Scotsman®

# 30 Inch Wide Eclipse Modular Cubers

## Technical Training

# Scotsman® Eclipse 1300 - 2000

- Ice Making Head
  - CME1386
  - CME1686
- Compressor Package
  - CP1316
  - CP2086
- Condenser
  - ERC1086
  - ERC2086

# The Eclipse System

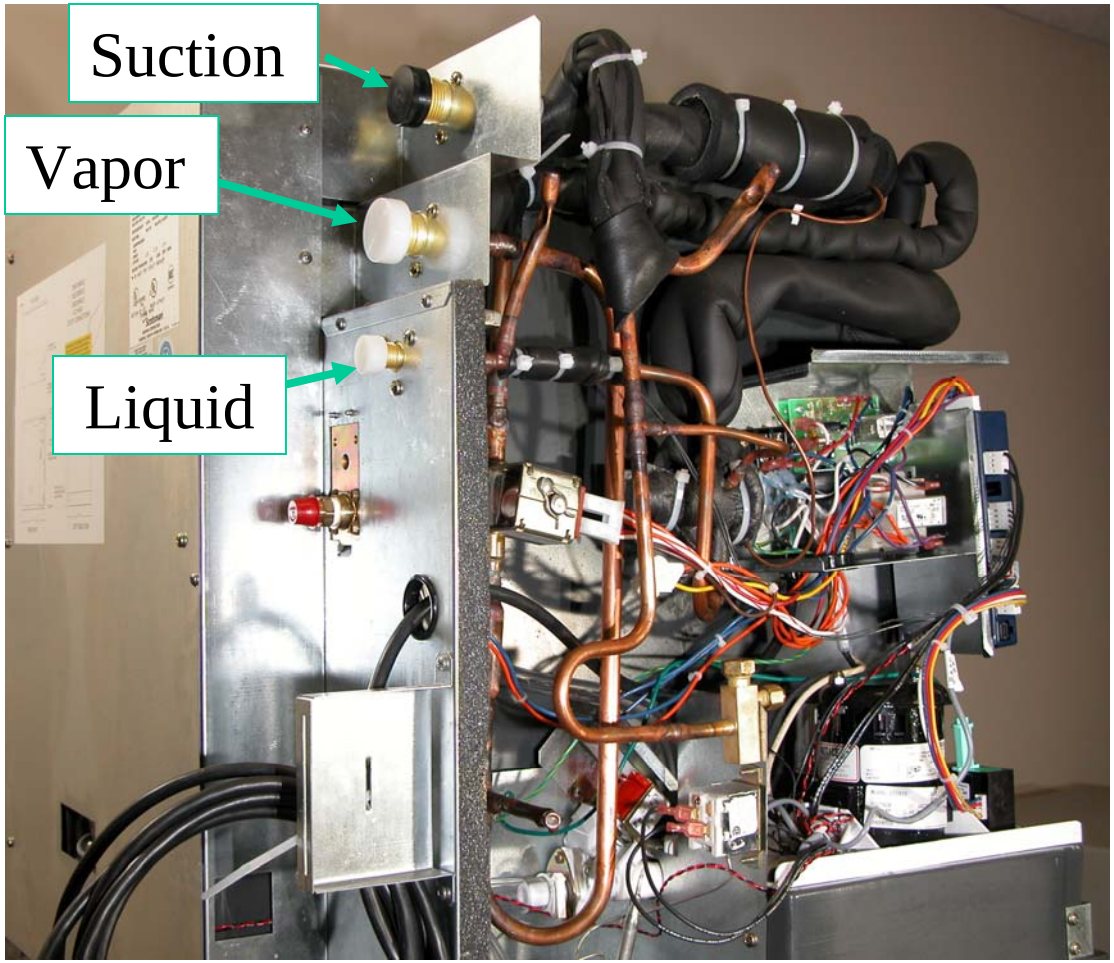
- The remote system is made up of three parts:
  - Ice Making Section or Head Unit - 115 volt
  - Compressor Package - 208-230 volt
  - AC Condenser - 208-230 volt
- Flexible Modular System
  - CME1386 or CME1686 can connect to CP1316
  - ERC1086 can be used on 1000, 1300 or 1600 systems
  - All are R-404A systems

# Ice Making Section

- 30” Wide Head Units
- CME1386 or CME1686 or CME2086
  - Remote Low Side
  - CM³ technology
    - Water and Control Systems
    - Rotomolded freezing compartment

# Ice Making Section

- Refrigerant Line Connections
  - Vapor
  - Liquid
  - Suction

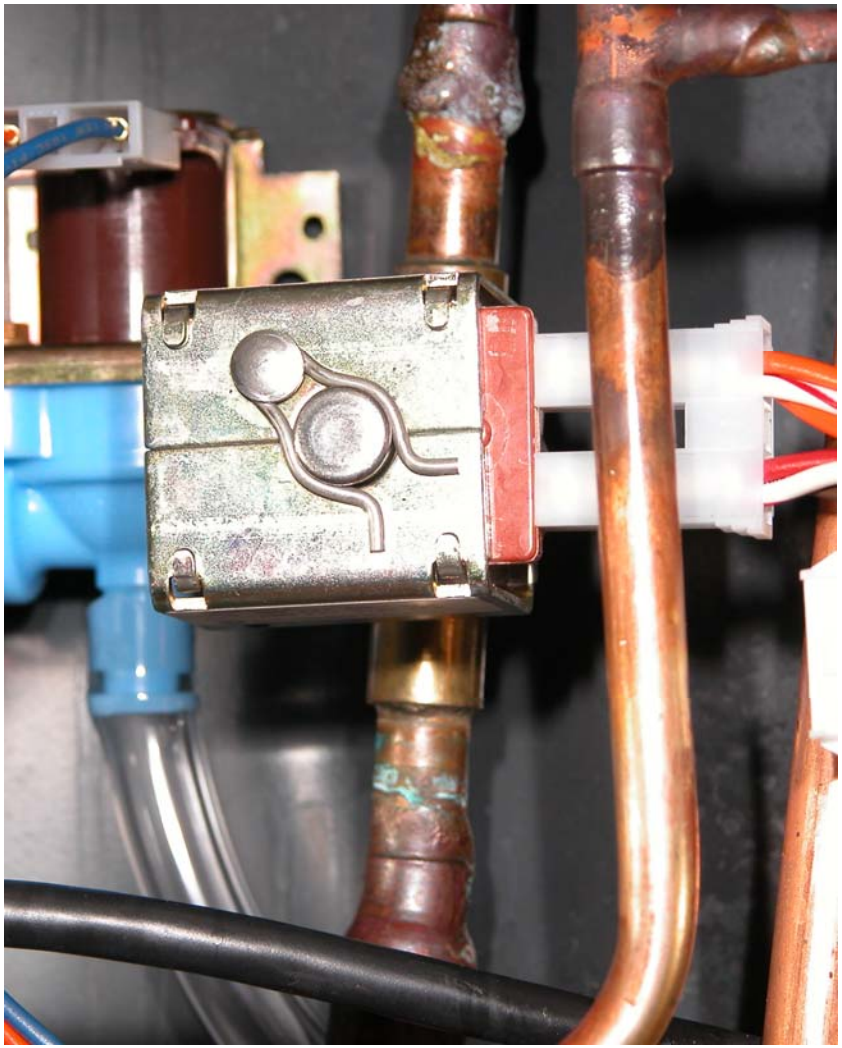


# Ice Making Section

- Ice making compartment
- Five or Six evaporators
  - CME1386 has 5
  - CME1686 and CME2086 have 6

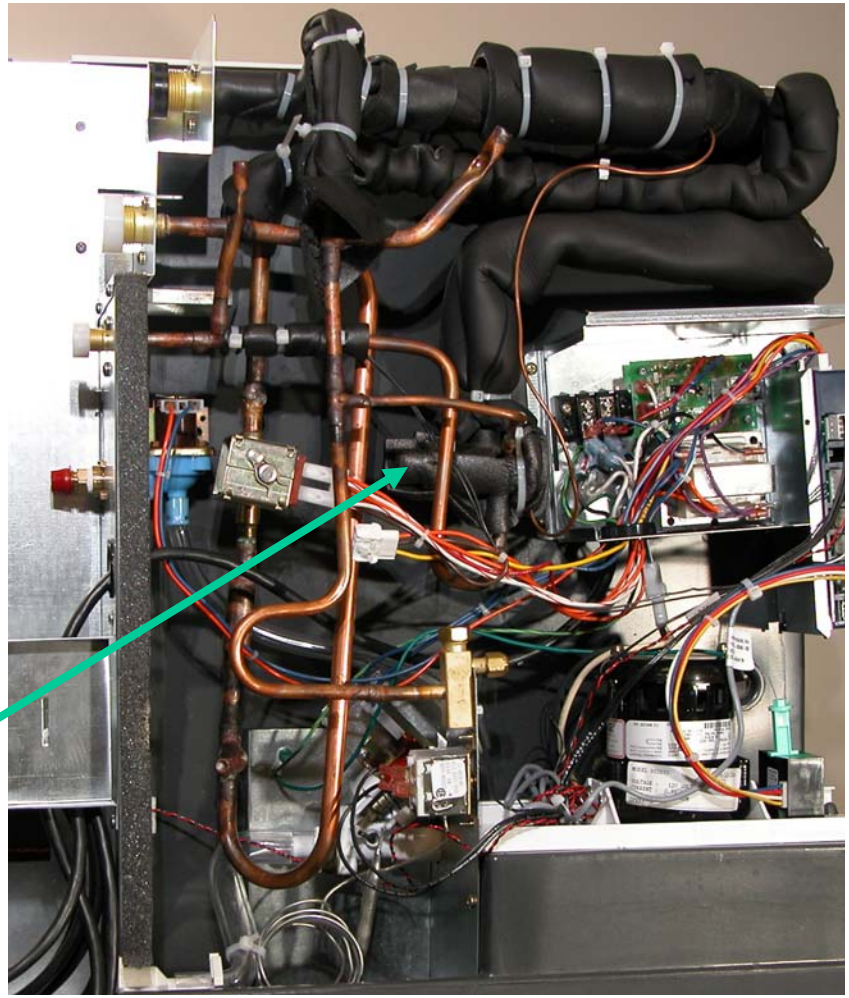
# Vapor Inlet Valve

- Purpose: Opens during harvest to allow vapor to enter the evaporators
- 24 volt coil



