-C1	OT-1L	1-1	C1	1-15	R1
G1-C2	OT-1L	1-2	C2	1-16	R2
G1-C3	OT-1L	1-3	C3	2-1	R3
G1-C4	OT-1L	1-4	C4	2-2	R4
G1-C5	OT-1L	1-5	C5	2-3	R5



# DESCRIPTION

## COLDLOOP SYSTEM SCHEMATIC

### Secondary Coolant Auxiliary Control

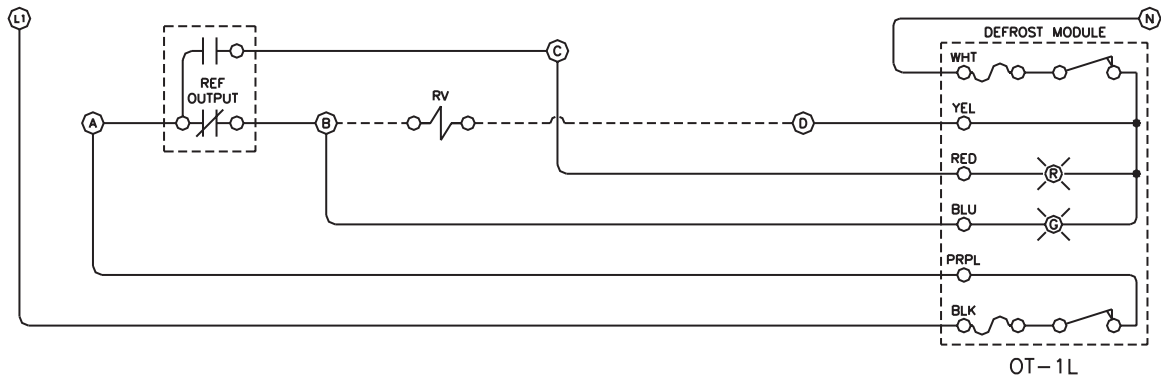


# DESCRIPTION

## COLDLOOP SYSTEM SCHEMATIC

### Refrigeration Control

Circuit	Dwg	Ref Out	A	B	C	D
B7S	OT-1L	3-5	50	51	52	53
B8S	OT-1L	3-6	55	56	57	58
B9S	OT-1L	3-7	60	61	62	63
B10S	OT-1L	3-8	65	66	67	68
B11S	OT-1L	4-1	70	71	72	73
B12S	OT-1L	4-2	75	76	77	78
B13S	OT-1L	4-3	80	81	82	83
B14S	OT-1L	4-4	85	86	87	88
B15S	OT-1L	4-5	90	91	92	93
B16S	OT-1L	4-6	95	96	97	98
B17S	OT-1L	4-7	100	101	102	103
B18S	OT-1L	4-8	105	106	107	108
B19S	OT-1L	5-1	110	111	112	113
B20S	OT-1L	5-2	115	116	117	118
B21S	OT-1L	5-3	120	121	122	123
B22S	OT-1L	5-4	125	126	127	128
B23S	OT-1L	5-5	130	131	132	133
B24S	OT-1L	5-6	135	136	137	138
B25S	OT-1L	5-7	140	141	142	143
B26S	OT-1L	5-8	145	146	147	148
B27S	OT-1L	6-1	150	151	152	153
B28S	OT-1L	6-2	155	156	157	158
B29S	OT-1L	6-3	160	161	162	163
B30S	OT-1L	6-4	165	166	167	168



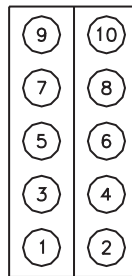
# DESCRIPTION

## COLDLOOP SYSTEM SCHEMATIC

### Condenser Control



CONTROL PANELS  
THIS END



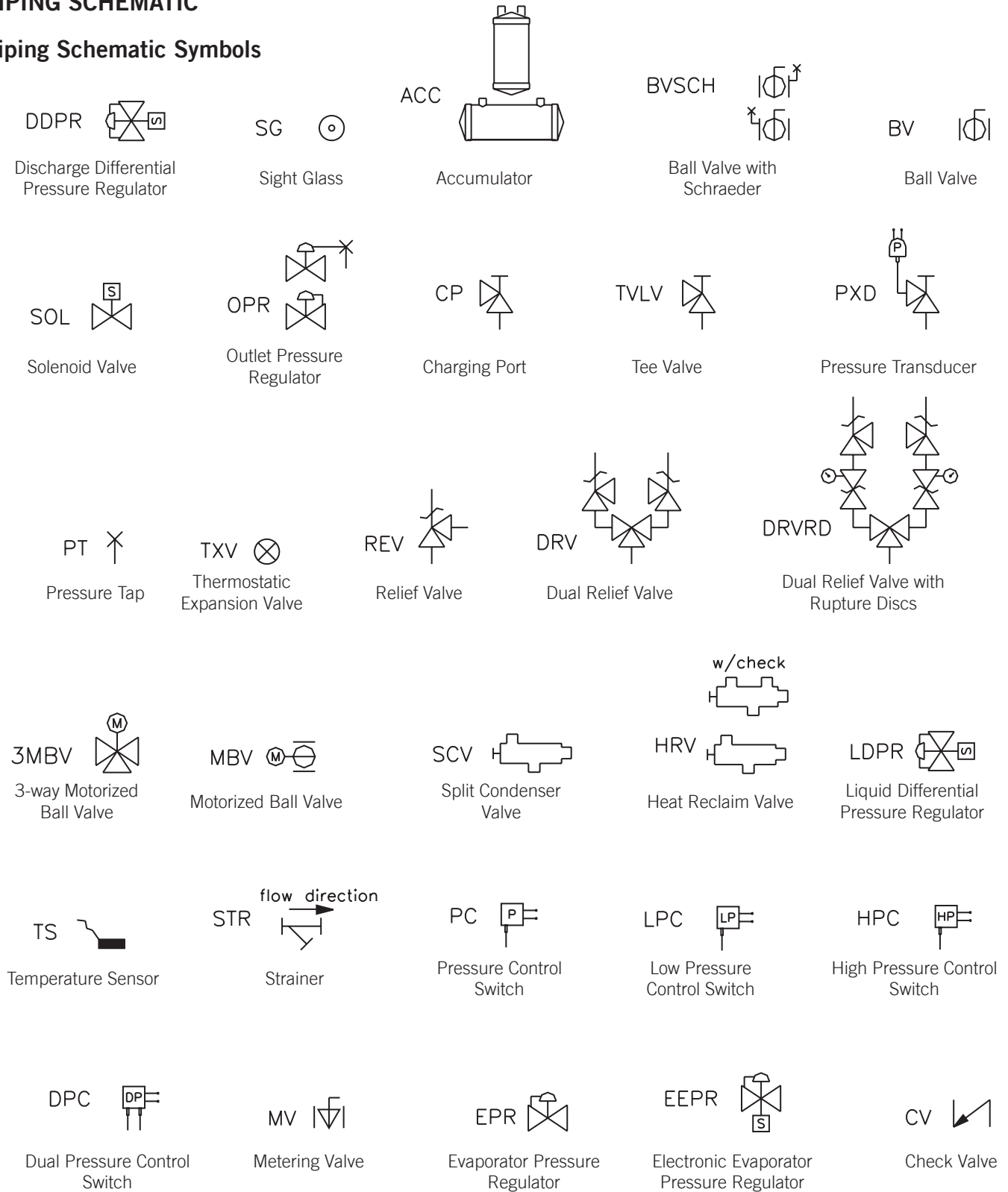
HEADERS THIS END

# DESCRIPTION

## COLDLOOP SYSTEM SCHEMATIC

### PIPING SCHEMATIC

#### Piping Schematic Symbols



# DESCRIPTION

## COLDLOOP SYSTEM SCHEMATIC

### Piping Schematic Symbols Cont.

RL



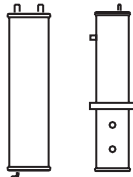
Rotolock

OR



Oil Reservoir

OS



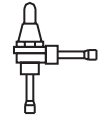
Oil Separator

OILF



Oil Filter

HLBV



High to Low Bypass Valve

VE



Vibration Eliminator

DM



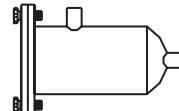
Discharge Muffler

ROF



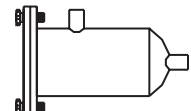
Replaceable Oil Filter

LFD



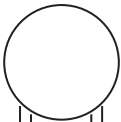
Liquid Filter Drier

SUCF



Suction Filter

HRH2O



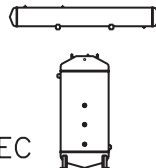
Hot Water Reclaim

HRAIR



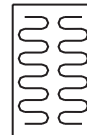
Air Heat Reclaim

REC



Receiver

MSBCL



Mechanical Subcooler

IPR



Inlet Pressure Regulator

OAT



Outside Ambient Temperature Sensor

DTC



Discharge Temperature Control Valve

COMP



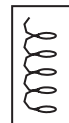
Compressor

ORF



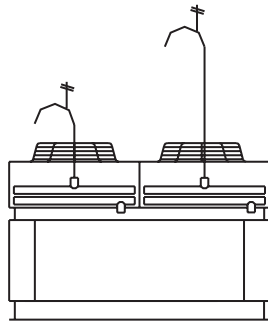
Orifice

LICT



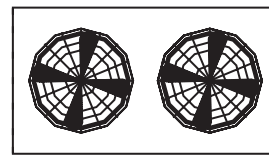
Liquid Injector Capillary Tube

COND



Condenser

EVAP

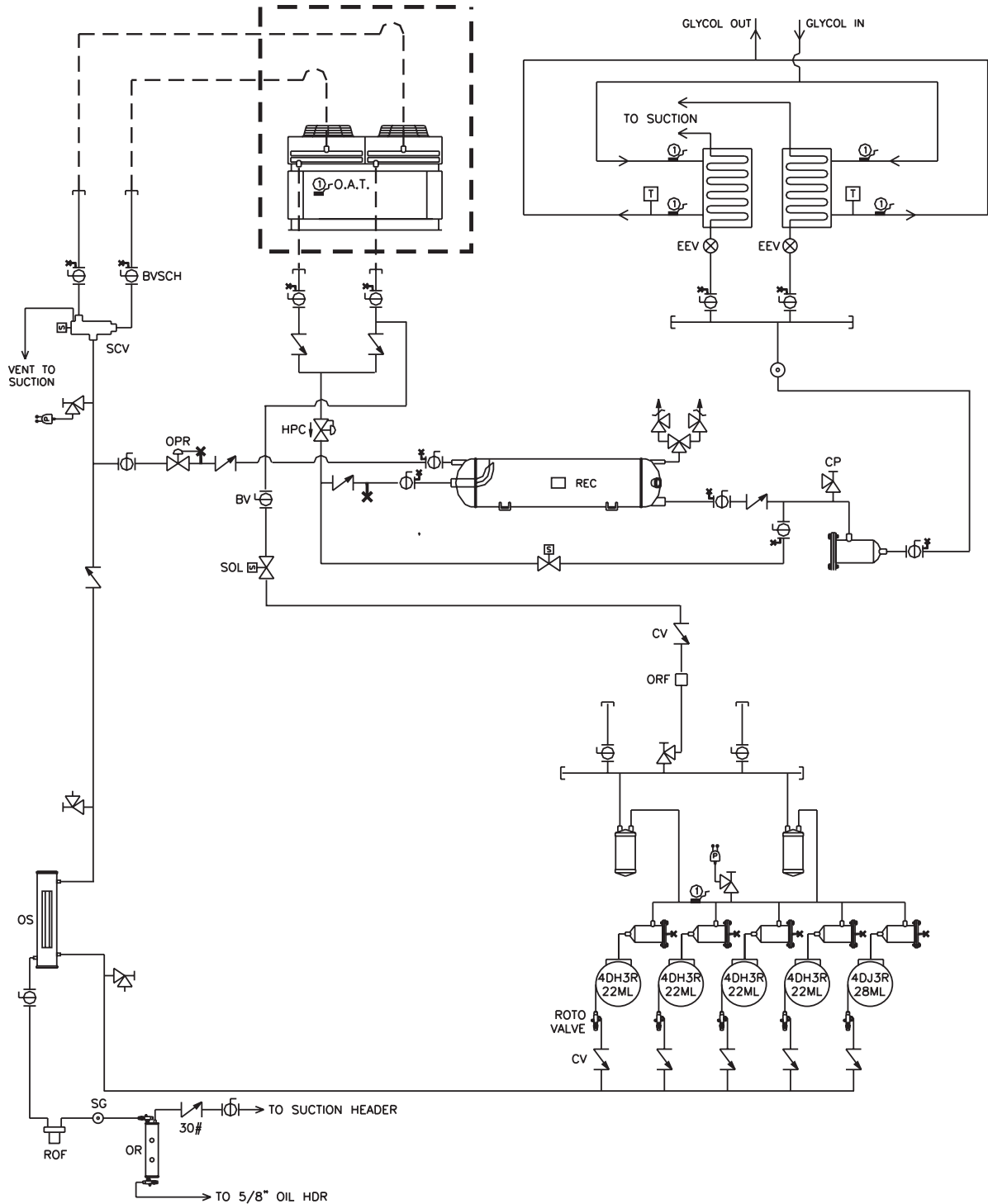


Evaporator

# DESCRIPTION

## COLDLOOP SYSTEM SCHEMATIC

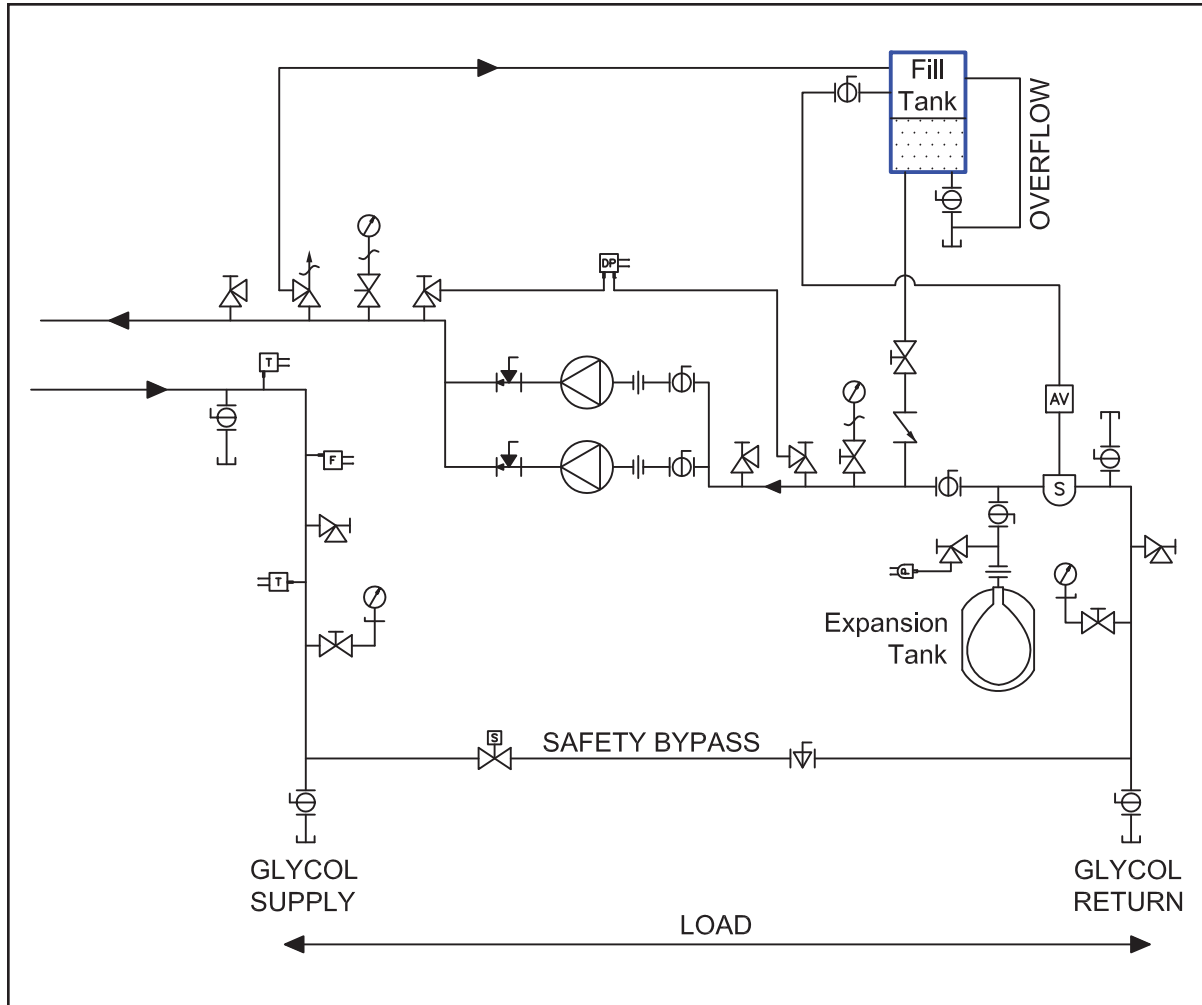
### ColdLoop System Primary Refrigerant Schematic



# DESCRIPTION

## COLDLOOP SYSTEM SCHEMATIC

### ColdLoop System Secondary Coolant Schematic





# INSTALLATION

## SHIPPING AND DAMAGE



### **Danger!**

Always read and understand the Safety information from page 7 to page 10 before installation, operation, or before performing maintenance. Failure to comply with this warning can result in serious injury or death!