# One TXV

- Single externally equalized valve
  - Meters refrigerant through a distributor



# Water Pump

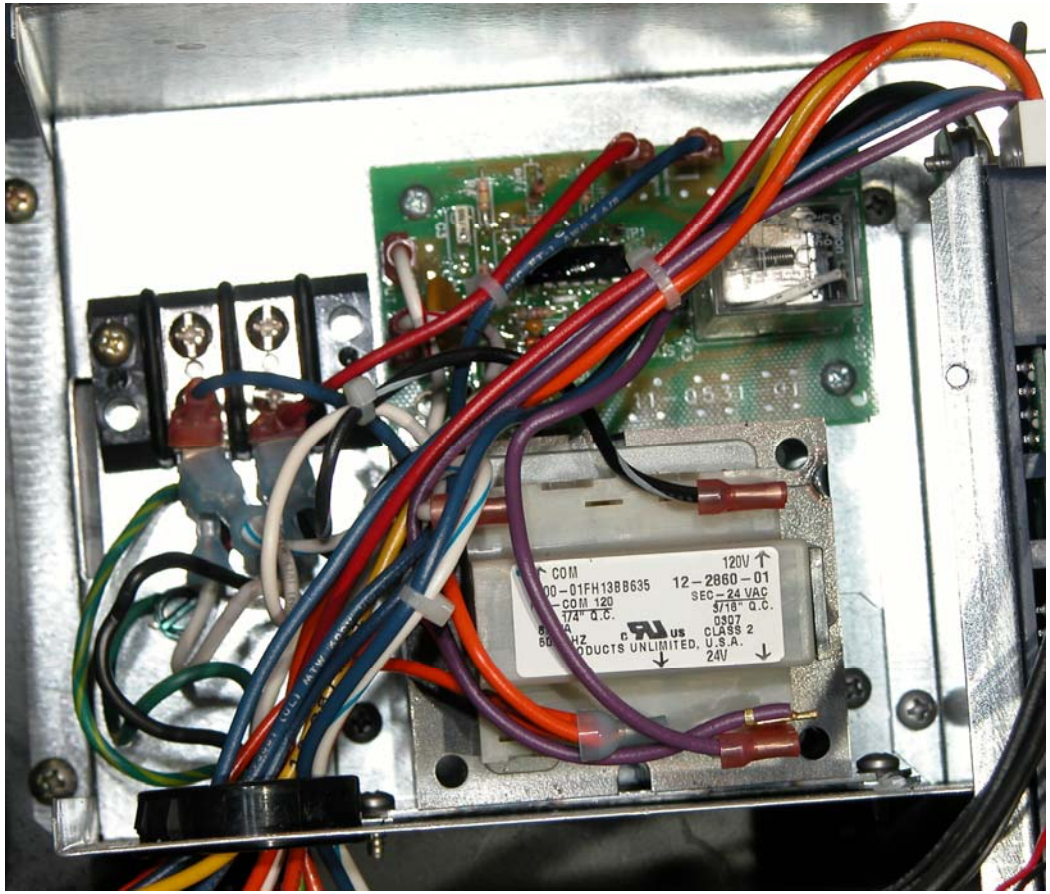
- 115 volt pump
- Same for all three
- Pedestal type
- Pump motor separated from reservoir
  - Keeps motor drier
  - Motor cap keeps condensation off motor

# Controller

- AutoIQ™plus
- Uses sensors for
  - ice harvest,
  - bin full indications
  - water reservoir temperature
  - water level
- Controls freeze and harvest cycles

# CME Electrical Box

- Transformer 115 to 24, 85 VA
- Purge valve timer
- Control wire connection nearby
  - Wire routes to compressor package
  - Controls contactor and solenoid valves




Box purposely mounted at an angle

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# Evaporator Covers

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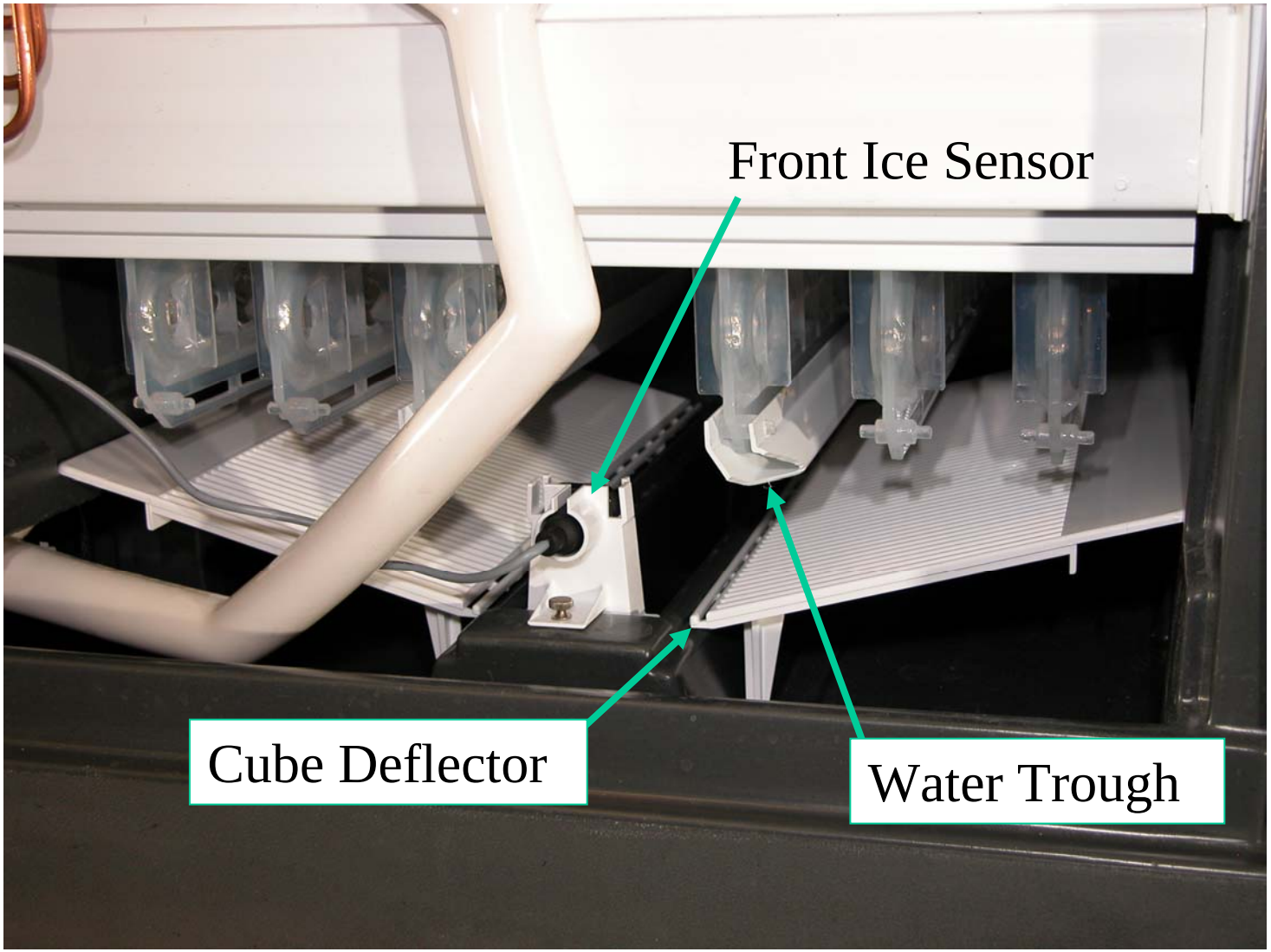
# Freezing Compartment