### **Warning!**

All personnel working on the installation, including temporary workers, must read and understand this manual. Failure to comply with this warning can result in serious injury or damage to equipment.

**Note: The installation contractor is responsible for the ColdLoop System installation, secondary coolant piping installation, the system start-up, and making sure that the entire system complies with all operation specifications.**

Zero Zone personnel inspect and test equipment before shipment to make sure that it complies with all end user specifications. When the carrier accepts equipment from Zero Zone, the carrier assumes the responsibility to deliver the equipment to the user in good condition and without damage.

## ACCEPTANCE

Before accepting equipment from a carrier, do the following.

1. Inspect the ColdLoop System and pallets to ensure that no damage is visible.
2. Inspect all visible surfaces for scratches, dents and other damage.
3. Verify receipt of all parts.
4. Verify the dry nitrogen holding charge in the refrigeration system (high side and low side) is as labeled (approximately 100 psig).

**Note: Do not sign the freight bill if any damage is evident. Take digital photographs and contact Zero Zone customer service.**

Zero Zone is not responsible for shipping damage. If any Zero Zone components are delivered with apparent damage, protect your rights by immediately doing the following.

1. File a claim with the carrier for all damages.
2. Contact Zero Zone at 800-708-3735 and report the damage and order replacement parts as necessary.

**Note: If any damages have occurred and you accept the ColdLoop System as is, you assume all responsibility for repairing the damages at your expense.**

# INSTALLATION

## INSTALLATION OVERVIEW

The Zero Zone ColdLoop System installation steps:

1. Place the secondary coolant system rack into place.
2. Connect services to the secondary coolant system rack.
3. Install the secondary coolant piping that connects the rack to the refrigerated fixtures.
4. Pressure test the secondary coolant piping system and fill with secondary coolant fluid.
5. Charge and test the primary refrigeration system.
6. Balance and adjust the secondary coolant system.

## INSTALLATION REQUIREMENTS

- The ColdLoop System and the secondary coolant piping installation must comply with the following:
  - Safety Standard for Refrigeration Systems (ANSI/ASHRAE Standard 15)
  - ASME B31.5 Refrigeration Piping Standard
  - All Zero Zone specifications, drawings, data, and the instructions in this manual
  - The standard SCCR rating is 10,000 amps. For SCCR requirements higher than 10,000 amps contact Zero Zone Refrigeration Systems Division.
  - All end user specifications and drawings
  - All local building codes and regulations
- The installing contractor must make sure that existing and installed secondary coolant system materials, piping, fittings, and controls are free of defects, lubricants, and debris.
- The installing contractor must make sure that all secondary coolant components can operate in the following conditions.
  - Medium temperature range of 0°F to 140°F
  - Pressures to 125 psig
  - Compatible with the secondary system coolant

# INSTALLATION

## COLDLOOP SYSTEM INSTALLATION

### PLAN THE LOCATION

**Warning!** Only qualified personnel should move or install the ColdLoop System. Failure to comply with this warning can result in serious injury and damage to equipment.

**Warning!** When removing from the pallet or moving the ColdLoop System, always wear safety glasses, safety shoes, a safety helmet, and gloves. Failure to observe this warning can result in serious injury!

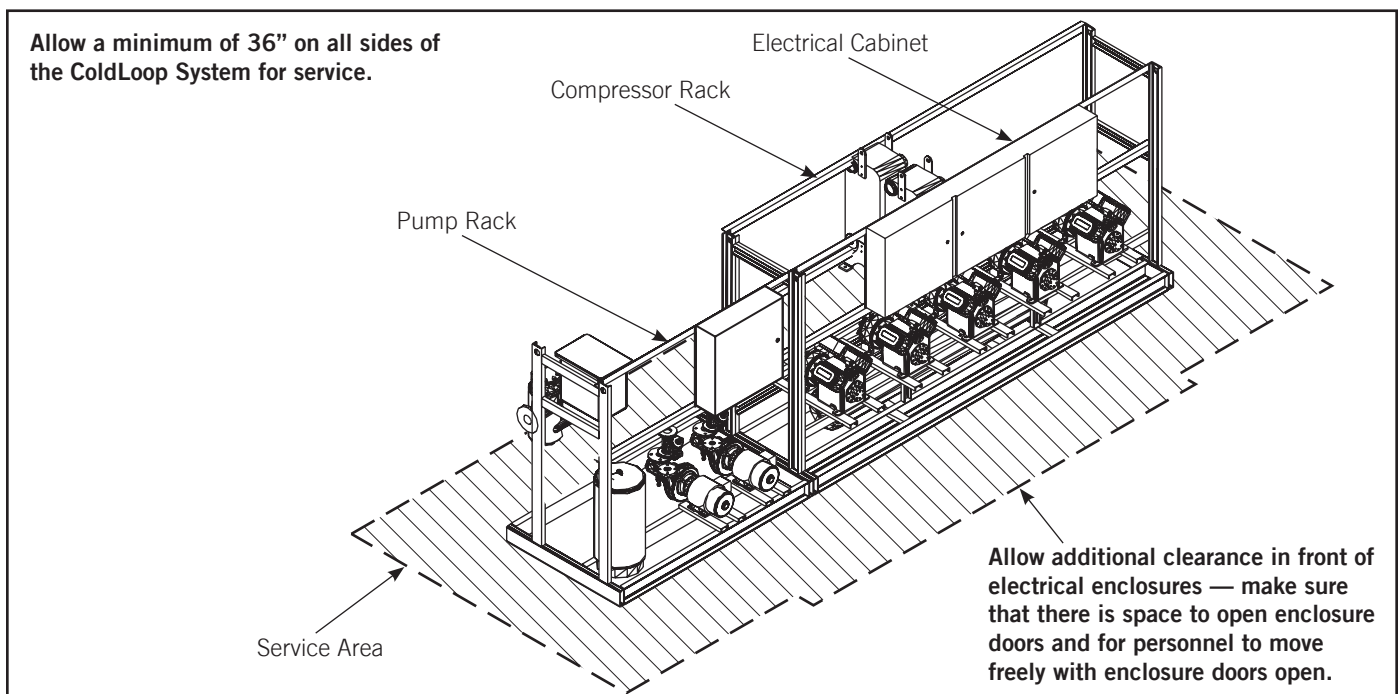
The ColdLoop System location must have sufficient room for installation, service, connection of electrical service, and the ColdLoop System refrigeration piping.

### General Requirements

**Note:** Placement of the ColdLoop System Cabinet must comply with NEC codes and local codes.

- The ColdLoop System must be placed on a concrete floor that is level and resistant to vibration.
- The concrete floor must be capable of supporting the weight of the ColdLoop System and the equipment used to transport the ColdLoop System to the final location.
- Refer to the piping diagram to plan the coolant system piping connections to the ColdLoop System.
- Allow a minimum of 36" on all sides of the ColdLoop System for service. It is desirable to allow additional clearance in front of electrical enclosures — make sure that there is space to open enclosure doors and for personnel to move freely with enclosure doors open. Check local and national electrical codes for any additional clearance requirements. Refer to **Figure 6** below.
- Make sure that the area has good ventilation.
- Make sure that there is sufficient overhead clearance to allow lift truck access, repair, and maintenance.
- Electrical service must connect through the top of the cabinet or the optional main disconnect.
- Make provisions for draining and/or disposal of glycol and other chemicals according to local codes.

**Figure 6 — ColdLoop System Service Area**



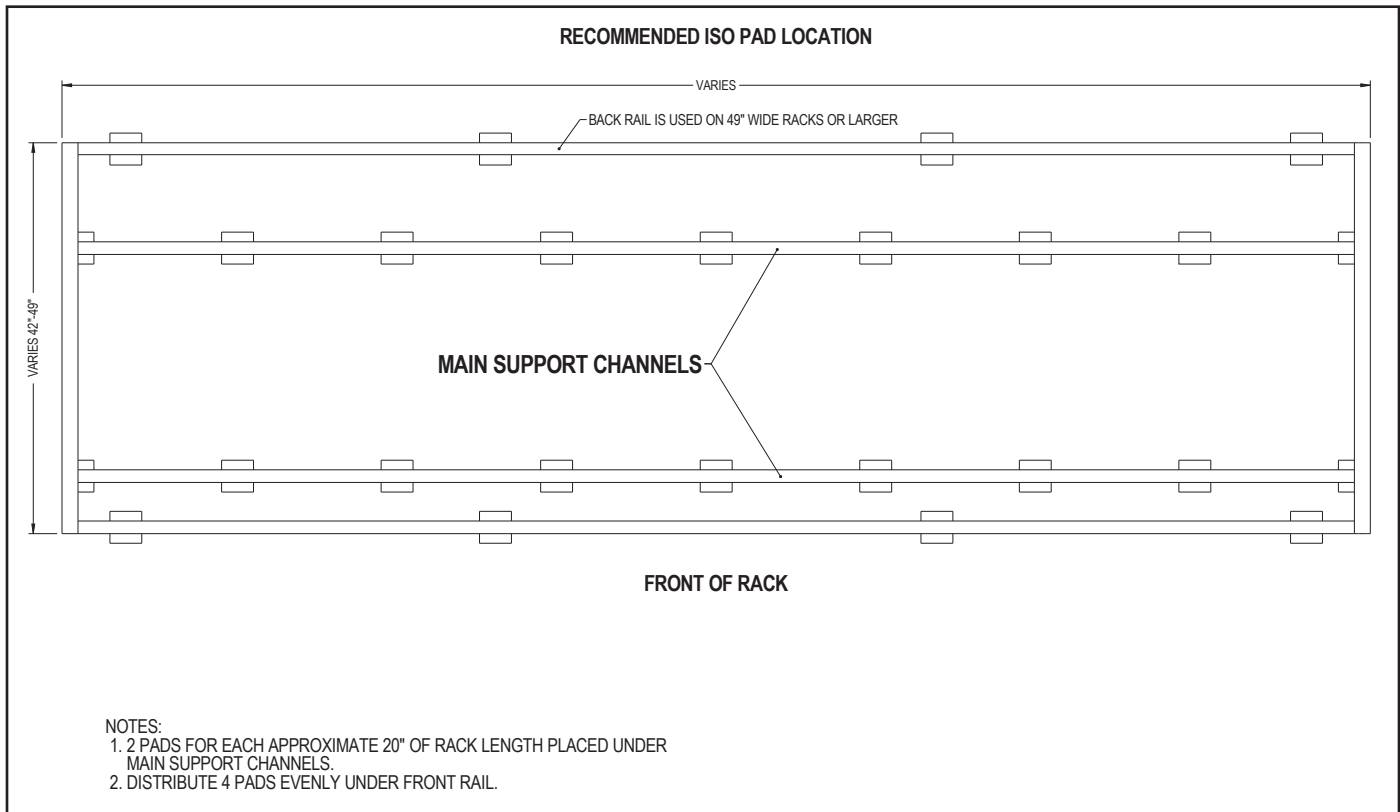
# INSTALLATION

## COLDLOOP SYSTEM INSTALLATION

### Isolation Pads

1. Arrange isolation pads as shown in **Figure 7** below.
2. Isolation pads can be attached to the floor with adhesive to prevent shifting.

**Figure 7 — Isolation Pad Location for ColdLoop System**



# INSTALLATION

## COLDLOOP SYSTEM INSTALLATION

### PLACE THE COLDLOOP SYSTEM

**Warning!** Only qualified personnel should install the ColdLoop System. Failure to comply with this warning can result in serious injury and damage to equipment.

**Caution!** Always move the ColdLoop System by inserting lift truck forks under the ColdLoop Secondary frame or connecting chains or cables to the ColdLoop Secondary frame. Failure to observe this warning can result in damage to the equipment.

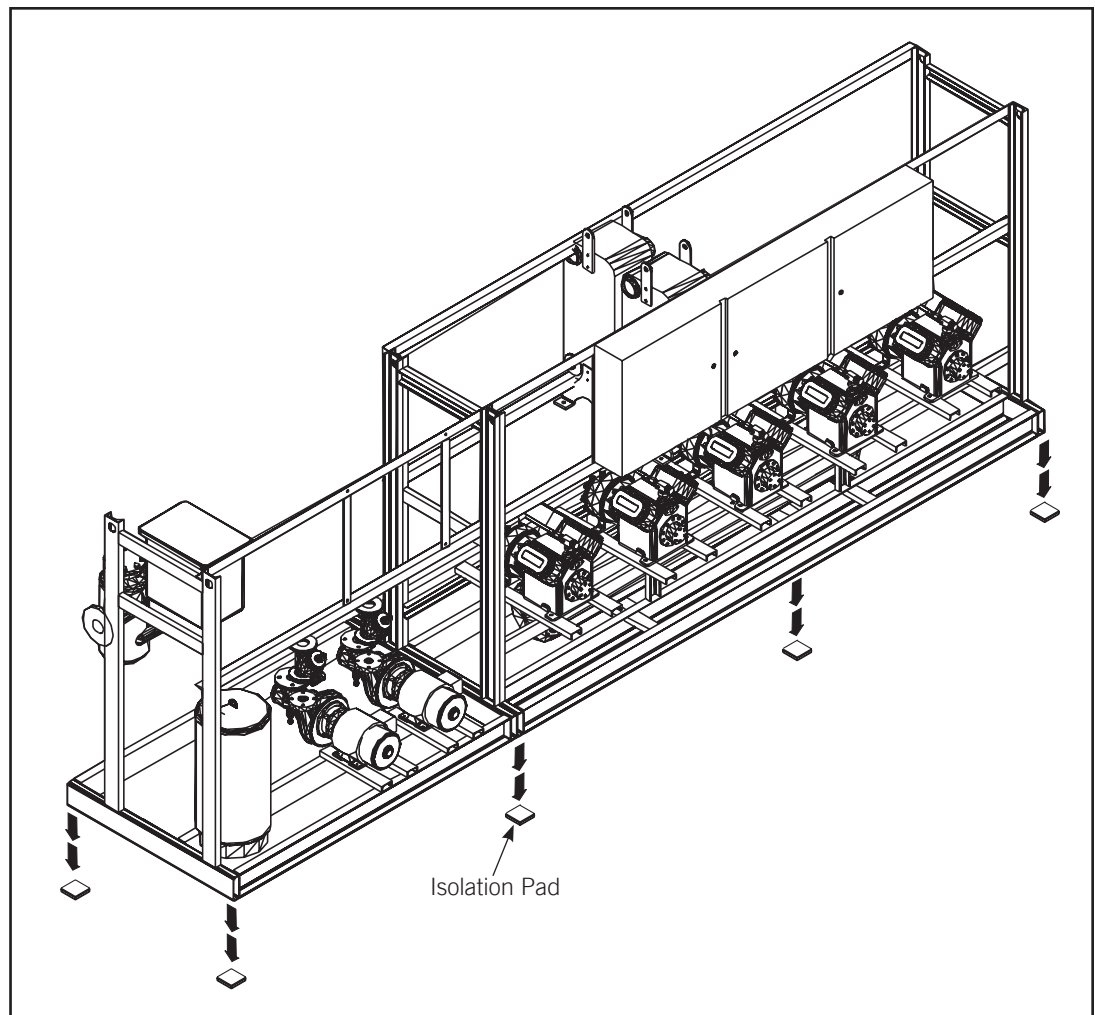
Lift the ColdLoop System unit using a hoist or crane.