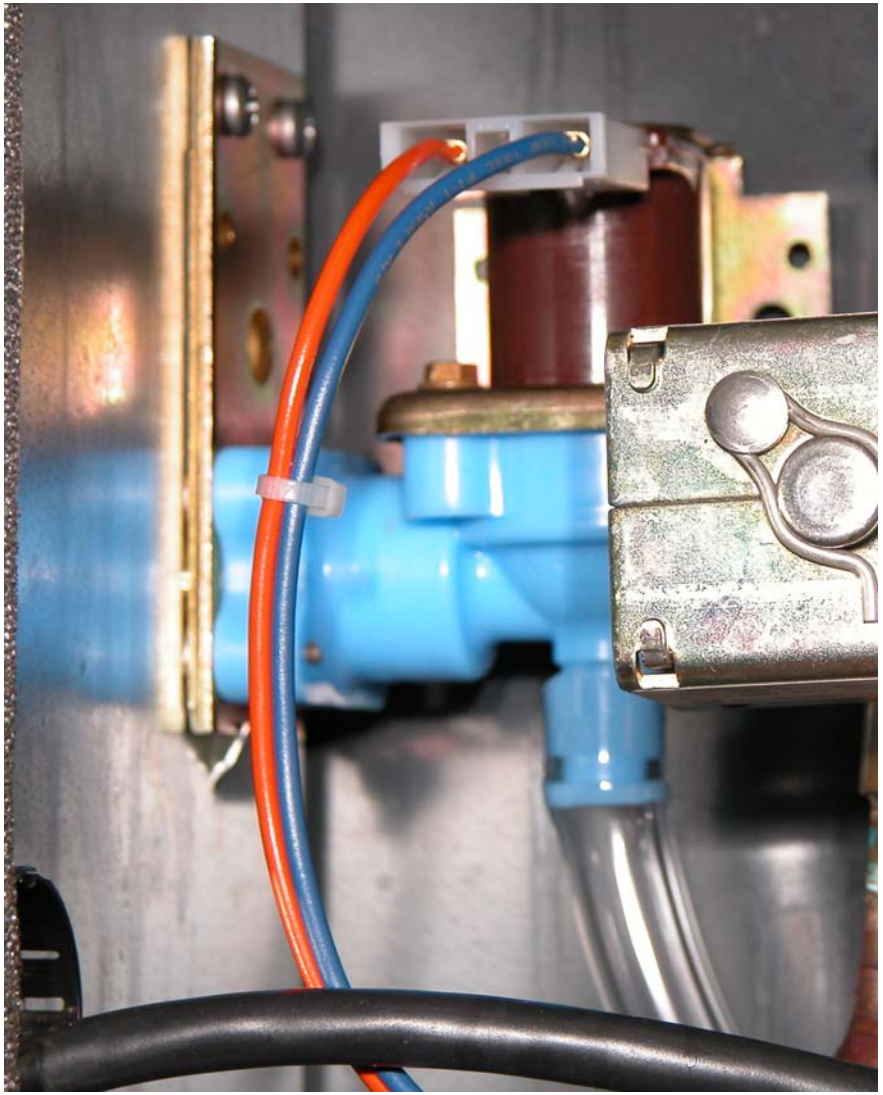


# Temperature Sensors

- Two sensors
  - Water
    - In pump discharge hose
    - Used to check water temp for anti-slush and refrigeration system operation
  - Liquid
    - Used to determine which pre-set time for first harvest cycle
      - Lower temperatures = longer first harvest cycle

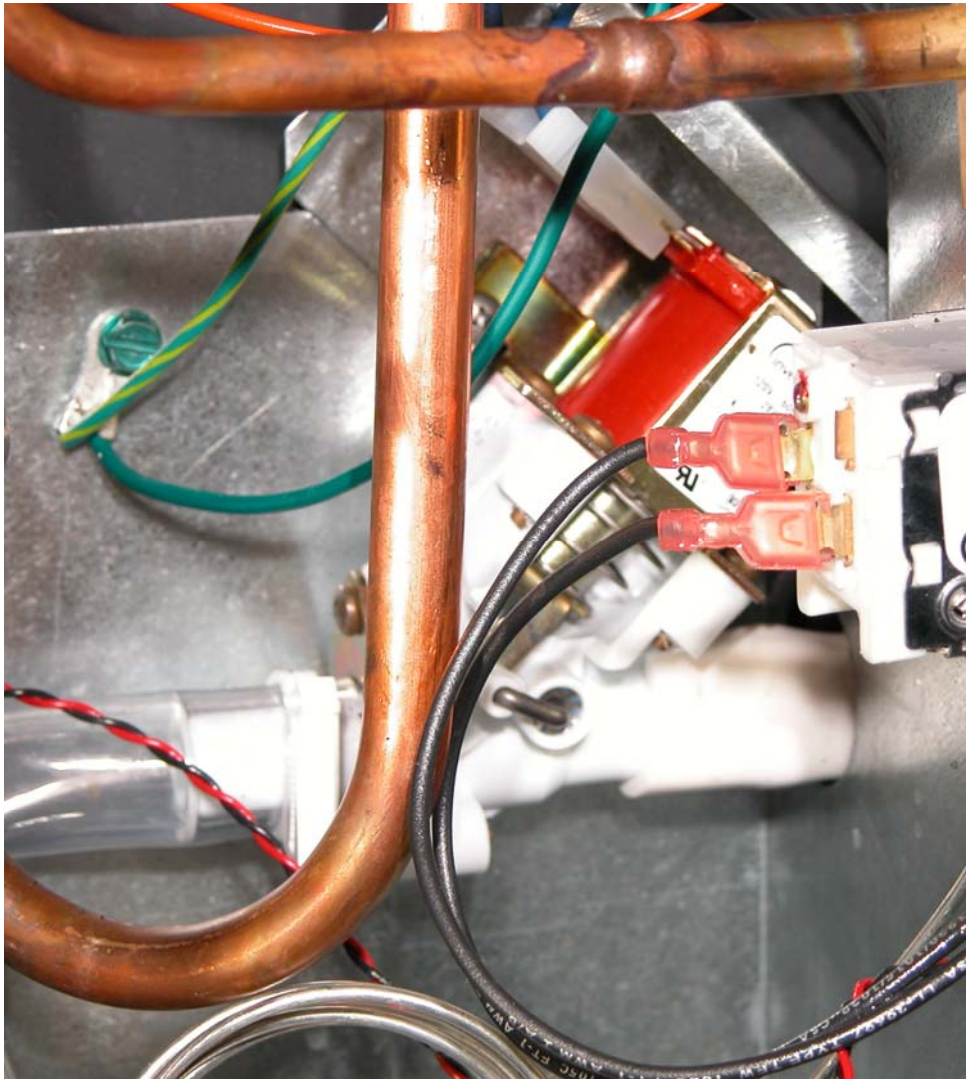
# Inlet Water Valve

- Opens to add water and fill reservoir
  - Adds water during harvest
  - Fills at beginning of freeze
  - Refills once more during freeze



# Purge Valve

- Opens to drain the reservoir during harvest
- Controlled by purge valve timer



# Ice Sensors

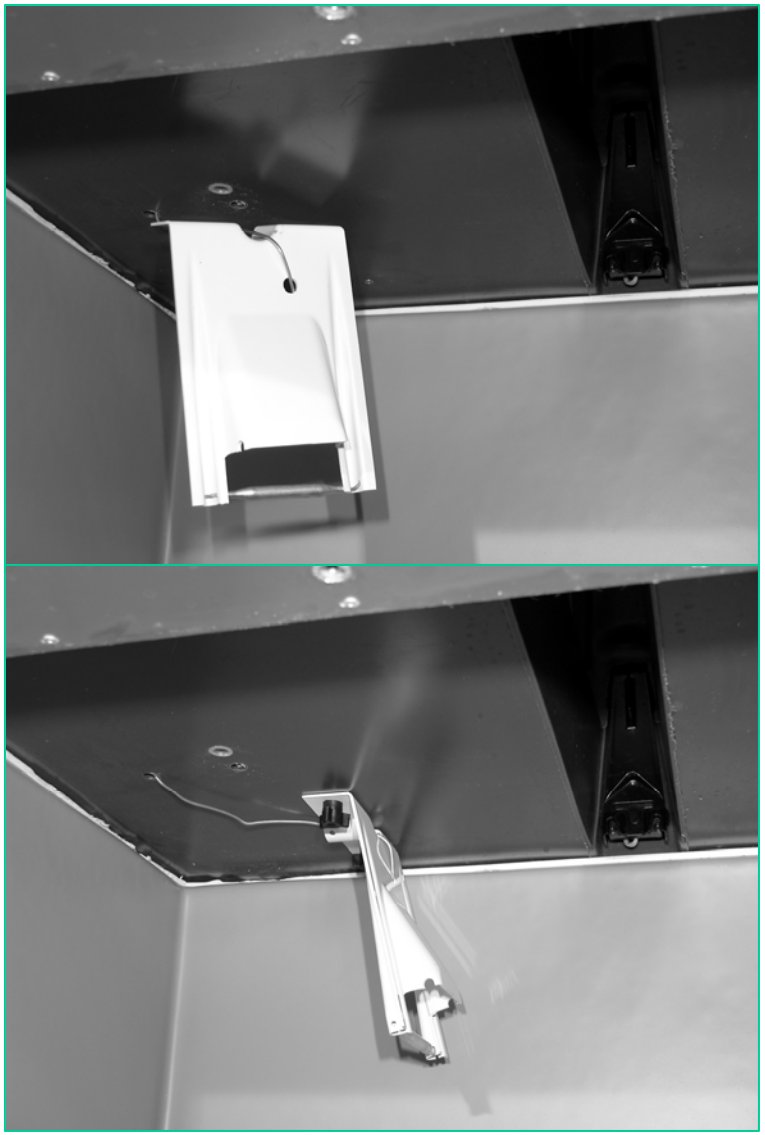
- Infrared sensors
  - Located at the ice outlet port
  - Create a light curtain
  - Harvesting ice triggers the sensor

# Bin Thermostat

- CME1386, CME1686 and CME2086 are all equipped with a bin thermostat.
- Thermostat routes through hole in base.