1. Connect chains or cables to ColdLoop System following custom lifting diagrams and instructions provided with the equipment documentation.

**Caution! Attachment of lifting cables or chains must follow provided custom lifting diagrams to prevent damage to the unit.**

2. Move the ColdLoop System to the isolation pads on the floor.
3. Place the ColdLoop System onto the isolation pads. Make sure that the pad places as shown in the isolation pad location diagram in **Figure 8**.

**Figure 8 — Placing the ColdLoop System Onto Isolation Pads**




**Warning!** Do not stand below ColdLoop frame when it is lifted or moved. When the ColdLoop frame is placed on the isolation pads, there is a possibility of a pinch hazard. Make sure feet and hands are clear to prevent injury. Failure to comply with this warning may result in serious injury.

4. Make sure that the ColdLoop System frame is level.
5. The ColdLoop System frame must firmly contact all isolation pads.

# INSTALLATION

## CONNECT THE ELECTRICAL SERVICE

### ELECTRICAL SOURCE


-  **Danger!** Only a qualified electrician should make the electrical connections. Connecting high voltage to the machine is dangerous and can result in death or serious injury. Appropriate safety equipment to protect the electrician from arc flash should be used.

The connection must be made from a remote, lockable (capable of being locked with multiple padlocks), grounded, disconnect (supplied by the end user) correctly sized for the electrical load. The consulting design engineer must determine the SSCR requirements for the equipment.

### Connection Capacity

- Refer to the ColdLoop System nameplate for the voltage and ampere capacity.
- Connection wiring size must comply with the National Electric Code and local codes.


### Ground the Distributed System

-  **Danger!** It is strongly recommended that the ColdLoop System be connected directly to an earth ground! An ungrounded machine is a dangerous electrical hazard. Serious injury or death can result.

-  **Danger!** Do not depend upon electrical conduit as a substitute for an earth ground connection!

-  **Danger!** Use a qualified electrician to make the correct earth ground connection.

- The ground connection must comply with the National Electric Code and local regulations.
- During normal operation, an ungrounded machine with a short in the electrical system is a dangerous hazard. An operator could complete the ground, resulting in death.
- During normal operation, an ungrounded machine can generate a static charge. This can result in static charges building up in compressor bearings causing serious erosion of the bearing balls and races. This will significantly reduce bearing life and result in premature failure of motors and other components. In some cases a static charge that builds in a machine can cause injury to personnel when dissipated or can ignite gas or dust particles suspended in the atmosphere.
- Local conditions such as moisture in the soil or type of soil will effect the method of grounding a machine.
- Always consult local regulations and codes.

-  **Caution!** Re-tighten all electrical connections before energizing. During shipment, fasteners can loosen; energizing with loose or disconnected wires can result in serious damage to equipment.

# INSTALLATION

## SECONDARY COOLANT PIPING INSTALLATION

### PLAN THE SECONDARY COOLANT PIPE CONFIGURATION

Secondary coolant supply and return piping system can be installed in many configurations, including the following.

- Individual circuit piping
- Loop piping
- Modified loop piping

The piping configuration should match the facility requirements by grouping controls in the optimum location, reducing pipe sizes and pipe quantity, and reducing coolant fluid volume.

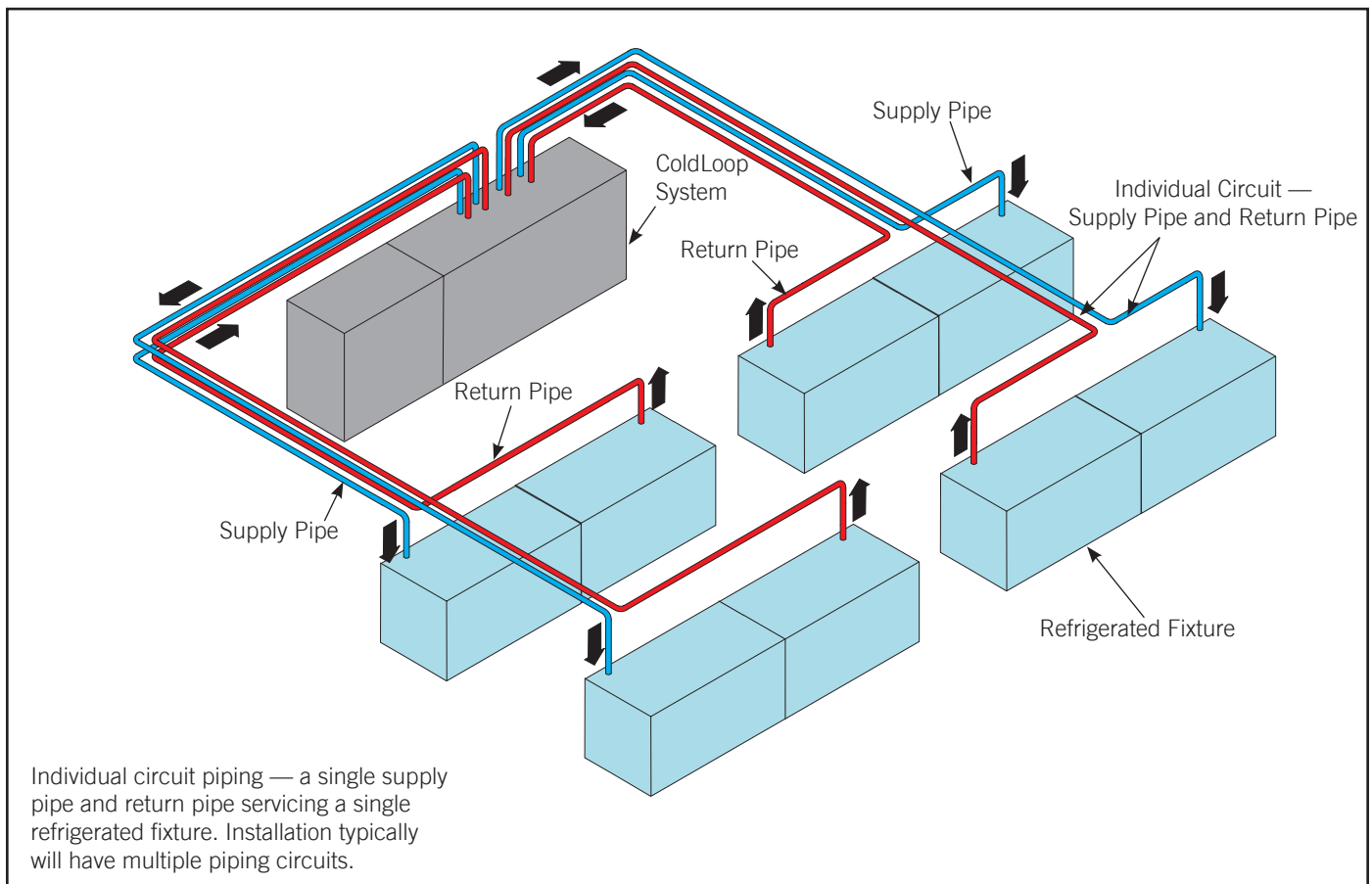
### Individual Circuit Piping

Refer to **Figure 9** below.

An individual circuit piping configuration has multiple sets of supply and return pipes between the ColdLoop System and each refrigerated fixture (individual walk-in cooler, individual case, and case line-ups). Each fixture has a set of pipes.

The defrost valves and controls are located in the machine room (or refrigeration center) enabling centralized servicing, adjusting the system, and balancing system flow.

**Figure 9 — Typical Individual Circuit Piping Application**



# INSTALLATION

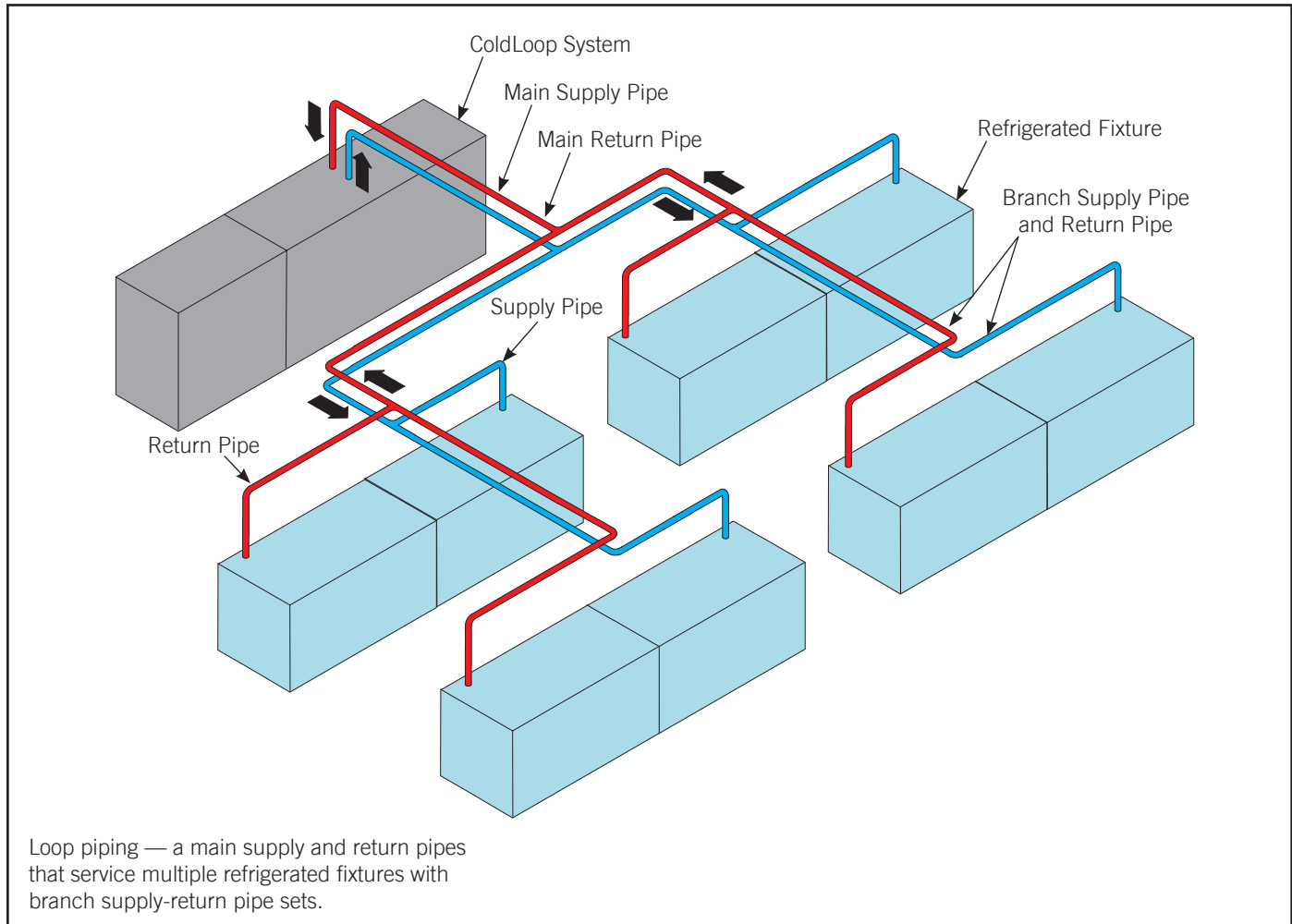
## SECONDARY COOLANT PIPING INSTALLATION

### Loop Piping

Refer to **Figure 10** below.

A loop piping configuration has a single supply pipe and return pipe servicing more than one refrigerated fixture. Smaller branch supply and return pipes connect each refrigerated fixture to the main supply and return pipes. The defrost valves and controls are located at each refrigerated fixture, enabling servicing, adjusting the system, and balancing system flow at the fixture.

**Figure 10 — Typical Loop Piping Application**



### Modified Loop Piping

Any combination of loop piping and individual circuit piping is a modified loop piping system. Multiple loop piping circuits can service areas of a supermarket or warehouse which require similar fluid temperatures or defrost characteristics reducing the pipe and insulation material required for an installation.

Circuits with individual supply pipes can be connected to a common return pipe. This allows locating a majority of the controls in the machine room and reducing the pipe required for the return side.

Remote headers or manifolds can be used to allow centralizing controls.



# INSTALLATION

## SECONDARY COOLANT PIPING INSTALLATION

### Circuit Piping Design Requirements

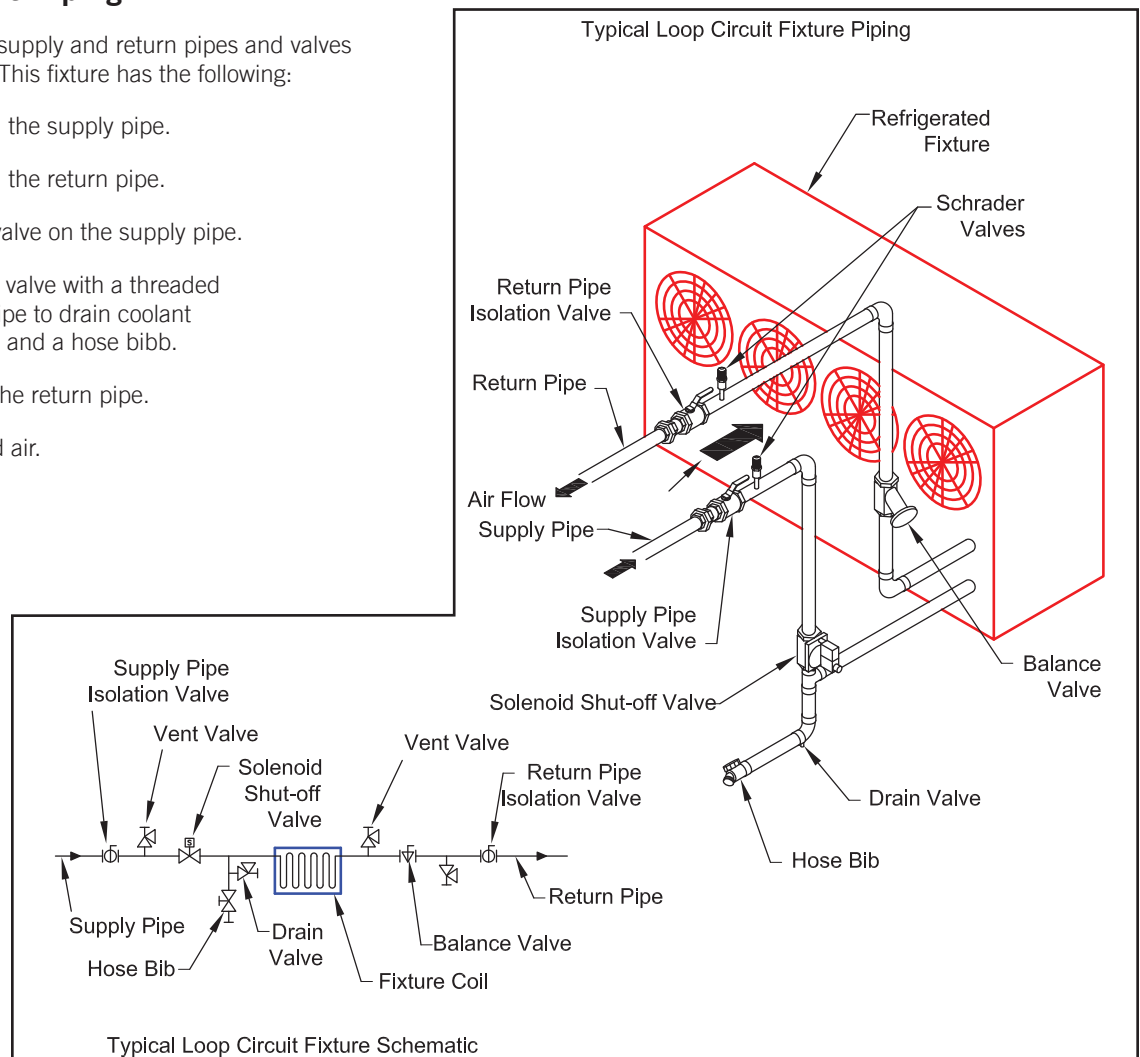
1. All piping configurations, individual circuit, loop piping, warm glycol defrost lines, and modified piping must have shut-off valves that enable isolating the circuit from the system.
2. When required, solenoid shut-off valves must be installed on the supply pipe upstream from a refrigerated fixture heat exchanger.
3. Balance valves must be installed on the return pipe downstream from the refrigerated fixture heat exchanger.
4. Solenoid valves used to interrupt cold coolant fluid flow during defrost can also control refrigerated fixture space temperature.
5. Balance valves can double as isolation shut-off valves if approved by the valve manufacturer.
6. A balance valve used to control flow must be located on the outlet pipe of the refrigerated fixture heat exchanger.
7. The use of any valve must comply with the valve manufacturer's specifications.
8. Check valves are added for warm fluid defrost to prevent reverse flow (not shown).