# Bin Thermostat

- Thermostat bulb must be mounted to the bracket
- The bracket mounts to the bottom of the ice machine



# Compressor Package

- Two models
  - CP1316
    - Reciprocating compressor
  - CP2086
    - Scroll compressor

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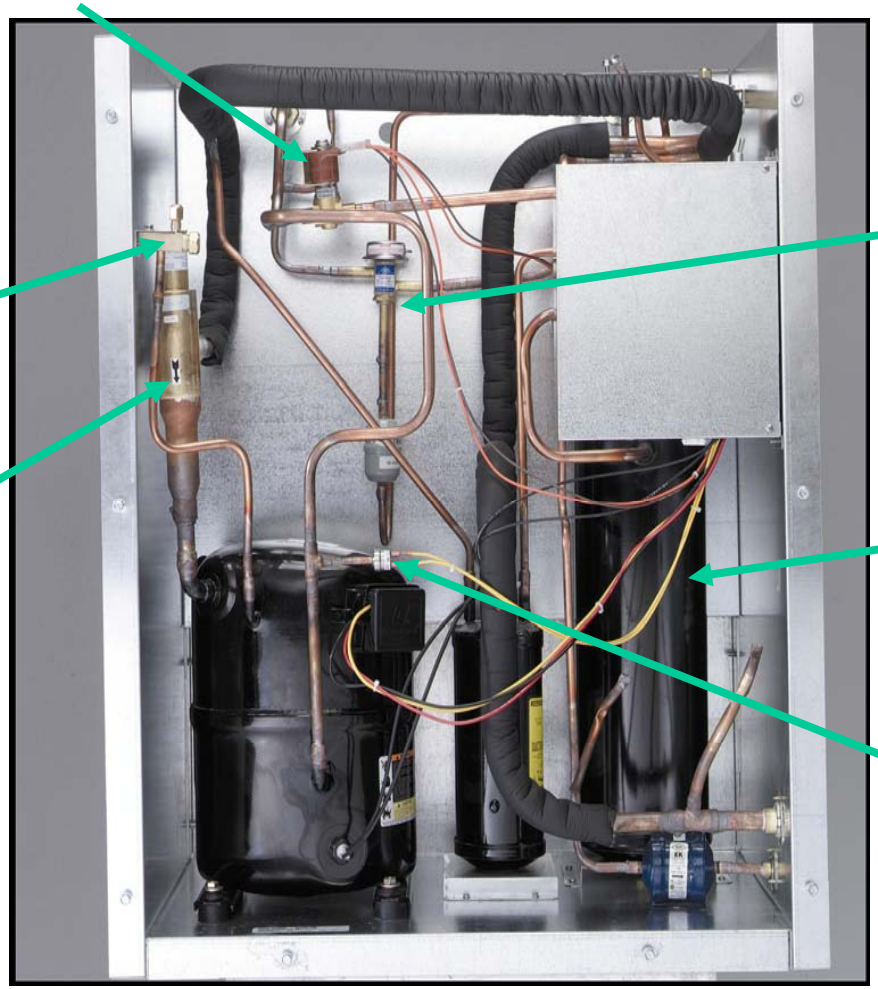
# CP Unit

Condenser Bypass Valve

Low Side Access Valve

CPR Valve



Headmaster

Receiver

High Pressure Cut Out - Auto Reset

# Access Valves


Low Side: Compressor Suction

High Side: Compressor Discharge

Receiver Liquid Outlet

# Scotsman® Crankcase Pressure Regulator

- CPR valve restricts compressor dome pressure during harvest
  - 55 to 60 PSIG
  - Pre-set - don't adjust it!

# Scotsman® Condenser Bypass Valve

- Normally Closed, opens during harvest
- Bypasses condenser coil and directs discharge gas to vapor line

# Headmaster

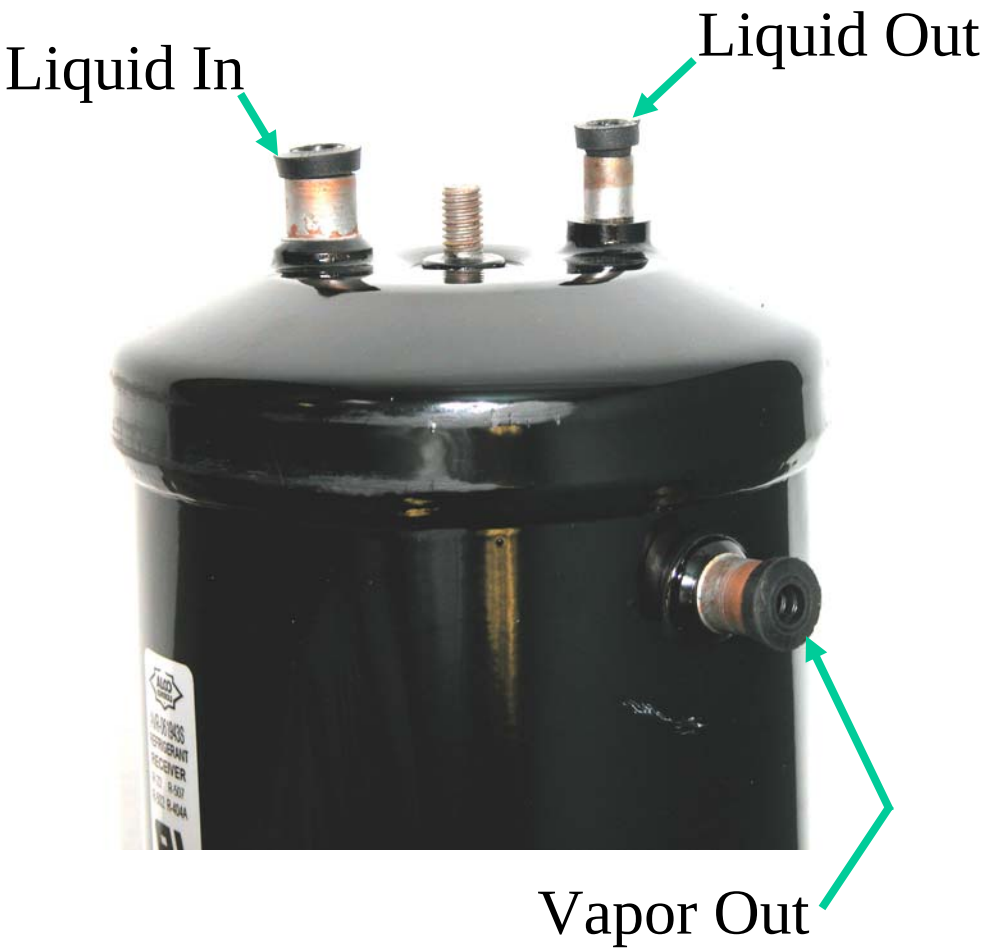
- Maintains discharge pressure during freeze
- Active at any temp below 70°F.
  - Rated at 217 PSIG, freeze cycle pressure may be between 220 and 250 during cold ambient operation

# Liquid Inlet Valve

- Normally Open, closes during harvest
- Controls liquid flow into receiver
- Isolates refrigerant in condenser during harvest
- Improves cycle time

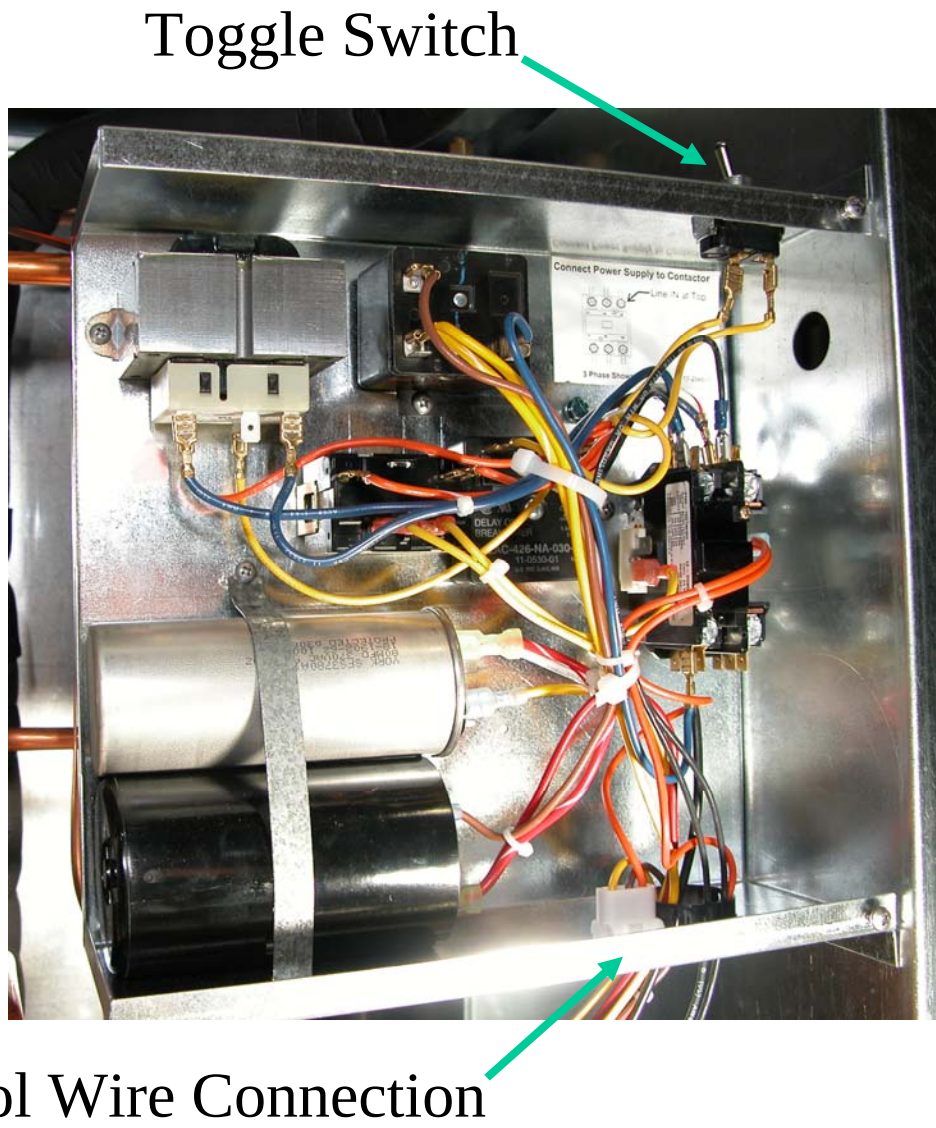
# Receiver

- Shipped with system charge
- Three ports
  - Liquid inlet
  - Liquid outlet
  - Vapor outlet



# Electrical Box

- Toggle switch controls condensing unit
- Control Wire connection from Ice Making Section to control the system
- Electrical power connected at contactor
- Remote condenser fan connects at contactor

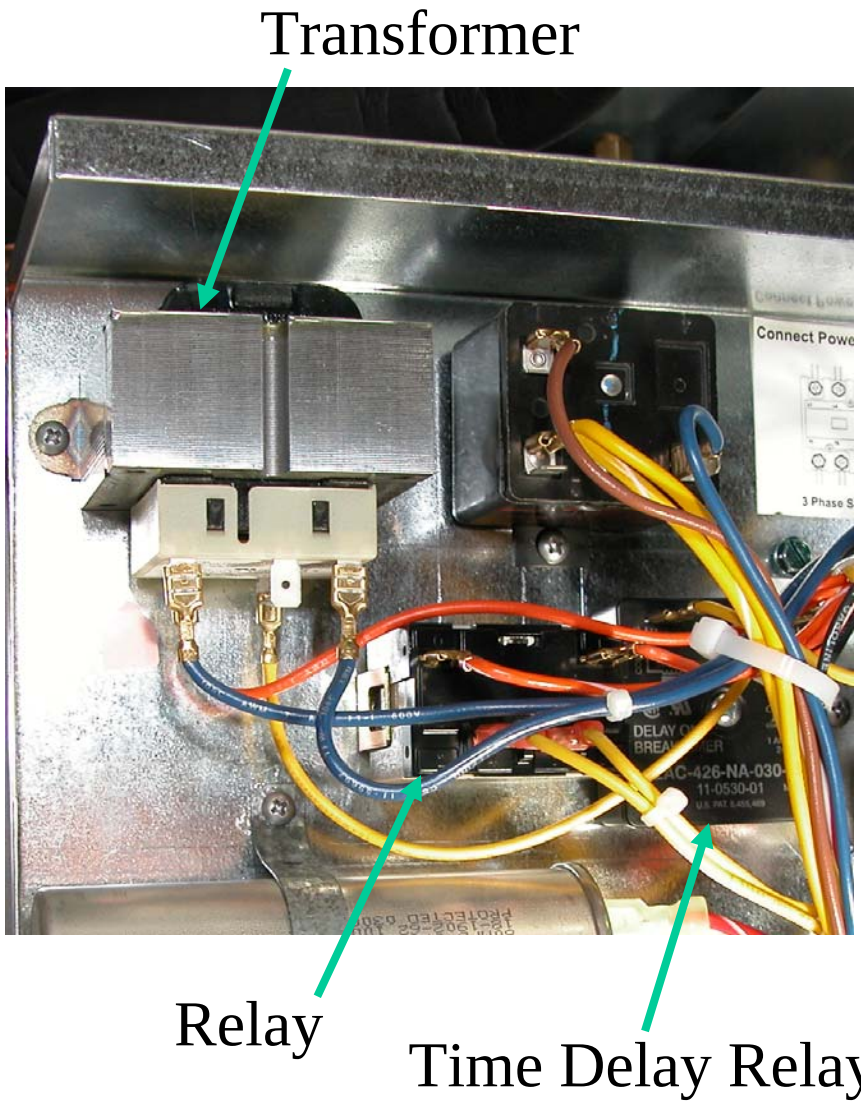


# CP2086

- Scroll compressor
- Three Phase
  - Supply wiring can make it start backwards
  - To fix, switch two power leads
- Single Phase
  - Always starts with the correct rotation
  - Can reverse after power interruption
  - Time delay relay in circuit to prevent reversal

# Scotsman® CP2086 Single Phase

- Compressor protection circuit
  - 24 volt transformer
  - 24 volt relay
  - Time Delay Relay
    - Power interruption of as little as 15 milliseconds causes relay to shut compressor off for 30 seconds
    - Compressor then restarts



# Scroll Compressor

- Oil sight glass and oil drain / fill port
- Don’t add oil!
  - Oil level will change during each cycle
  - Ranges between 1/3 & 1/2 full

# Condensers

- Two models - ONLY for Eclipse
  - ERC1086 - used with CP1386 and CP1686
  - ERC2086 - only used with CP2086
- No headmaster in condenser
  - Headmaster is in CP unit
- Swivel nut connections for CP unit
  - Don’t connect these condensers to a regular remote!

# System Installation

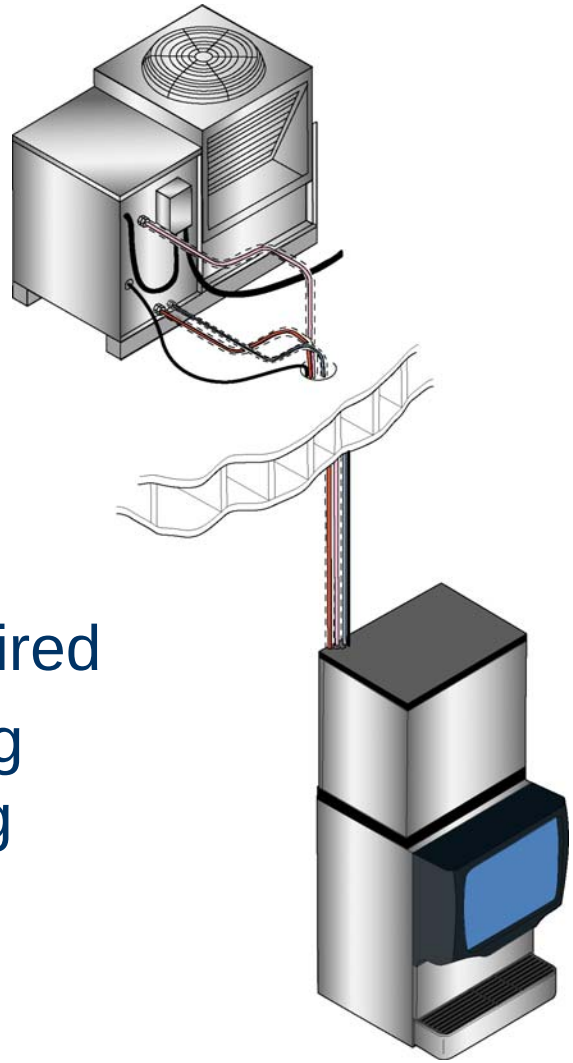
- Three systems, single and three phase for each
  - 1300
  - 1600
  - 2000
- Must match components to create system

# System Installation

- 1300 -
  - CME1386, CP1316, ERC1086
- 1600 -
  - CME1686, CP1316, ERC1086
- 2000 -
  - CME2086, CP2086, ERC2086
- CP units may also be connected to approved central condenser coil using tubing kit RTE10
  - Coil must NOT have headmaster

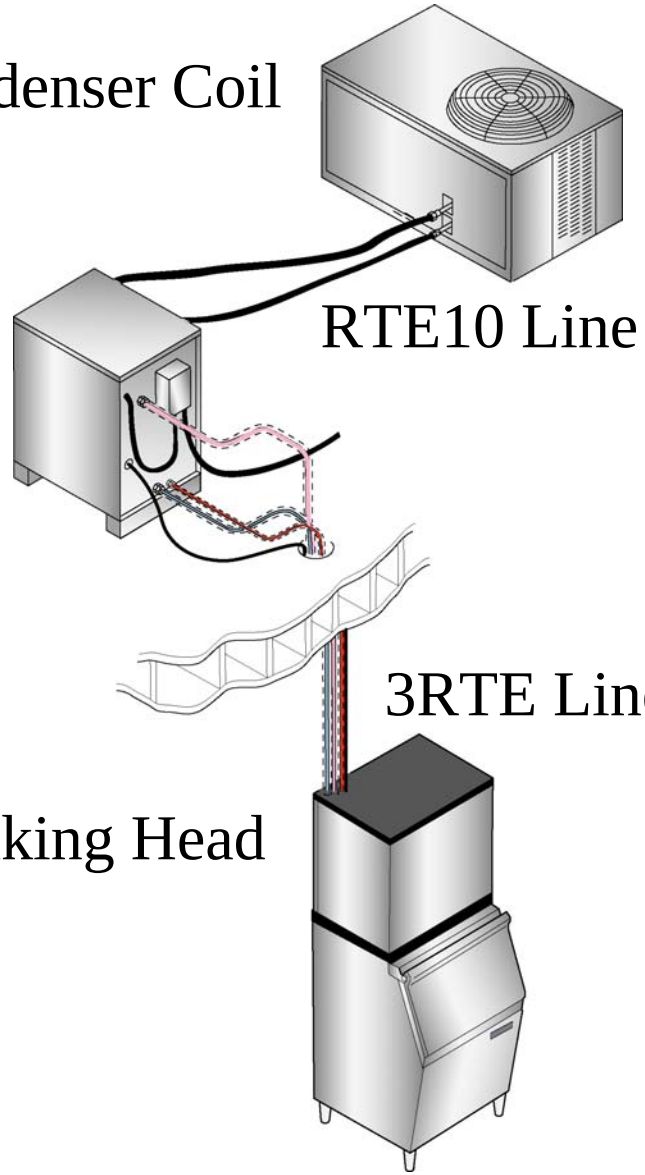
# Equipment Location

- CME can be above or below condensing unit
  - If above, limit is 15 feet
- Pre-charged lines are used
  - 3 tubes per set
  - 20, 50 and 75 foot only
  - No extra refrigerant charge required
  - S trap required when condensing unit is over 20’ above ice making head