### Refrigerated Fixture Piping

**Figure 11** shows typical supply and return pipes and valves for a refrigerated fixture. This fixture has the following:

- An isolation valve on the supply pipe.
- An isolation valve on the return pipe.
- A solenoid shut-off valve on the supply pipe.
- A coolant fluid drain valve with a threaded cap on the supply pipe to drain coolant fluid from the fixture and a hose bibb.
- A balance valve on the return pipe.
- A vent valve to bleed air.

**Figure 11 — Typical Circuit Piping to a Refrigerated Fixture**



# INSTALLATION

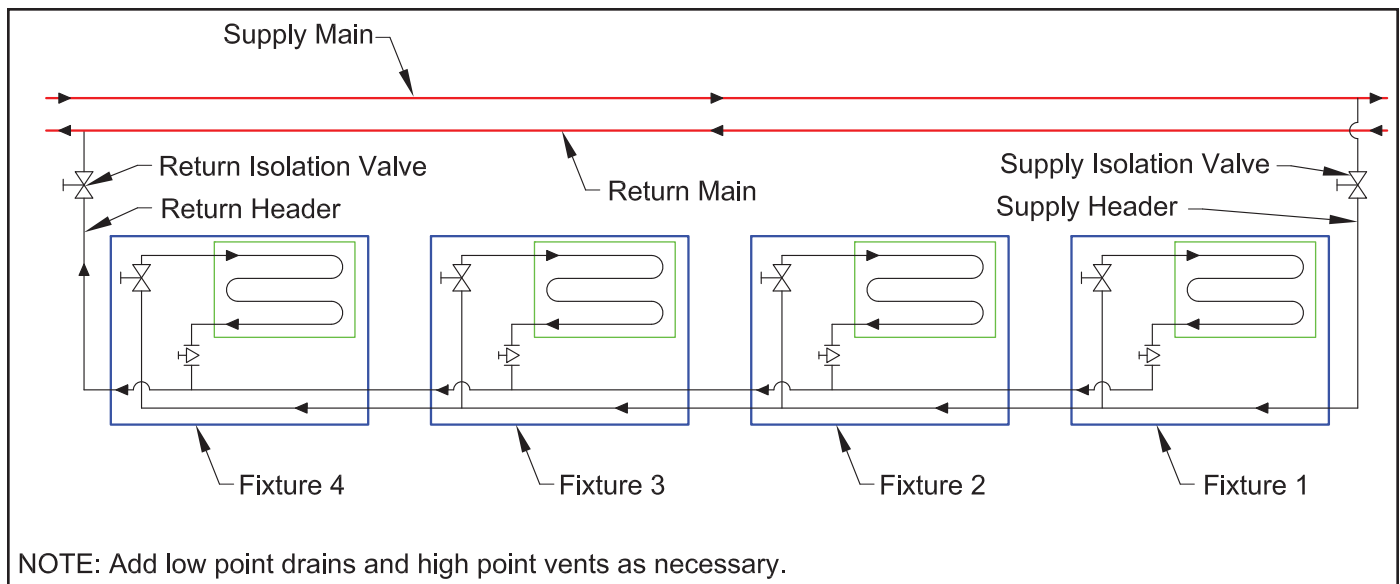
## SECONDARY COOLANT PIPING INSTALLATION

### Multiple Fixture Piping

Piping circuits that connect to multiple fixtures (a series of coils operating in parallel) must be piped to reduce balancing problems during system start-up.

- The coolant fluid arrangement should utilize reverse return piping which requires that the first coil in the supply be piped as the last to the return pipe.
- The first-in, last-out approach helps equalize the pressure drop across each coil and simplifies the balancing problem.

Figure 12 — Typical Parallel Coil Application Schematic



# INSTALLATION


## SECONDARY COOLANT PIPING INSTALLATION


### SECONDARY COOLANT FLUID REQUIREMENTS


#### Approved Secondary Coolant

Zero Zone specifies Dow Chemical Company DOWFROST™ (a propylene glycol fluid containing food grade inhibitors) mixed with water must be used as the medium temperature secondary coolant fluid in the ColdLoop System. Contact factory for approval of other glycol manufacturers.

 **Warning!** All personnel using or in contact with the secondary coolant fluid must read and understand all of the information contained in the DOWFROST™ Material Safety Data Sheet. Failure to comply with this warning can result in serious injury!

 **Warning!** Never expose pure DOWFROST™ fluid to an open flame or spark. Failure to comply with this warning can result in fire.

 **Caution!** Never mix DOWFROST™ with secondary coolant fluids from different manufacturers. Thermal transfer properties can be changed or an unpredictable or dangerous chemical reaction may result.

 **Caution!** Never mix any fluid other than water (demineralized or distilled) when diluting the secondary coolant. A loss of thermal transfer properties can be changed or an unpredictable or dangerous chemical reaction may result.

#### Secondary Coolant Properties

Zero Zone recommends the following secondary coolant mixture by weight. The use of any other fluid mixture as a secondary coolant must be approved in writing by Zero Zone. Failure to comply with this requirement will void the product warranty. The secondary coolant can be purchased premixed from Zero Zone. The secondary coolant fluid mixture must be:

- 35% Dow Chemical Company DOWFROST™
- 65% water (demineralized or distilled)

Verify the coolant mixture concentration with a refractometer at room temperature (specific gravity of 1.033 at 65°F to 70°F).

The DOWFROST™ and water mixture properties are listed in the table at the right.

#### Secondary Coolant Safety

Dow Chemical Company DOWFROST™ fluid is safe for incidental food contact and complies with USDA and FDA regulations. The fluid contains food grade industrial inhibitors to prevent corrosion.

DOWFROST™ has the following hazards.

- Hazardous in the case of inhalation
- Irritant in the case of eye contact
- Flammable, in the case of high temperatures; auto ignition at temperatures above 770°F (410°C) and open cup flash point 215.6°F (102°C)
- Slightly flammable, undiluted, in the case of direct exposure to flames or sparks
- 1,000 gallons of DOWFROST™ will shrink by 13 gallons when cooled from 75°F to 20°F.

**Table 3 — DOWFROST™ Properties**

DOWFROST™ Properties, 35% Mixture by Weight	
Color	Colorless, Transparent
Specific Gravity, 70°F	1.033
Boiling Point	216°F
Freezing Point	+2°F
pH	8.0 to 10.0
Burst Point	-40°F

# INSTALLATION

## SECONDARY COOLANT PIPING INSTALLATION

### Handling and Storage

- Small spill — dilute with water and mop up or absorb with an inert dry material and place in a waste disposal container.
- Large spill — absorb with an inert dry material and place in a waste disposal container. Neutralize the residue with a dilute solution of acetic acid. Finish cleaning by spreading water onto the contaminated surface. Use an industrial vacuum and transfer the water into the sanitary drain system.
- Storage requirements:
  - Place secondary coolant containers in a cool, well-ventilated area.
  - Do not store in temperatures above 249°F (121°C).
  - Make sure that all containers are tightly sealed.
  - Dispose of empty coolant containers (fire hazard) in accordance with the DOWFROST™ Material Safety Data Sheet.

### In Case of Fire

- Small fire — smother with a dry chemical
- Large fire — use water spray, fog, or foam. Never use a water jet.

## SECONDARY COOLANT PIPING MATERIALS



### Danger!

**Only qualified refrigeration technicians should make the refrigeration piping connections. Failure to comply with this warning can result in death or serious injury.**

- All piping connections must comply with Good Piping Practices, the piping schematic, and tag instructions on the connection points of the ColdLoop System.
- All piping must comply with local codes and regulations.

### Pipe Material Requirement

The installing contractor must select secondary coolant piping materials that comply with the following specifications:

Operating temperature range ..... 0°F to 140°F

Operating pressure range..... 125 psig

Chemical compatibility ..... Secondary system coolant (propylene glycol, DOWFROST™)

Construction specifications..... Compliant with local codes and regulations

### Plastic Piping Requirements

A variety of plastic piping materials are widely used in medium temperature secondary coolant installations. All plastic pipe joints must conform with the pipe manufacturer's requirements. The pipe manufacturers requirements must be reviewed and approved in writing by Zero Zone before installation. It must also follow the piping manufacturers instructions.

# INSTALLATION

## SECONDARY COOLANT PIPING INSTALLATION

### Copper Piping Requirements

Copper piping must conform with the following:

- Copper pipe grades..... Follow ASTM standards for proper application. Not all materials used in glycol systems are suitable for the refrigerant system.
- Copper to copper joints..... Soft solder and flux or hard solder; consult the component manufacturer's installation instructions.
- Soft solder materials..... Zero Zone recommends Stay-Brite (manufactured by the Harris Products Group) or Silvabrite™ (manufactured by Wolverine Joining Technologies) silver and tin alloy (3 to 5% Ag, remainder Sn) solder that is soldered using dry nitrogen. Only use glycerin-based, water-soluble silver solder flux. **Flux must not contain zinc or zinc compounds.**
- Hard solder materials..... Zero Zone recommends Stay Silv® 15 (manufactured by the Harris Products Group) or Silvaloy® 15 (manufactured by Wolverine Joining Technologies) using dry nitrogen. Use only a water based flux.

### Steel Piping Requirements

Carbon steel or stainless steel piping can be used with the following considerations.

- Press-fit systems..... Schedule 5 externally galvanized pipe in 2" diameter or smaller.
- Threaded joint systems ..... Schedule 40 carbon steel pipe or piping with thicker walls can be used.
- Corrosion protection..... Protection against galvanic corrosion (use dielectric couplings) and external corrosion must be incorporated in the system design.
- Cleaning..... Before joining carbon steel pipe, blow nitrogen through the pipe to remove debris. Systems constructed with carbon steel pipe must be thoroughly cleaned before charging.

# INSTALLATION

## SECONDARY COOLANT PIPING INSTALLATION

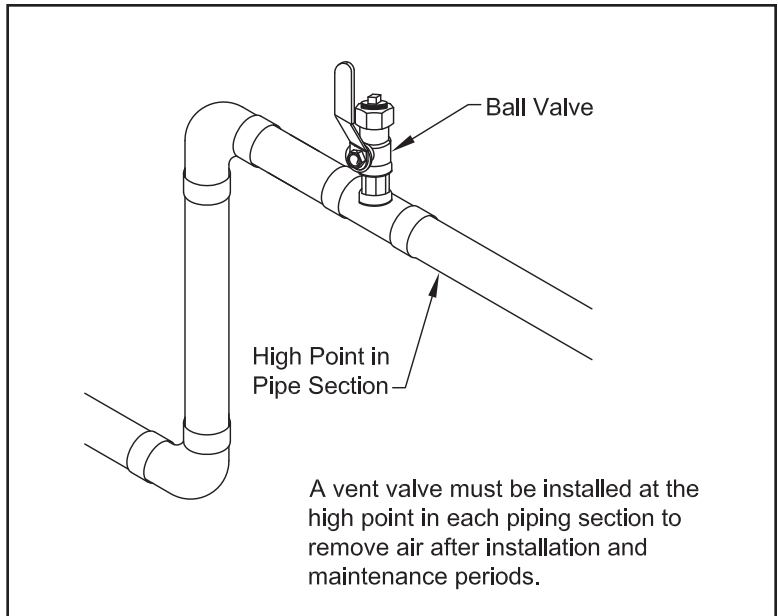
### GOOD PIPE DESIGN PRACTICE

#### Air Traps and Drains

Secondary coolant piping must be installed so that air traps are avoided.

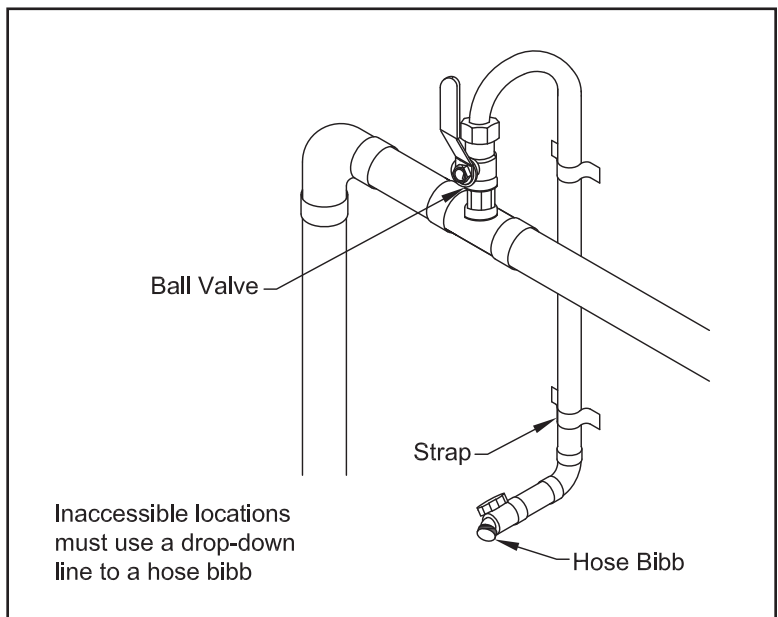
1. Always install a 1/4" or 3/8" vent valve at the highest point in each pipe section so that air can be removed during installation and during maintenance periods. Refer to **Figure 13** on the right.

Figure 13 — Vent Valve at High Point in Circuit



2. Piping section high points that are in inaccessible locations such as at a ceiling level, should have a drop-down line with a 1/4" or 3/8" threaded hose bibb.