# Other Configurations

Approved Central Condenser Coil



RTE10 Line Set

CP Unit

3RTE Line Set

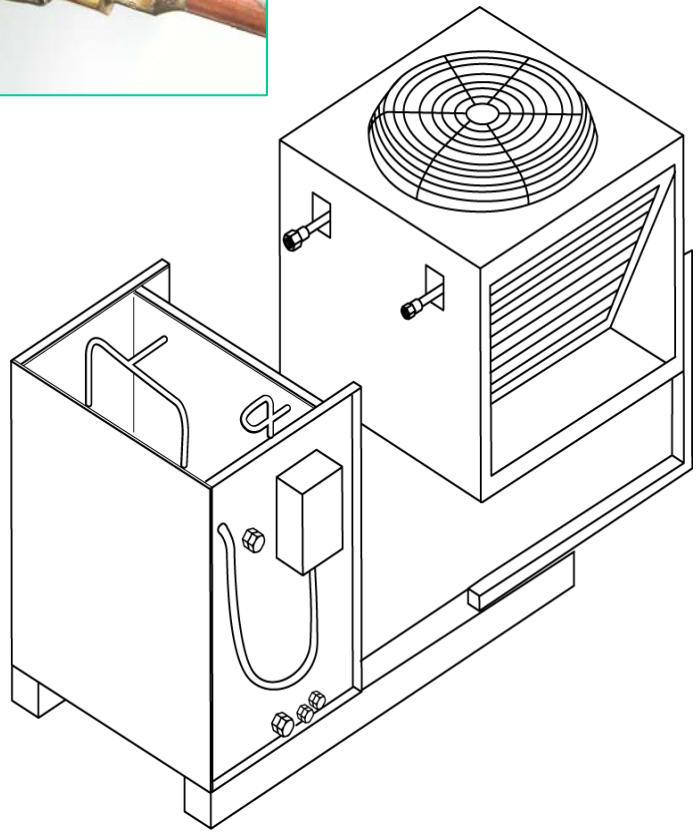
Ice Making Head

# Condensing Unit

- Modular system - connect CP to ERC
- Assemble on roof or ground
- ERC has back legs and two braces
  - Assemble legs and braces to condenser
- Connect wires to junction box
- Place ERC on back of CP - lip on CP holds ERC up

# Condensing Unit

- Fasten CP to ERC
- Connect liquid and discharge line connections
- Route wire to CP control box and connect to contactor



# Quick Connects

## Partial Assembly, One Thread Showing

Status: Not Ready, diaphragms partially pierced

# Quick Connects

## Partial Assembly, Threads are Flush

Status: Not Ready, diaphragms pierced but connection not leak proof.

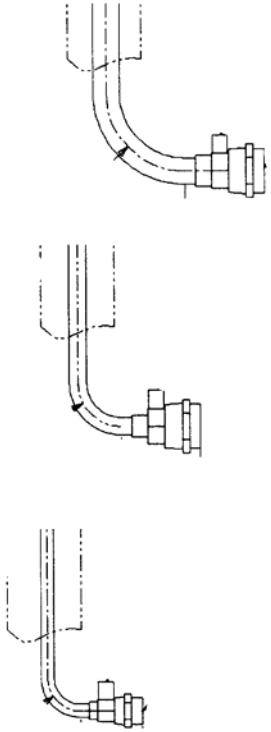
# Quick Connects

## Completed Assembly

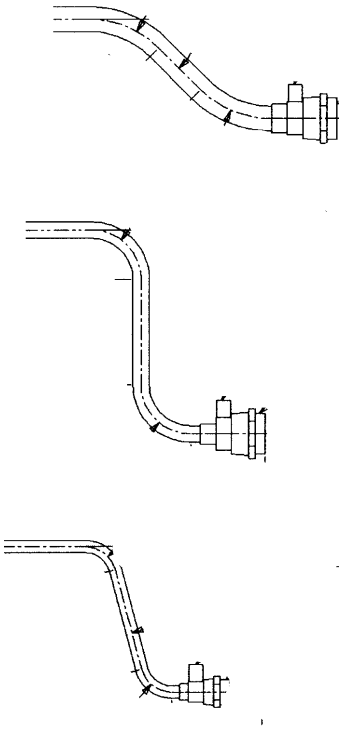
Status: Ready, diaphragms fully pierced and joint is leak proof

# Line Set

- Three tubes
- Reversible
- CME routing determines which end goes to CME
  - Out the back - use double-bend ends at CME
  - Out the top - use single 90 degree ends at CME



Ends for out the CME top



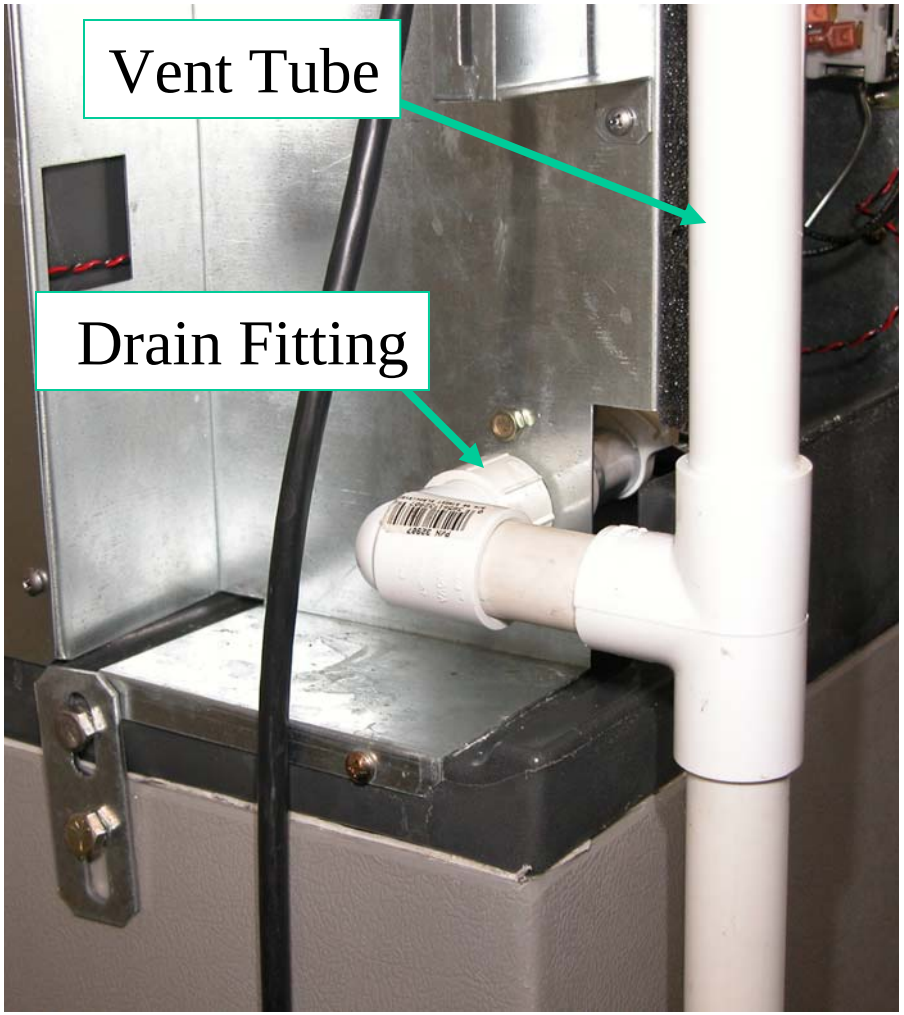
Ends for out the CME back

# Line Set Installation

- Route lines in two groups
  - Liquid and Vapor
  - Suction separately for ease of routing
    - 3/4” tube requires careful handling
  - Check for holding charge before installation
  - Route control wire with line set
  - Only shorten if necessary
    - Do before connections are made!
    - Purge with nitrogen while brazing
      - Schraders at both ends for purging
    - Evacuate to 300 microns or less
    - Add holding charge if connecting later

# Install CME

- Flush against wall capability
- Drains left or back
- Route refrigeration tubes out the top for flush installations
- 115 volt unit, cord provided



# Utility Connections

- Attach water inlet
- Attach drain - 3/4”
- Connect refrigerant tubing. Add foam tape/cork tape to suction line nut
- Secure unit at sides or back with provided strap-clips

# Condensing Unit

- Connect precharged lines
  - Use refrigerant oil
  - Use two wrenches to prevent quick-connect diaphragm damage from rotating tube
- Connect control wire
- Connect power, check voltage

# Initial Start Up

- Check installation
  - Power
  - Water
  - Drain
  - Tube Routing
- No soak out needed
  - Plug in CME unit
  - Check EEPROM code
  - Push Freeze to start