Figure 14 — Vent with Hose Bibb

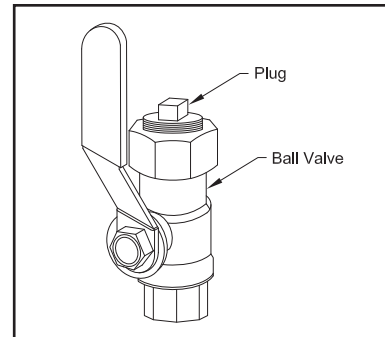


# INSTALLATION

## SECONDARY COOLANT PIPING INSTALLATION

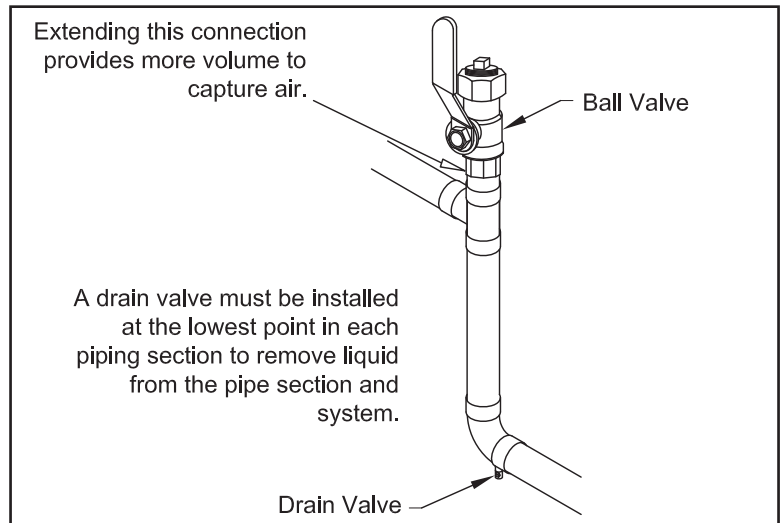
- Vent valves must have the following features.
  - A vent valve must have a threaded connection so that a hose or pipe fitting can be attached to bleed air from the pipe section.
  - A vent valve must have a cap capable of sealing the threaded valve port before starting the system.

Figure 15 — Typical Air Vent Valve



- The lowest point of each pipe section must have a 3/8" or 1/2" drain valve to remove liquid from the pipe section.
  - The drain valve must have a threaded connection so that a hose or pipe fitting can be attached to bleed air from the pipe section.
  - The drain valve must have a cap capable of sealing the threaded valve port before starting the system.

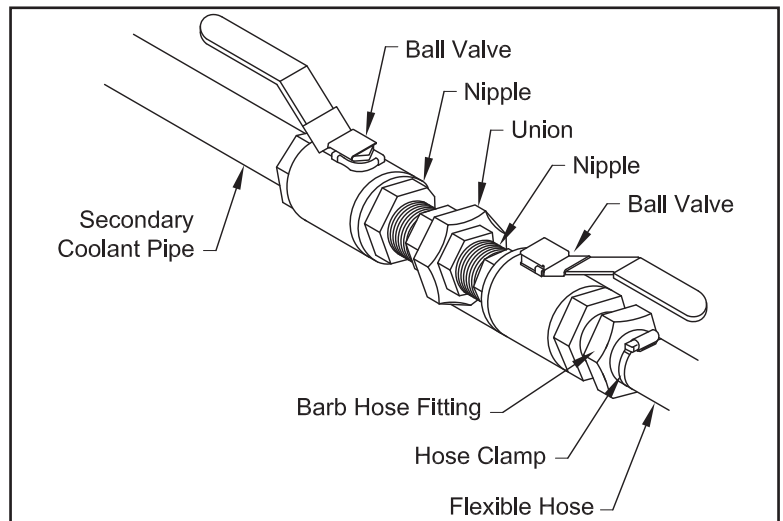
Figure 16 — Drain Valve at Low Point in Circuit



### Miscellaneous Applications

Case and walk-in coils can be attached to secondary coolant piping with quick disconnects and flexible hoses. The hose materials must comply with the pressure and temperature requirements in Piping Specifications on **page 44**. Flexible hoses must always connect to a ball valve using a barbed hose fitting and a hose clamp. Refer to **Figure 17** on the right.

Figure 17 — Hose to Secondary Coolant Pipe Connection



# INSTALLATION

## SECONDARY COOLANT PIPING INSTALLATION

### Secondary Coolant Pipe Expansion

Expansion loops must be included in all long straight pipe sections to accommodate expansion and contraction of the piping elements. Plastic pipe has a greater coefficient of expansion compared to steel or copper. Refer to the piping manufacturers manual for expansion loop design instructions.

- Always follow the ASME B31.5 Refrigeration Piping Standard.
- Horizontal expansion loops are preferred to reduce the possibility of air traps. Refer to **Figure 18** on the right.

Figure 18 — Typical Horizontal Pipe Expansion Loop

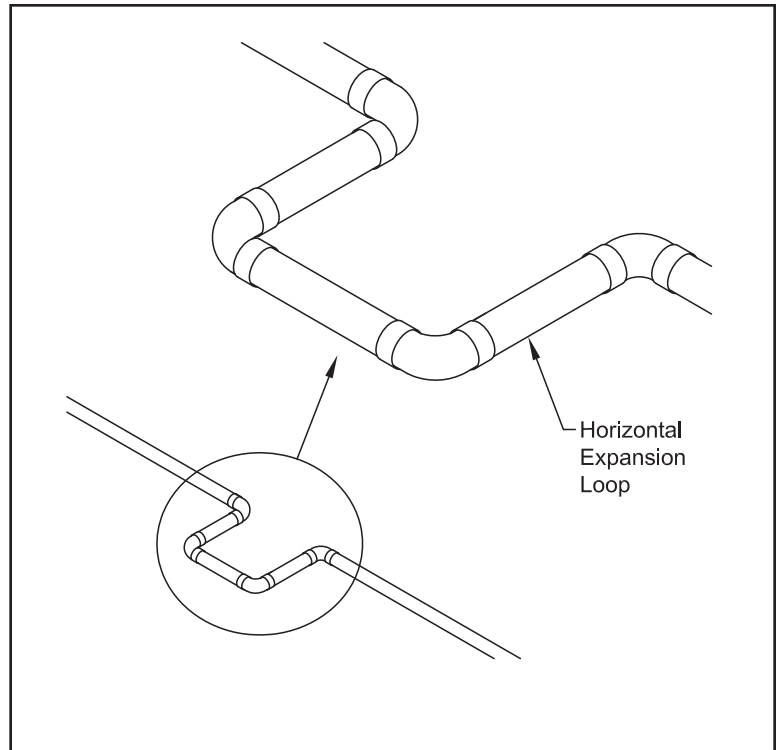
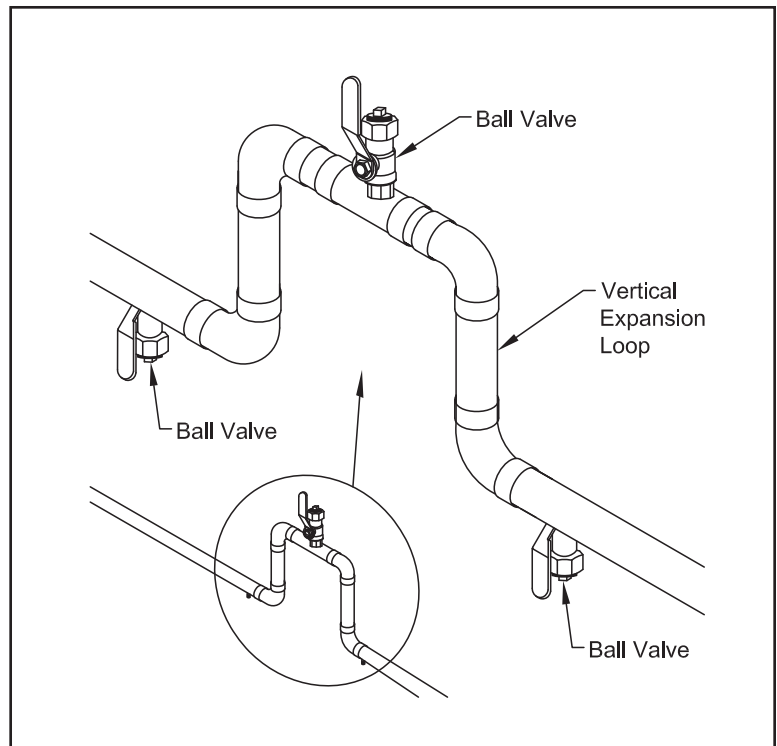


Figure 19 — Typical Vertical Pipe Expansion Loop

- When vertical expansion loops are installed, always place a vent valve at the highest point of the loop and drain valves at the low points. Refer to **Figure 19** on the right.





# INSTALLATION

## SECONDARY COOLANT PIPING INSTALLATION

### SECONDARY COOLANT PIPE INSULATION

#### Secondary Coolant Pipe Insulation Materials

Zero Zone recommends using a flexible, closed-cell elastomer for secondary coolant pipe insulation.

Recommended manufacturers are:

- L'ISOLANTE K-FLEX USA (web site: [www.kflexusa.com](http://www.kflexusa.com))
- Armacell LLC (web site: [www.armaflex.com](http://www.armaflex.com))
- Rubatex Corporation (web site: [www.rubatex.com](http://www.rubatex.com)).

Styrofoam, an expanded, extruded, rigid, connected-cell polystyrene foam, or Tymer 2000, a polyurethane modified polyisocyanurate cellular foam, can be used as an alternative. These materials are available in minimum 1" thickness and must be covered with an appropriate jacket material to preclude moisture absorption. Refer to manufacturer's for additional information. Styrofoam insulation required thickness is greater than closed-cell elastomers. Over time, the thermal insulating properties of styrofoam insulation materials degrade. Complex piping configurations that include involved shapes and are difficult to insulate can use a closed-cell rubber material such as Rubatex. This material is not efficient in temperature applications below 0°F.

#### Secondary Coolant Pipe Insulation Design

Secondary coolant lines must be insulated to prevent condensation, even in conditioned spaces. Ambient heat absorbed by the secondary coolant fluid reduces system efficiency. To improve system efficiency and reduce energy use, secondary coolant lines must be insulated with a vapor proof insulation.

#### Coolant Pipe Insulation Requirements

- Insulation materials and installation must comply with local building codes and the insulation manufacturer's specifications.
- Use of insulation materials not listed in this manual must be approved by Zero Zone in writing.
- Insulation materials installation must significantly reduce heat transfer between the secondary coolant fluid lines and the ambient space.
- The insulation installation must prevent condensation, ice formation, and pipe material corrosion on all pipe surfaces.
- Insulation design must consider the following factors:
  - Ambient space conditions (dry bulb temperature and humidity)
  - Air velocity
  - Insulation material
  - Performance requirement
- Copper pipe transporting warm fluid for defrost must be insulated with a minimum 1/2" thick flexible, closed-cell elastomer to prevent condensation.
- Pipe insulation is not required for plastic secondary coolant piping transporting warm fluid for defrost.

# INSTALLATION

## SECONDARY COOLANT PIPING INSTALLATION

### Insulation Thickness to Control Condensation

Insulation thickness is dependent upon the dry bulb temperature of the space, relative humidity, and air velocity moving over the insulated pipe. These conditions are classified as mild, normal, and severe. Refer to **Table 5** below to classify the ambient space condition.


After the ambient space condition is determined, use **Table 5** below to determine the insulation thickness to prevent condensation for different size secondary coolant fluid pipe diameters. The table applies to both closed-cell elastomers and rigid closed-cell styrofoam.

**Table 4 — Ambient Space Conditions for Secondary Coolant Pipe Insulation**

MEDIUM TEMPERATURE SECONDARY COOLANT PIPING INSULATION CONDITIONS			
Ambient Condition	Dry Bulb Temperature	Relative Humidity	Air Velocity
Mild	80°F	50%	0 ft/min
Normal	85°F	70%	0 ft/min
Severe	90°F	80%	0 ft/min

### Insulation

All valves, controls, and fittings contacting secondary coolant fluid must be insulated so that routine maintenance and replacement can be easily accomplished. The insulation must not have voids or air pockets which will collect moisture.

 **Caution!** Do not expose closed-cell insulation, (both elastomers and rigid Styrofoam) to ultraviolet light. Prolonged exposure will cause degradation of the insulation properties.

**Table 5 — Recommended Thickness for Closed-Cell Insulation**

Customer specifications and LAHJ (Local Authority Having Jurisdictions) supercedes table.

RECOMMENDED CLOSED-CELL INSULATION THICKNESS									
Pipe Size Inside Diameter, Inch	Mild Ambient Condition			Normal Ambient Condition			Severe Ambient Condition		
	Fluid Temp 50°F	Fluid Temp 35°F	Fluid Temp 0°F	Fluid Temp 50°F	Fluid Temp 35°F	Fluid Temp 0°F	Fluid Temp 50°F	Fluid Temp 35°F	Fluid Temp 0°F
3/8 to 1-3/8	3/8"	3/8"	1/2"	3/8"	1/2"	3/4"	3/4"	3/4"	1-1/2"
1-3/8 to 3	3/8"	3/8"	1/2"	3/8"	1/2"	1"	3/4"	1"	1-1/2"
3 to 4	1/2"	1/2"	3/4"	1/2"	1/2"	1"	3/4"	1"	1-1/2"
Over 4	1/2"	1/2"	3/4"	1/2"	3/4"	1"	3/4"	1"	1-3/4"

# INSTALLATION

## SECONDARY COOLANT PIPING INSTALLATION

### R Values

The table to the right displays R Values calculated using a K factor of 0.2575 (0.25 plus 3% test error allowance at 75°F, 24°C mean temp) and nominal wall thickness in each case. Lower operating temperatures will result in improved R values.

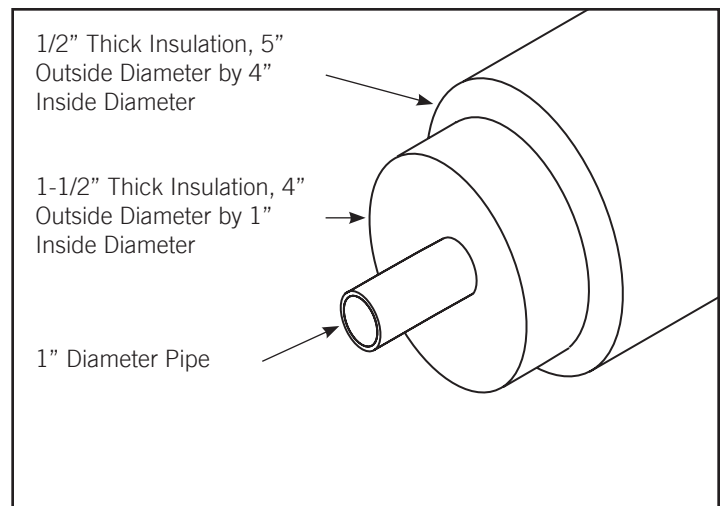
Table 6 — R Value Per Square Foot

R VALUE, PER SQUARE FOOT					
Insulation ID, inch	R Value, Insulation Wall Thickness				
	3/8"	1/2"	3/4"	1"	1-1/2"
3/8	2.6	3.5	5.5	—	—
1/2	2.5	3.3	5.2	—	—
5/8	2.4	3.2	5.3	7.4	12.5
3/4	2.3	3.0	5.3	7.3	11.8
7/8	2.2	3.1	5.3	7.0	11.3
1-1/8	2.3	3.1	5.5	7.1	10.8
1-3/8	2.1	3.1	5.2	7.2	10.0
1-5/8	2.5	3.1	5.2	7.1	9.8
1-1/2 IPS	2.4	3.0	5.0	6.7	9.3
2-1/8	2.5	3.2	5.0	6.8	9.3
2 IPS	2.5	3.1	4.9	6.6	9.1
2-1/2 IPS	2.5	3.2	4.8	6.4	8.7
2-5/8	2.4	3.2	4.8	6.5	8.8
3-1/8	2.3	3.1	4.6	6.2	8.4
3 IPS	2.4	3.3	4.7	6.2	8.4
3-5/8	2.3	3.2	4.6	6.0	8.2
4-1/8	2.3	3.1	4.6	5.9	8.0
4 IPS	2.3	3.2	4.6	5.9	7.9
5 IPS	—	3.0	4.3	5.6	7.5
6 IPS	—	3.1	4.2	5.7	7.5
8 IPS	—	3.0	4.3	—	—

### Excessive Insulation Thickness

The maximum thickness of commercially available closed-cell elastomer insulation is 1-1/2". If 2" thick insulation is required, use a second layer, 1/2" thick. Refer to **Figure 20** on the right.