# Start Up

- CME unit
  - Opens & closes Purge Valve
  - Fills with water
  - Switches on Pump
  - Switches on Condensing Unit
    - Compressor and fan begin to operate
- Adjustments
  - Purge is adjustable

# Scotsman® Operation - Control System

- $CM^3$ control system
  - Water level sensor for
    - Reservoir water fill
    - Freeze cycle termination
  - Ice sensors to sense
    - Ice harvest
  - Controller determines cycles and operates components
    - Uses water level to determine freeze cycle length
    - Uses length of time for ice to fall to determine next harvest
    - Uses thermostat to determine bin full

# Control Details

- Water level sensor
  - Two photo-electric eyes in housing
  - Top eye blocked tells controller water level is low
  - Bottom eye blocked tells controller water reservoir is full

# Control Details

- Ice sensors - photo-eyes
  - Located at bottom of ice drop zone
  - One side is an emitter, the other a detector
  - Creates a light curtain that can sense groups of cubes falling during harvest

# Operation - Freeze

- Similar to conventional remote ice cubers
  - Condensing unit forces liquid refrigerant to the ice making section
    - TXV meters refrigerant all evaporators
  - At a pre-determined water temperature, the pump stops for 30 seconds
  - As ice forms on the evaporators, the water level drops
  - About half way through the cycle the water reservoir re-fills
  - The next time the water level drops to the point where the top of the slot in the float stick blocks the eyes, the system goes into the harvest cycle

# Operation - Harvest

- Eclipse features Cold Temperature Harvest
  - Condensing Unit may be located outside
    - Temperature Range between -20 and 120 F.
    - Receiver is with the condensing unit
    - Vapor line connects discharge gas and receiver vapor to vapor inlet line in ice making section
    - High vapor flow rates achieved with no compressor impact due to use of CPR valve
    - Vapor contains latent heat - even at sub-zero temperatures
    - Condensing vapor in the evaporators transfers the heat
    - Evaporators warm up and ice is released

# Scotsman® Operation - Harvest Details

- Vapor inlet valve opens
- Condenser bypass valve opens
- Receiver inlet valve closes
- Purge valve opens
- Pump stops for a time then restarts to purge the reservoir of water
- Purge valve closes after 40 seconds
- Inlet water valve opens for a few seconds to add water to the reservoir for harvest assist
- Harvest continues until the controller stops it

# Scotsman® Operation - Harvest Control

- Controller begins timing harvest
- Ice falling interrupts the signal from the ice sensor emitter to the receiver
  - The time of that interrupt is recorded by the controller
  - The last time the controller receives an interrupt signal is saved as the cube release time
  - Extra time is calculated from the actual cube release time

**Measured Cube Release Time + Calculated Extra Time = Harvest Time**

# Operation

- Freeze Cycle Time (90/70):
  - 1300 - 16 to 17 minutes
  - 1600 - 17 to 18 minutes
  - 2000 - 12 to 13 minutes

- Harvest Cycle Time (90/70)
  - 1300 - 2 minutes
  - 1600 - 1 1/2 to 2 minutes
  - 2000 - 2 1/2 minutes

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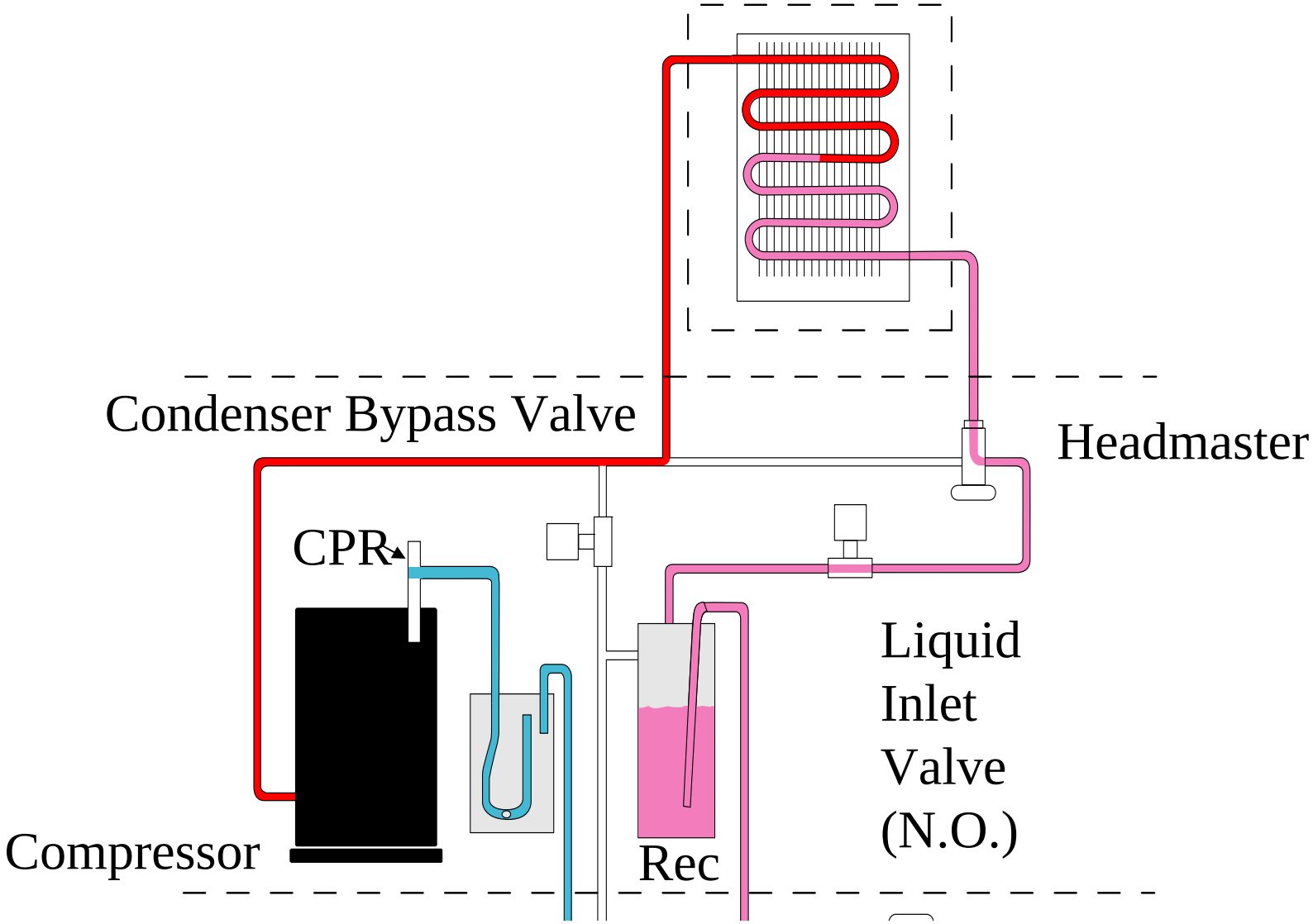
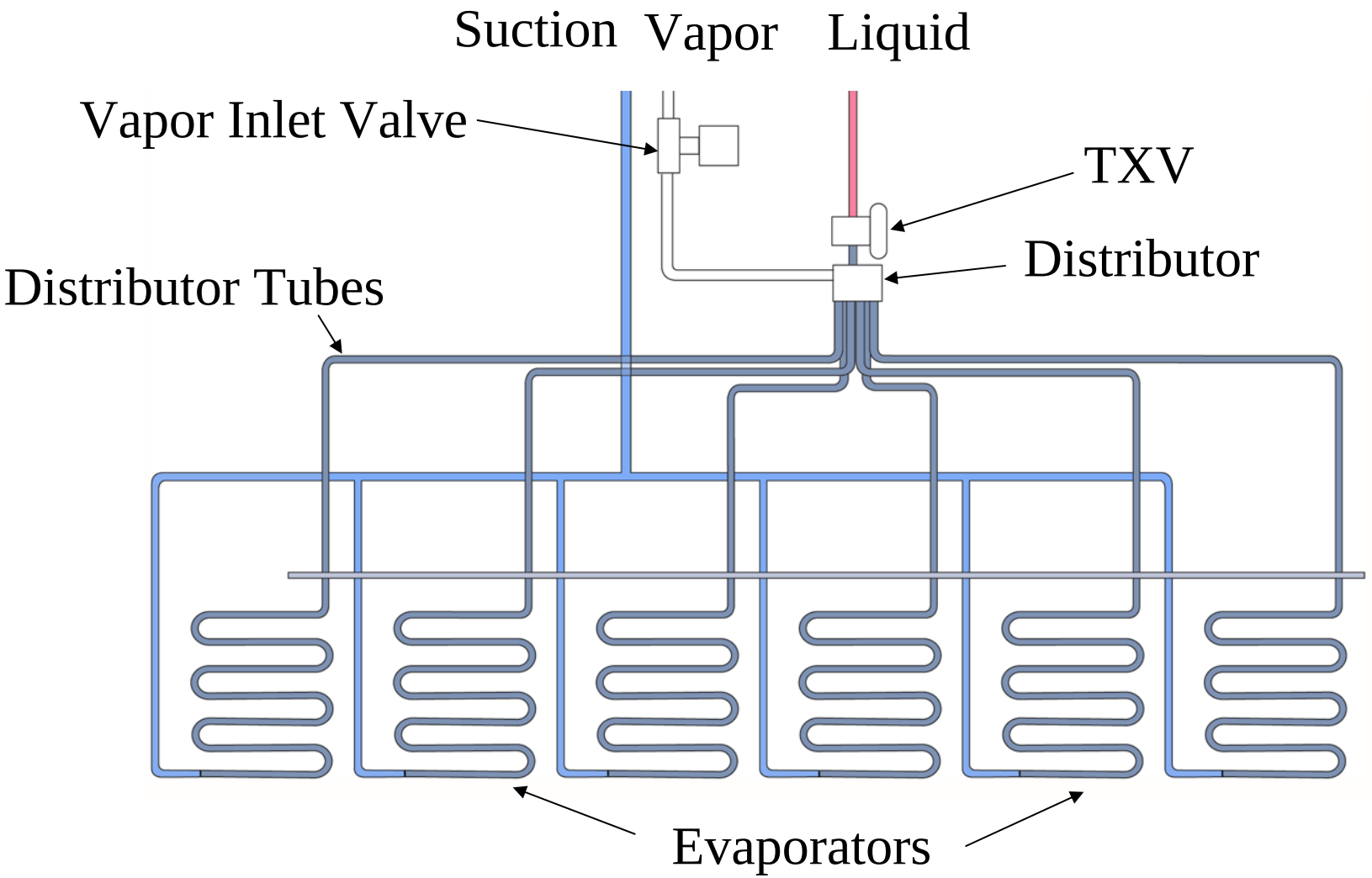
# Condensing Unit