Figure 20 — Typical Application Using Two Layers of Insulation to Insulate a Pipe



# INSTALLATION

## SECONDARY COOLANT PIPING INSTALLATION

### Actual Pipe Diameters

Pipe and tubing with the same nominal pipe size manufactured from different materials can have significantly different outside diameters. The chart below lists actual outside diameters for pipe fabricated from copper (rigid pipe and soft tubing), iron pipe (black iron, typically referred to as IPS), stainless steel, wrought iron, ductile iron, PVC, CPVC, PEX, and glass (fiberglass).

- Not all materials are available in all sizes. Black iron (IPS), stainless steel (SS), PVC, CPVC, PVDF, galvanized and wrought iron have the same outside diameters.
- Copper pipe and PEX tubing have the same outside diameters.
- The soft copper tubing outside diameter is the nominal tube size.
- Ductile iron and C900/905 have similar outside diameters.

Table 7 — Pipe Outside Diameters

ACTUAL PIPE OUTSIDE DIAMETER (All dimensions are inches)							
Nominal Pipe Size, Inch	Soft Copper Tube	Copper Pipe Type K and L	PEX Tube	IPS, SS, PVC, PVDF, CPVC	Wrought Iron	Ductile Iron	Glass Pipe
1/8	.125			.405			
3/16	.188						
1/4	.250	.375	.375	.540	.540		
5/16	.313						
3/8	.375	.500	.500	.675	.675		
1/2	.500	.625	.625	.840	.840		
5/8	.625	.750	.750				
3/4	.750	.875	.875	1.050	1.050		
7/8	.875						
1		1.125	1.125	1.315	1.315		1.31
1-1/8	1.125						
1-1/4		1.375	1.375	1.660	1.660		
1-3/8	1.375						
1-1/2		1.625	1.625	1.900	1.900		1.84
1-5/8	1.625						
2		2.125	2.125	2.375	2.375		2.34
2-1/2		2.625		2.875	2.875		
3		3.125		3.500		3.96	3.41
3-1/2		3.625		4.000			
254		4.125		4.500		4.80	4.53
5		5.125		5.563			
6		6.127		6.625		6.90	6.66
8		8.125		8.625		9.05	

# INSTALLATION

## SECONDARY COOLANT PIPING INSTALLATION

### Elastomer Insulation Installation Techniques

Elastomer insulation performance depends upon good installation techniques.

Follow the three basic concepts listed below.

1. Size the insulation thickness and inside diameter correctly.
2. Always push the insulation material — never pull the insulation into place.
3. Seal all seams, butt joints, and open ends.

#### Size the Insulation

Proper sizing applies to both insulation inside diameter and wall thickness. When sizing insulation, consider the pipe size, fluid temperature, ambient temperature, relative humidity, etc. If the insulation thickness is incorrect, the performance will fail to reach expectations. This can result in excessive condensation on the outer surface of the insulation.

Pipe insulation inside diameters are designed to slide easily over piping and most fittings.

#### Push Don't Pull

When installing insulation, it is important not to stretch or pull the insulation; it must be pushed into place rather than pulled.

Stretching the elastomer insulation by pulling causes two problems:

- A reduction in thickness.
- Stress on the insulation, which will result in cracks in the insulation.

All butt joints must be fitted under compression to insure adhesion. In addition, to prevent stress on the joint resulting from expansion and contraction, insulation should only be attached to systems which are unheated at the time of installation.

Keep pipes sealed when sliding on insulation to prevent insulation lubricating powder from entering the pipe.

#### Seal all Seams

All seams and joints in the entire system must be sealed to control condensation. All butt joints, longitudinal seams, and termination points should be sealed by an approved contact adhesives, factory applied pressure sensitive adhesive, or other methods recommended by the manufacturer.

**Note: The use of electrical or duct tape is not recommended.**

When using a contact adhesive, the adhesive should be applied to both surfaces (a thin uniform coating on the pipe outside and on the insulation inside), allowed to tack dry, and pressed firmly together.

When using pressure-sensitive adhesive insulation, application is easier. There is no need to wait for it to become tack dry after applying adhesive. Care should be taken when removing the release liner from the PSA to avoid contamination with dirt.

The insulation must also be sealed around all tees, ells, fittings, valves, and at the end of the pipe runs to prevent ambient air with moisture from entering the system.



#### Caution!

**If the elastomer insulation system is not sealed, the insulation's performance will not reach expectations. Failure to observe this warning will result in condensation formation between the insulation and the pipe.**

# INSTALLATION

## SECONDARY COOLANT PIPING INSTALLATION

### Piping Structural Support

**⚠ Caution!** Always comply with local building codes and regulations when designing and installing secondary coolant pipe supports. Failure to comply with this caution can result in serious damage and a loss of system efficiency.

Metal hangers used to support the pipe being insulated create an insulation application problem. The weight of the pipe is concentrated at the point of contact with the hanger and compresses the insulation on the pipe in that area if the insulation is not supported correctly. The compressed insulation (as a result of the reduced thickness) would not perform as expected. Maintaining the correct insulation thickness is especially critical on cold piping systems, where a reduction in design thickness could result in condensation.

- Always comply with building code minimum support spacing specifications. When calculating pipe hanging support spacing, always include the coolant fluid weight in the calculation.
- Supports for plastic piping must prevent sagging resulting from a combination of the pipe flexibility and coolant fluid weight.
- Secondary coolant piping must be installed so that pipe vibration is eliminated. Pipes that rub against solid objects wear holes through copper or insulation and can result in fluid leakage.
- When secondary coolant pipes pass through structural walls, each pipe must be contained in a sleeved-fitting that prevents pipes from touching.
- Piping supports for insulated secondary coolant piping must comply with the following:
  - The support saddle support surface must be smooth and support a surface length of at least three pipe diameters.
  - The support saddle must support an area of at least 120° of the pipe surface.
  - The saddle may be constructed from galvanized steel, aluminum, or PVC plastic.
  - The saddle may be supported by a column on the floor or by a hanger mechanism attached to the roof. A minimum 1" space should be between parallel pipes (to prevent condensation from forming on the insulation surfaces).

Figure 21 — Typical Insulated Pipe Support

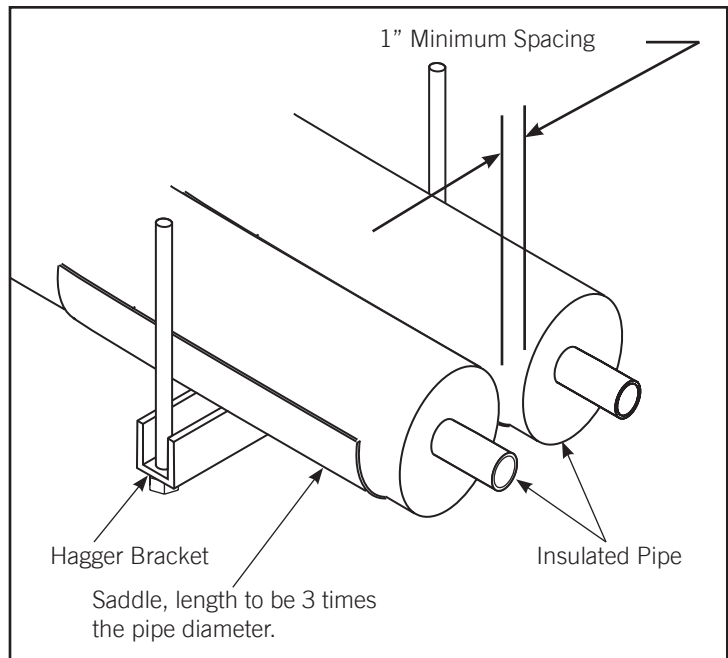
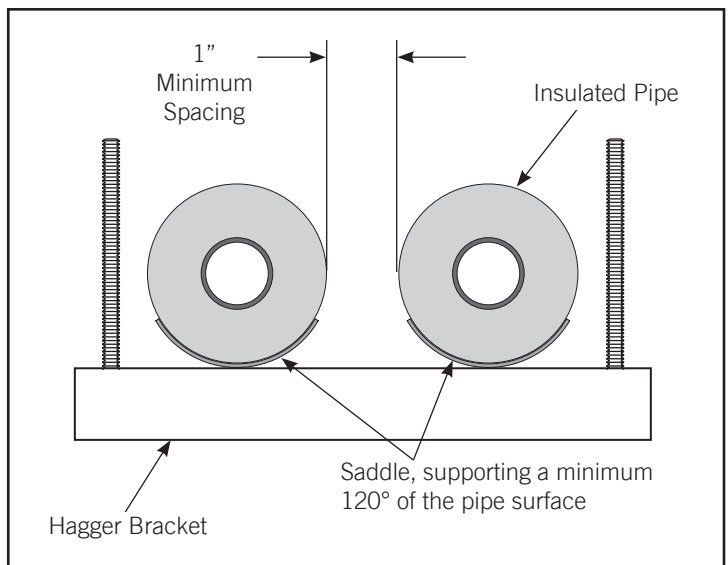


Figure 22 — Typical Insulated Pipe Support Bracket and Saddle



# INSTALLATION

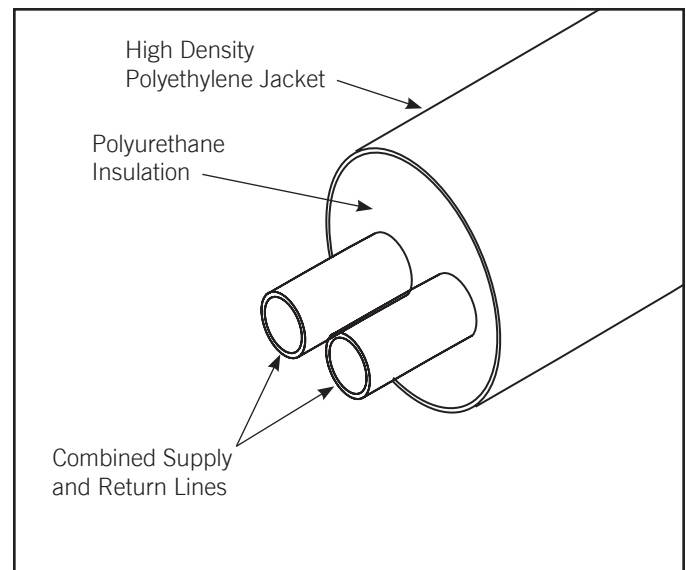
## SECONDARY COOLANT PIPING INSTALLATION

- Commercial pipe clamping systems allowing pipes to be held rigidly without causing damage are available. These systems should include some form of rubber grommet fitting around the pipe and attached to a bracket.
- Secondary coolant piping must be protected from mechanical damage. Where piping is exposed to possible damage, the pipes should be routed out of the way or be protected in some form of protective shield. Avoid burying secondary coolant piping.
- Piping support must prevent heat transfer from the secondary coolant fluid pipe to the support structure (by using insulation material).

### PRE-INSULATED PIPING

- Pre-insulated piping systems are available to be used in secondary coolant fluid pipes.
- Carrier pipe material can be:
  - Steel (welded joints or press-fit systems)
  - PVC
  - Copper, Type K, L, and M
- Insulation: polyurethane foam
- Jacket: high density polyethylene

**Figure 23 — Typical Pre-Insulated Double Pipe**



#### **Caution!**

All pre-insulated piping systems must be installed according to the piping manufacturer's specifications and instructions. Failure to comply with this caution can result in a system failure.

Pre-insulated double piping may be used, combining supply and return lines, in a single insulated jacket. These double pipe assemblies should not be used with warm fluid defrost applications.

# INSTALLATION

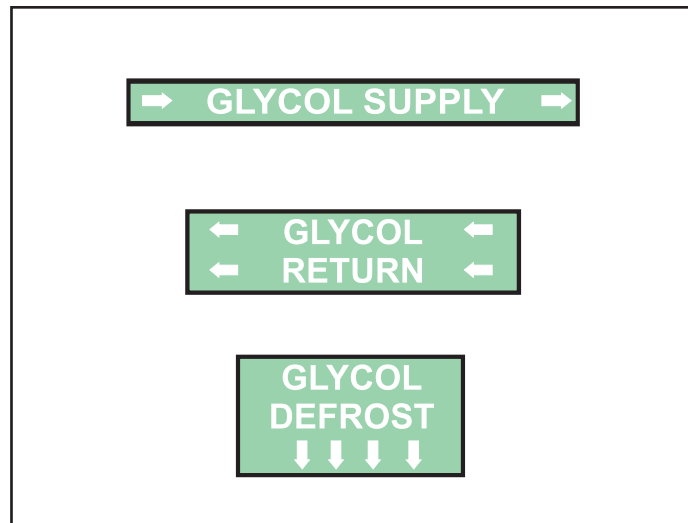
## SECONDARY COOLANT PIPING INSTALLATION

### SECONDARY COOLANT PIPE LABELING

All secondary coolant piping and fittings must be clearly labeled so that operation and maintenance personnel can easily identify all elements of the secondary coolant system.

1. All labeling must comply with ANSI/ASME Standard A13.1-81, Scheme for the Identification of Piping Systems.
2. DOWFROST™ is classified as a low hazardous material. Labels should have white characters on a green background.
3. Each label will display the following information.
  - a. Secondary coolant fluid type.
  - b. Pipe purpose, supply, return, or defrost.
  - c. Arrow indicating the flow direction.
4. Labels should be positioned on the pipes so they can be easily read. Proper label placement:
  - Lower side of the pipe if the operator has to look up to the pipe.
  - On the upper side of the pipe if the employee has to look down towards the pipe.
  - Directly facing the employee if on the same level as the pipe.
5. Labels should be located near valves, branches, where a change in direction occurs, on entry and re-entry points through walls or floors, and on straight segments with spacing between labels that allows for easy identification.
6. Refer to the table below for character heights.

**Figure 24 — Example of Typical Pipe Labels**



**Table 8**

OUTSIDE PIPE DIAMETER	LETTER HEIGHT
3/4" to 1-1/4"	1/2"
1-1/2" to 2"	3/4"
2 1/2" to 6"	1 1/4"
8" to 10"	2-1/2"
Over 10"	3-1/2"



# COLDLOOP SYSTEM START-UP



## **Danger!**

Always read and understand the information in Safety from page 7 to page 10 before installation, operation, or before performing maintenance. Failure to comply with this warning can result in serious injury or death!



## **Warning!**

All personnel working on the installation, including temporary workers, must read and understand this manual. Failure to comply with this warning can result in serious injury or damage to equipment.

*Note: The installation contractor is responsible for the ColdLoop System installation, secondary coolant piping installation, the system start-up, and making sure that the entire system complies with all operation specifications.*

## START-UP PREPARATION



## **Caution!**

Never run the primary refrigeration system with the secondary coolant system off or with secondary coolant fluid flow interrupted. Failure to observe this caution will result in a ColdLoop Secondary freeze-up which can cause significant damage.

Before placing the ColdLoop Secondary system into service, make sure that the following items are completed.


1. Make sure that the ColdLoop secondary and primary refrigeration system compressor rack is level.
2. Make sure that the secondary coolant system piping complies with the system piping schematic and good refrigeration practices.
3. Make sure that the electrical service is connected and that the remote disconnect is fused, grounded, and sized correctly. All service connections must comply with the National Electrical Code and local regulations.
4. During shipment, vibration can cause fasteners and fittings to loosen. With the remote disconnect and main disconnect placed into the off position and locked out, make sure that all fasteners in the ColdLoop System are tight. Make sure that all wire connections in the electrical enclosure are tight. Check all fittings for tightness.
5. Leak test the entire primary refrigeration system.
6. Place the remote disconnect into the on position.
  - Check the voltage, line to line, on the main disconnect terminals on the line side.
  - The voltage must be within 5% of the voltage rating on the nameplate.

## COMMON TOOLS

- Glycol Transfer Pump
- Garden Hose
- Garden Hose Shut-off Valves
- Anti-Siphon Adapter
- Pails
- Clear Tubing to Connect to Vents and Drains
- Hose Clamps
- Protective Gloves to Avoid Dye Staining
- Pressure Gauges Specifically for Glycol
- Tire Pressure Gauge
- Differential Pressure Gauge
- Refractometer

# COLDLOOP SYSTEM START-UP

## SECONDARY COOLANT SYSTEM START-UP

 **Caution!** Do not attempt to start the primary refrigeration system until the secondary coolant system pumps are circulating 35% propylene glycol and the primary refrigeration system startup procedure is completed. Failure to comply with the caution can result in serious damage to the ColdLoop Secondary system.

### PIPING PRESSURE TEST

The secondary coolant piping system must be pressure tested before cleaning or filling with coolant fluid. Follow the guidelines in ASME B31.5, *Code for Pressure Piping*.

1. Testing can be one of the following methods:
  - a. Hydraulic test with clean water
  - b. Pneumatic test with dry nitrogen (pneumatic tests make leak repair easier)
2. The piping system must be tested at the pressure specification for the system using one of the methods above.
  - a. Any elements (relief valve etc.) in the system that are rated for service less than design pressure must be isolated during the pressure test.
  - b. These elements must be tested at their designed pressure rating.
3. The system must sustain the design pressure level or higher for four hours without any leakage.
  - a. An ambient temperature drop during a pneumatic test that causes a system pressure drop below the minimum test level terminates the pressure test.
  - b. If any leakage is observed, terminate the test:
    - i. Repair the source of the leakage.
    - ii. Restart the test.
4. If a pneumatic test method is used, the coolant pumps must be isolated from the system to avoid damage to the pump seals.
5. Plastic piping may deform and expand during the initial stages of the test. Consult the pipe manufacturer for additional testing method information.
6. Test procedure and results must be documented and submitted to the end user and Zero Zone.

### Test Procedure

1. Make sure that control circuits are energized and that all solenoid valves function.
2. Open all:
  - a. Balance valves, fully
  - b. Ball valves, fully
  - c. Solenoid valves
3. Close all:
  - a. Vents (Make sure that all threaded caps are installed.)
  - b. Drains (Make sure that all threaded caps are installed.)
4. Pressure test piping after isolating:
  - a. The expansion tank
  - b. The coolant pumps, if conducting a pneumatic test
  - c. Any components that are not rated for the test pressures

# COLDLOOP SYSTEM START-UP

## SECONDARY COOLANT SYSTEM START-UP

### SECONDARY COOLANT PIPING CLEANING

After the secondary coolant piping system has been successfully tested, it must be cleaned to remove any debris or residue created during the installation before filling with coolant fluid.



**Caution!** Do not run the primary refrigeration system while cleaning the secondary coolant system. Failure to observe this caution can result in a heat exchanger freeze-up and significant damage to the system.

### Flushing Procedure

Refer to **Figure 25** on **page 60**.

1. Open all internal valves in the system (all solenoid valves must operate and be open).
2. Close all drain valves and vent valves.
3. Connect hoses:
  - a. Connect a clean water source to a valve such as the **DRAIN VALVE** at Point 1 on the schematic in **Figure 25** on **page 60**.
  - b. Connect a drain hose to the highest valve in the system such as the **VENT VALVE** at Point 2 on the schematic in **Figure 25** on **page 60**.
4. Fill the system from the clean water source.
  - a. It may be necessary to restrict the **DRAIN AND VENT VALVE** to maintain system pressure at a maximum of 30 psig.
  - b. Starting at the lowest point in the system, open each vent valve to the atmosphere until air is expelled from the circuit and water flows from each vent valve. Close the valve and proceed to the next vent valve.
  - c. Make sure that all air is vented from all refrigerated fixture coils. Isolate and flush one circuit at a time.
5. Continue to flush the system until the water flowing from the drain hose is clear.
6. Remove the clean water source.
  - a. Close the valve at Point 1.
  - b. Close the valve at Point 2.
  - c. Disconnect the clean water source and the drain hose.

### Flushing Steel Pipe

1. Clean carbon steel piping with a solution of 1 to 2% trisodium phosphate and water.
2. Flush until the cleaning solution runs clean.
3. After the initial flush with trisodium phosphate and water, flush with clean water.
4. If the system continues to show dirt after step 2 above, using a stronger cleaner will be required.
5. If a petroleum-based flux is used for soldering piping or other components, special cleaning is required.
  - a. Fill the piping system with a solution of 1-part trisodium phosphate and 100-parts clean hot-water (up to 150°F) and circulate for four hours.
  - b. Drain the trisodium phosphate-water solution from the system.
  - c. Fill the piping system with a solution of non-foaming detergent (1-part per 400-parts water) and clean hot-water (up to 120°F). Circulate for four hours.



**Caution!** Do not use a foaming detergent or a detergent that contains chlorides. Failure to observe this caution can result in damage to the system.

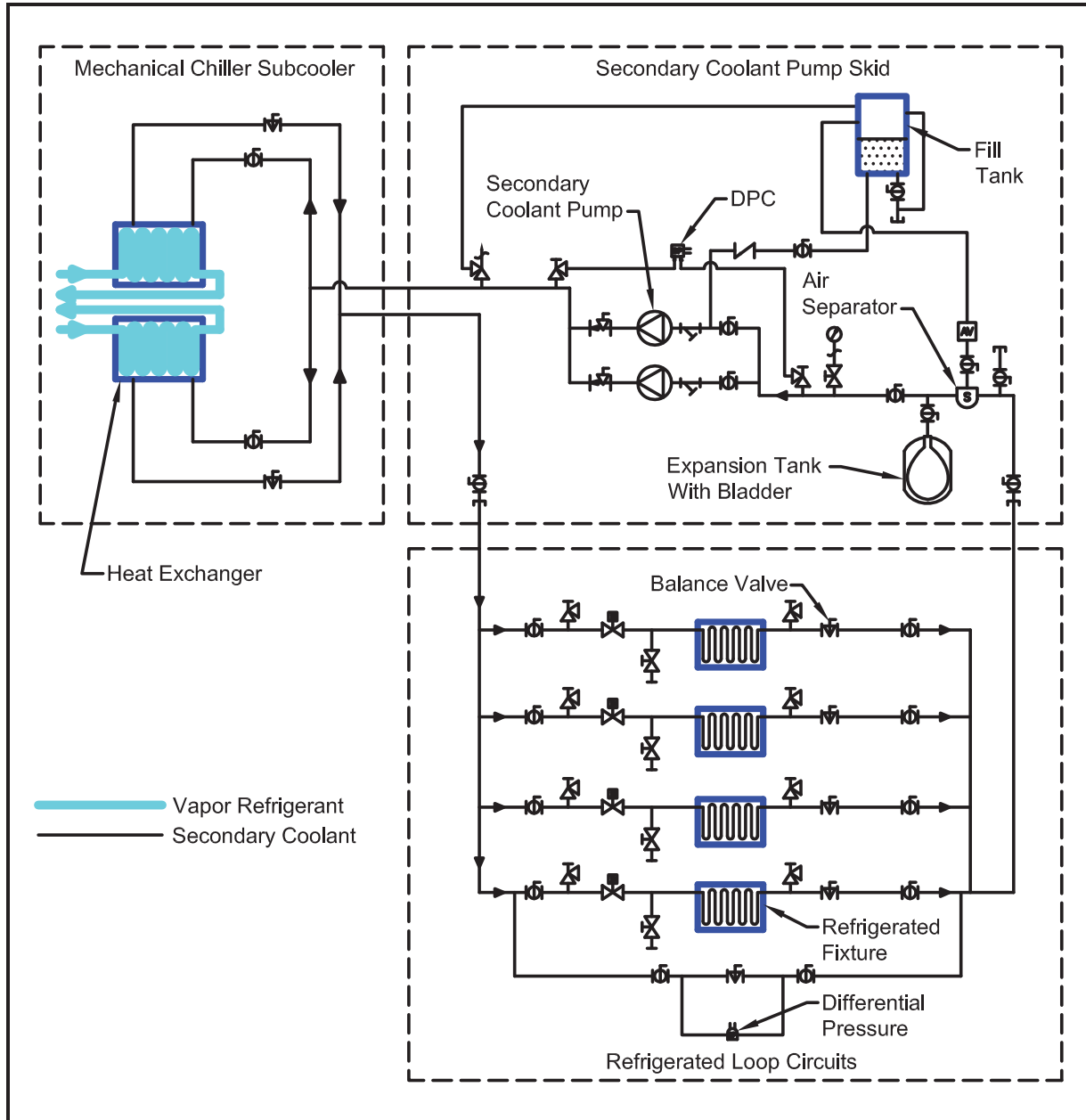
- d. Flush the pipe system with clean hot water until the system is free of cleaning solutions.
- e. Remove and clean all strainers.

# COLDLOOP SYSTEM START-UP

## SECONDARY COOLANT SYSTEM START-UP

### SECONDARY COOLANT PIPING CLEANING

Figure 25 — Schematic of a Typical Medium Temperature Secondary Coolant Installation



# COLDLOOP SYSTEM START-UP

## SECONDARY COOLANT SYSTEM START-UP

### Expansion Tank

The expansion tank contains a rubber bladder that holds the glycol and is surrounded by pressurized air. The expansion tank has four main purposes. The first purpose is to provide an air cushion that will allow glycol to expand if the glycol temperature warms. This could happen when the system is shut down and warms from operating conditions (say 20 to 25°F) to ambient conditions. The second purpose is to provide a pressure ballast to keep the system from losing pressure if a small amount of glycol is lost during servicing or from a small leak. The third purpose is maintaining a positive pressure at the highest point in the system. The fourth purpose is to maintain a net positive suction pressure for the pump. **The tank pressure must be set before any liquid is added to the system.**

The pressure for the initial air charge is determined by the store layout. The goal is to maintain a positive pressure in all parts of the system at all times and make the best use of the surge capacity of the bladder. If the initial air pressure is too low or too high, surge volume will be used up. As the system is filled with liquid, the liquid height will increase the static pressure measured at the pump skid. The bladder pressure should be 2- 5 psi higher than the eventual static head pressure. Static pressure in psi is calculated by taking the difference in height from the expansion tank to the tallest pipe in the system and multiplying it by .45 psi/ft of 35% glycol. Regardless of the calculations, the bladder pressure should not be set lower than 10 psi.

- **Example 1:** The expansion tank is at grade on the floor. The highest pipe is 20 ft off the floor.  $(20 \text{ ft} \times .45 \text{ psi/ft of 35\% glycol}) + 5 \text{ psi} = 14 \text{ psi}$ .
- **Example 2:** The expansion tank is on the roof and the highest pipe is 8 ft above the expansion tank.  $(8 \text{ ft} \times .45 \text{ psi/ft of 35\% glycol}) + 5 \text{ psi} = 8.6 \text{ psi}$ . The minimum setting is 10 psi so the tank would be set at 10 psi.

The following is an example of typical set points for the system with the highest pipe 20 ft above grade.

- Bladder pressure (before adding liquid to the system) = 14 psi.
- Typical pump suction pressure (system pressure) (10 psi above bladder set point) = 24 psi. The pressure is adjusted by adding more glycol to the system as described on **page 63** of this manual.
- Low suction pressure safety = 5 psi.
- Optional low suction pressure alarm 5 psi below system pressure = 19 psi.

Check the pressure using a tire pressure gauge. Add air if necessary using a tire inflator. The pressure must be checked **before** the liquid is added to the system. After the system is filled with liquid, the bladder pressure will match the system pressure whenever the system pressure is above the initial bladder pressure, making a reading meaningless.

The following is an example of expansion tank capacity for a system with a 1000 gallon charge and operating pressures determined in the examples above. Consult the factory to determine your specific capacities.

- System charge (measured on site) = 1000 gallons
- Required expansion volume (calculated) = 9.2 gallons
- Static head (measured on site) = 20 ft
- Expansion tank size (Zero Zone standard size) = 37 gallons
- Expansion tank pre-charge (determined above) = 14 psig
- Pump suction pressure (system pressure, determined above) = 24 psig
- Available expansion volume (calculated) = 15.6 gallons
- Leak volume before rapid pressure drop (calculated) = 9.6 gallons

# COLDLOOP SYSTEM START-UP

## SECONDARY COOLANT SYSTEM START-UP

### Start the Coolant Pumps

After the piping system flows clean water from the drain, run the coolant pumps as follows. Close and cap all valves used to flush the system as shown in **Figure 25** on **page 60**. Fill the fill tank with water.

1. Before starting a pump motor, make sure that a pressure gauge is installed on each side of the coolant pumps.
2. Start the coolant pumps as follows:
  - a. Make sure that each pump is full of water by cracking a pump vent and then closing the pump vent — If no water comes out of the vent, add water to the system using the fill tank. At this point, gravity will feed the water into the pumps from the fill tank.



#### **Caution!**

**Never run a coolant pump when it is dry. Failure to observe this caution will result in damage to the pump seals.**

- b. Manually cycle each pump on and off, one at a time, to make sure the rotation direction is correct.
- c. Start the pumps, one at a time, and check current draw for each pump. If the current draw is above the FLA listed on the pump motor, reduce it by throttling the pump balance valve until a safe amperage is achieved.

#### **System operation**

Two pressures are used to monitor system operation. The first is system pressure. The pressure can be measured when the pumps are turned off or it can be measured at the pump suction with the pumps running. The second pressure is pump differential. Pump differential pressure is measured with one or more pumps running. The pump differential is the total pressure drop in the system and may vary by valve settings and how many fixtures are calling for cooling.

System pressure is developed by using the pumps to draw fluid out of the fill tank and force it into the system. See the Expansion Tank section for appropriate pressure settings.

#### **System fill/pressurization procedure:**

Whenever any of the following conditions are observed, air is trapped in the secondary coolant system.

- Erratic or uneven fluid flow.
- Fluctuations in suction and discharge coolant pump pressures.
- Excessive noise cause by the pump impeller.

To pressurize the system, do as follows. Refer to **Figure 25** on **page 60**.

- a. Make sure that all system vent and drain valves are closed and that all other internal valves are open.
- b. The fill tank fluid level must be between the minimum fill level and the overflow level.
- c. All pumps should be shut off.
- d. Close fill valve.
- e. Turn on the coolant pump connected to the fill line.
- f. Close the pump's suction valve.
- g. When the coolant pump suction pump pressure gauge reads below 0 psig:
  - i. Slowly crack open the fill valve.
  - ii. Fluid will flow from the fill tank into the system.
  - iii. Close the fill valve before the fill tank below the minimum fill level.

# COLDLOOP SYSTEM START-UP

## SECONDARY COOLANT SYSTEM START-UP



### Caution!

**Do not allow the fill tank go below the minimum fill level. Allowing the fill tank to empty with the coolant pumps running and the fill valve open causes the system to ingest air.**

- iv. Add fluid to the fill tank. Open the pump's suction valve.
  - v. Continue the filling cycle by repeating step f - i through v, until the system pressure reaches 15 psig.
  - vi. The second pump may be energized.
  - h. When fluid is circulating, the suction pressure will rise above 0 psig and the automatic air vent system will expel air from the system.
3. Continue to run both pumps and adjust the system pressure (pump inlet pressure) to about 10 psig above the initial bladder pressure. Add water to the fill tank and system as necessary.
    - a. Flush each loop circuit for about 10 minutes with all other loop circuits isolated.
    - b. Run the entire system for two hours. Continue to monitor the system, maintaining a minimum system pressure of 20 psig and pump motor amp draw below the motor FLA.

### Drain the System



### Caution!

**Caution! Do not drain the secondary coolant piping system unless it will be filled with coolant fluid immediately. Never leave the secondary coolant piping system empty after flushing or cleaning. Failure to observe this caution can result in corrosion.**

1. Shut down the coolant pumps.
2. Open all drain valves.
3. Force all of the water from the system with dry nitrogen at the pump skid and at the fixtures. This may take more than one nitrogen sweep.
4. Check the drained water for cleanliness and repeat the flushing process if the drained water is dirty.
5. Open and clean the pump strainers and remove the disposable suction strainer. Reinstall the permanent pump strainers.

### Add Coolant Fluid to the System

Refer to **Figure 25** on **page 60**. This illustration is a schematic of a typical ColdLoop secondary coolant system with a loop circuit.

Secondary coolant fluid may be pre-mixed or mixed on site.

- If the coolant fluid will be mixed on site, mix the solution in drums before starting to add to the system.
- Always check the coolant fluid freezing point, either pre-mixed or mixed on site, with a refractometer before adding. It must indicate a freezing point of +2°F.
- Pump the secondary coolant fluid from a drum with an external pump with a strainer.



### Caution!

**Avoid introducing air into the system. Always vent the system after filling to remove all trapped air. Failure to observe this caution can result in significantly reduced operating performance.**

# COLDLOOP SYSTEM START-UP

## SECONDARY COOLANT SYSTEM START-UP

### Initial Fill Procedure

Refer to **Figure 25** on **page 60**.

The first 10% of glycol fill for the system should be 100% concentrated glycol.

1. Connect a hose from the external pump to a valve on the lower part of the supply side of the coolant system on the pump skid. The pumps inlet line should be inserted into the bottom of the glycol drum.
2. Close all drain valves.
3. Fill the coolant system on the pump skid first and then each loop circuit, one at a time.
  - a. Close the supply isolation valve, Point 4, and the return isolation valve, Point 3. Refer to **Figure 25** on **page 60**.
  - b. Open all internal valves and vent valves in the secondary coolant system of the section being filled (excluding the valves in the loop circuits).
4. Start filling the system with the external pump.
  - a. As the fluid flows from the lower portion of the system, close each vent valve as coolant fluid reaches and flows from the valve.
  - b. Continue filling the system, closing vent valves from the lower part to the highest part of the system.
5. Open the supply isolation valve, Point 4, closed in step 3a above. Leave the return isolation valve closed.
6. Set up the loop and circuits for one-at-a-time filling as follows. Refer to **Figure 25** on **page 60**.
  - a. Open all isolation supply valves, vent valves, drain valves, and the hose bibb valves.
7. Start filling the first loop circuit. Refer to **Figure 11** on **page 41**.
  - a. Start the external pump.
  - b. Open the first loop circuit solenoid isolation valve.
  - c. Close the supply pipe vent valve when coolant fluid flows from the valve.
  - d. Close the supply pipe drain valve and hose bibb when coolant fluid flows from the valves.
  - e. Close the return pipe vent valve when fluid escapes and then open the return pipe isolation valve.
  - f. Open the return pipe isolation valve.
  - g. Operate loop for 5 minutes.
  - h. Turn off pumps.
  - i. Close loop feed valve.
8. Continue filling the loop circuits by repeating step 7a to 7e on each circuit.
9. Dye can be added to one of the later drums of glycol before it is pumped into the glycol. Alternatively, dye can also be added to the glycol fill tank. Avoid getting dye on your hands or clothing.
10. Turn off the fill pump when the system is full.

### Pressurize the System

After the initial fill, add fluid to the fill tank. At this point, the remaining air must be removed from the system.

Whenever any of the following conditions are observed, air is trapped in the secondary coolant system.

- Erratic or uneven coolant fluid flow.
- Fluctuations in suction and discharge coolant pump pressures.
- Excessive noise cause by the pump impeller.



# COLDLOOP SYSTEM START-UP

## SECONDARY COOLANT SYSTEM START-UP

To pressurize the system, do as follows.

1. Make sure that all system vent and drain valves are closed and that all other internal valves are open.
2. The fill tank fluid level must be between the minimum fill level and the overflow level. All pumps should be shut off.
3. Close fill valve.
4. Turn on the coolant pump connected to the fill line.
5. Close the pump's suction valve.
6. When the coolant pump suction pump pressure gauge (system pressure) reads below 0 psig:
  - a. Slowly crack open the fill valve.
  - b. Fluid will flow from the fill tank into the system.
  - c. Close the fill valve before the fill tank is below the minimum fill level.

**Caution!** Do not allow the fill tank to go below the minimum fill level. Allowing the fill tank to empty with the coolant pumps running and the fill valve open causes the system to ingest air.

- d. Add coolant fluid to the fill tank.
- e. Continue the filling cycle by repeating step 6a to 6e until the system pressure is 10 psig above the bladder's initial pressure.

**Note:** When the primary refrigeration system runs, the secondary coolant fluid volume shrinks requiring the addition of more coolant fluid to the fill tank.

**Open the pump's suction valve.**

7. When coolant fluid is circulating, the suction pressure will rise above 0 psig and the automatic air vent system will expel air from the system.

Periodically open vents at the high points in the system to remove air. Glycol that exits during the venting process can be returned to the fill tank.

Operating only a few circuits at a time will help move air to bleed points.

8. Continue monitoring system pressure for weeks following the initial startup. Micro bubbles of air will slowly be removed from the system. Maintain system pressure 10 psig above the bladder's initial pressure.

Figure 26 — Typical Refrigerated Fixture Piping

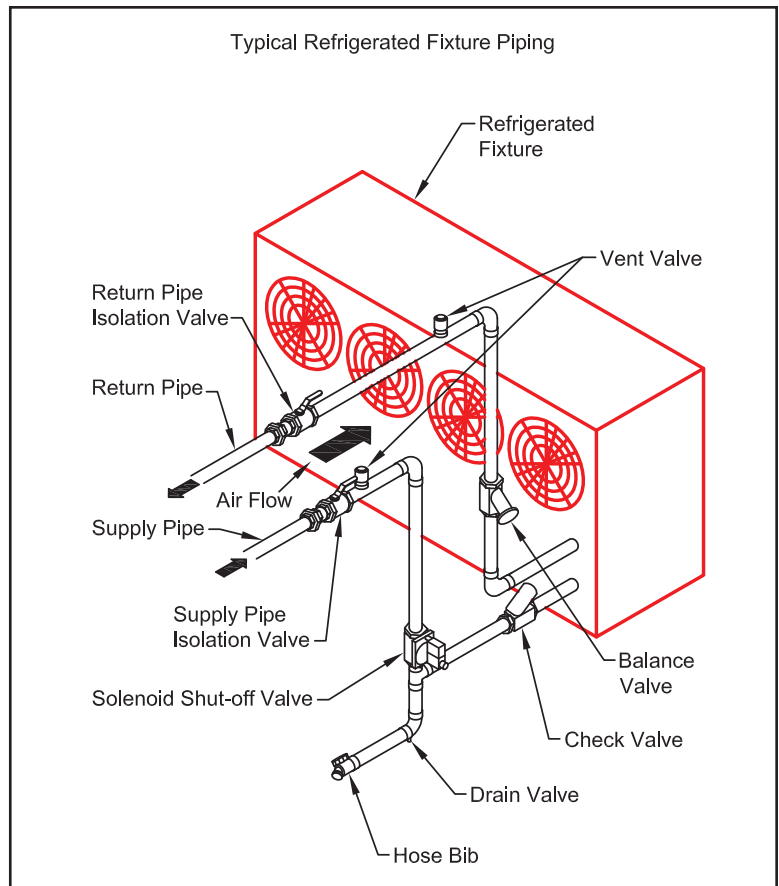
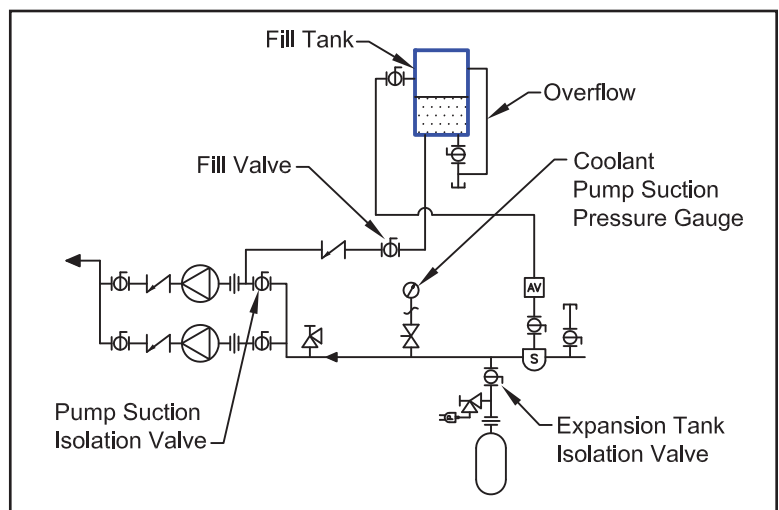


Figure 27 — Fill Tank, Expansion Tank, Coolant Pump Schematic



# COLDLOOP SYSTEM START-UP

## SECONDARY COOLANT SYSTEM START-UP

### SAFETY SWITCH SETUP

The following must be adjusted and verified before operating the primary refrigeration system. These devices prevent a ColdLoop Secondary freeze-up which can cause catastrophic damage to the system.

- Low Temperature Thermostat (Freeze Stat)..... Turns the compressors off when the secondary coolant fluid temperature approaches the freezing point — set point should be about 5°F above the coolant fluid freezing point (in this case, DOWFROST™ at a 35% solution is 2°F, so the set point should be 7°F).
- Differential Pressure Switch..... Turns the compressors and coolant pumps off when there is low coolant pump differential pressure — the set point should be 5 psi-differential below the operating differential pressure.
- Compressor Low Pressure Switch..... Turns the compressors off when the primary refrigerant suction pressure approaches the corresponding coolant fluid freezing point — the pressure setting should relate to 2 to 3°F above the coolant fluid freezing point.
- Low Pump Pressure Switch..... Turns the compressors and coolant pumps off if the glycol pump suction pressure is below set point. Typical setting is 5 psi.

# COLDLOOP SYSTEM START-UP

## SECONDARY COOLANT SYSTEM START-UP

### BALANCE VALVE SETTINGS

#### System Balance

System balance is important for a glycol system. A properly balanced system reduces the energy that a pump consumes and assures all fixtures will be able to make temperature. Balance valve manufacturers may provide specific balance procedures and sell equipment that reduces the time to balance a system. The following are general balance procedures.

#### System Preparation

- All air should be out of the system
- The system should be at operating temperature
- Pump suction pressure should be set
- Pumps should be operating at full design capacity

#### Proportional Flow

All normal fixture solenoids should be forced open. Defrost solenoids (if in the system) are forced closed.

The pump speed drive(s) should be locked to operate at full speed.

All balance valves should be 90% open. This will not optimize pump flow, but will allow easier future adjustability, should a case require colder temperatures after balancing.

Begin balancing the fixtures on one main branch.

Using a differential pressure gauge and valve manufacturer flow sheet data, measure pressure drop at the valves and determine and record the flow rates of the fixture.

Determine which fixture has the lowest flow rate in proportion to the designed flow rate. Often this fixture is the farthest from the pump system. The proportional flow rate could be below design for the fixture or the lowest proportional flow rate could be above design at about 110%.

This fixture becomes the control fixture. Other fixtures in the circuit will have their valves closed until the proportion of fixture flow to design flow is within 5% of all fixtures. Note as other valves are closed, the lowest proportional flow fixture will have increasing flow. Balancing may take a few iterative cycles.

After balancing one branch, move to the next branch and begin the process again.

After all fixtures are balanced to the same proportional flow within their own branch, balance the branches against each other using the branch balance valve.

Balance valves normally have adjustment locks that prevent the valve from being inadvertently opened to a different position after servicing. The valve should be locked after final balancing to maintain the setting.

Once the cases have a similar cycle rate, the pump control point can be adjusted until the fixtures have reached their design flow rates. All fixtures flow rates move up or down proportionally to increases or decreases in pump flow rate. All glycol solenoid valves should be returned to automatic control.

#### Case Temperature Method

This method uses the case temperature to determine which fixtures require more or less flow. Set all balance valves at 3/4 open. Operate the system and use the control system to monitor the case temperatures and solenoid valve cycling. Make adjustments until all cases have similar valve cycle rates and are at temperature. Cases that are too cold or have too much cycling will need their valves closed and should be adjusted first. Cases that are warm or have less valve cycling will require their valves to be opened. The cases are piped in parallel. When one valve is adjusted, it has a slight opposite impact on the rest of the fixtures in the store. Once the cases have a similar cycle rate, the pump control point can be raised until the valves are cycling on for 75-80% of the time.

# COLDLOOP SYSTEM START-UP

## SECONDARY COOLANT SYSTEM START-UP

### VALVE SETTINGS

**Pump suction isolation valve:** This valve is set at the full open position unless the pump is being serviced or the valve is closed as part of the system fill process (see [page 64](#)).

**Pump discharge triple valve:** This valve operates as a check valve, stop valve, and flow regulating valve. The valve is set in the full open position for normal operation and provides a check feature to prevent reverse rotation if the pump is shut down and the parallel pump is running. The valve can be closed for servicing or determining the maximum pump differential. Pump capacity can be controlled by partially closing the valve. When a speed drive is used, the valve is left full open and capacity is controlled by the speed drive.

**Chiller balance valves:** This valve is set at the full open position. The system piping is installed to provide balanced flow between the paired chillers. One valve can be partially closed if the flow rate and/or leaving temperature from the chillers is not balanced. Closing one valve will force flow to the other chiller. The valves can be fully closed to isolate the chiller for service. The chiller balance valve pressure ports can be used to measure pressure drop and calculate flow rate. The calculated flow rate will be less than the actual flow rate because of turbulence in and out of the valve body.

**Circuit isolation valves:** These valves are set at the full open position unless the circuit needs isolation.

**Fixture balance valves:** If the traditional proportional balance method is used to balance the system, the valves are at the full open position. They will be closed as needed during the balancing process. If the system will be balanced using the solenoid cycle count method the valve should be set 3/4 open at the start of balancing. The valve will be opened or closed depending on fixture flow requirements and system piping.

**End of loop valve:** This valve is set at the 50% open position. Record the pressure measured by the differential pressure transducer that is connected upstream and downstream of the end of loop valve. The pressure drop should be measured with the glycol at temperature after the system is balanced and all solenoid valves open. A minimum pressure drop at the end of loop valve maintains chilled fluid flow in the system and assures that a pressure differential and cold glycol are available for fixtures when the system calls for cooling.

**Detailed Instructions:** Refer to the custom component section of the manual for specific operating and maintenance instructions for the valves.

### DIFFERENTIAL PRESSURE SETTING

The differential pressure across the coolant pumps is affected by solenoid flow valves opening and closing, balance valve settings, and other conditions in the secondary coolant system piping. The differential pressure switch setting should be adjusted when the coolant pumps are operating at full capacity, all solenoid valves are open, all balance valves have been set, and all defrost valves are closed. The differential pressure measured under these operating conditions is the operating differential pressure. The safety switch setting should be 5-psi lower than the operating differential pressure.

### DEFROST

Defrosts should be scheduled to smooth load variations.

### PRIMARY REFRIGERATION SYSTEM START-UP IS COVERED IN THE RACK MANUAL.



#### Caution!

Never run the primary refrigeration system without a secondary coolant pump running or with secondary coolant fluid flow interrupted. Failure to observe this caution will result in a chiller freeze-up which will cause significant damage.



For other technical support, please refer to  
Zero Zone Installation and Operation Manuals  
available on the Service page at:

[WWW.ZERO-ZONE.COM](http://WWW.ZERO-ZONE.COM)

or contact the Zero Zone at:

**800-247-4496**

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