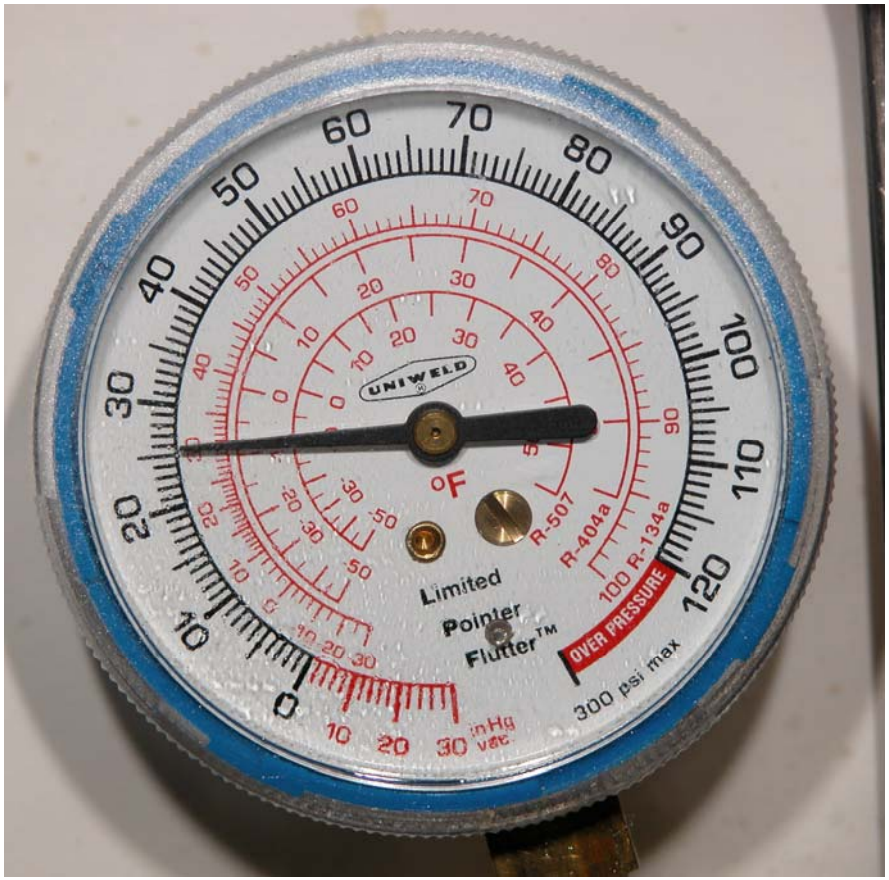


# Ice Making Section



# System Pressures

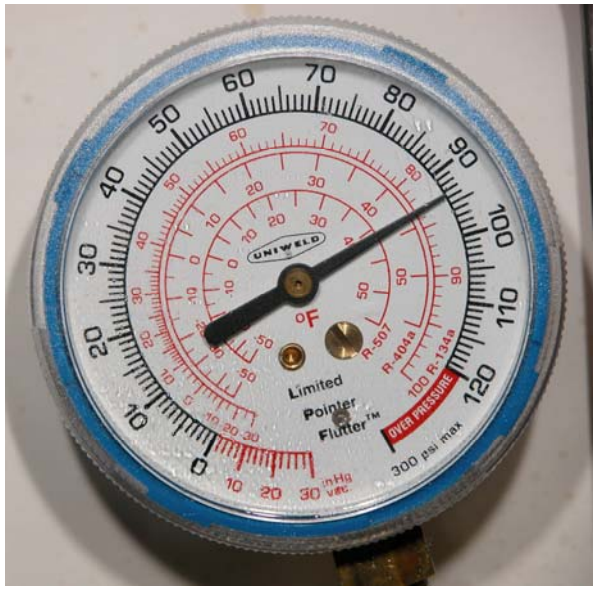
- Freeze Cycle
  - Rapid Pull Down to between 50 and 40 PSIG
  - Gradual Pull Down to
    - 1300 30 to 34 PSIG
    - 1600 35 to 37 PSIG
    - 2000 23 to 25 PSIG just before Harvest
  - Pressures at CP unit or CME will be the same during Freeze

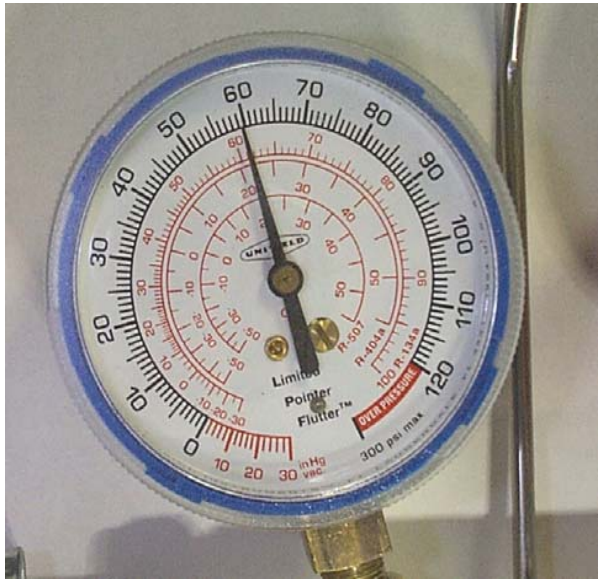



2000 lb model, end of freeze

# System Pressures

- Harvest Cycle
  - At the ice making section, low side pressure rapidly increases to 90 - 95 PSIG or higher in hot ambient conditions
  - At the CP unit compressor access valve, dome pressure is limited by the CPR valve to 55 - 60 PSIG during harvest



# System Pressures

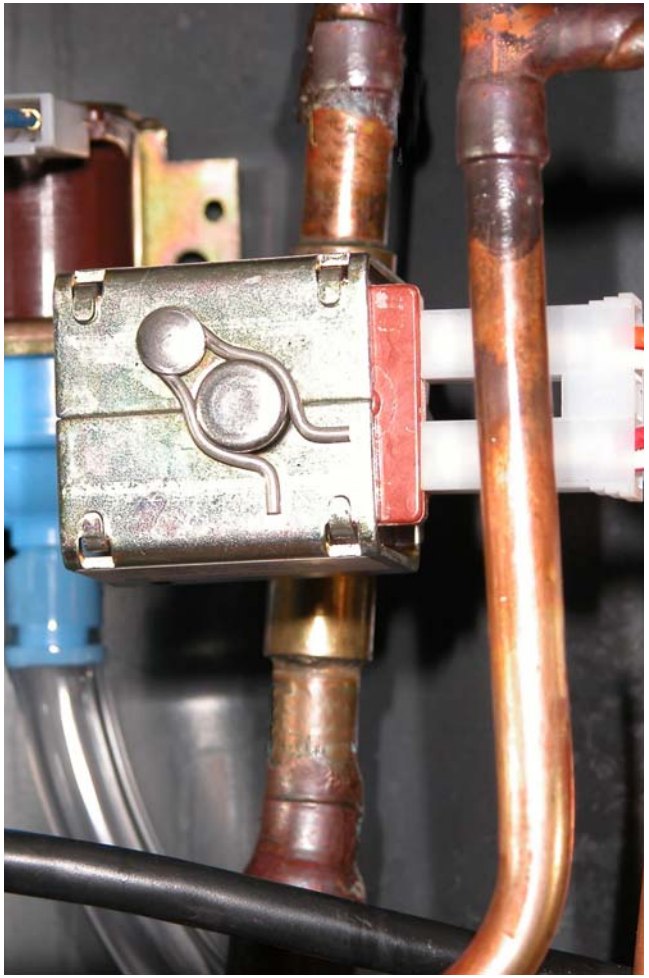
- CP Unit
  - Discharge during low ambient freeze will be about 240 PSIG
  - Discharge during harvest will be about 100 PSIG
  - High Pressure Cut Out opens at 450, closes at 350 PSIG

# Maintenance

- De-lime with Scotsman Ice Machine Cleaner
  - Push & release clean button
  - Pour in 24 ounces of ice machine cleaner
  - Clean for 10 minutes, then push and release clean button again, wait 20 minutes and shut unit off
- Check distributors for scale build up

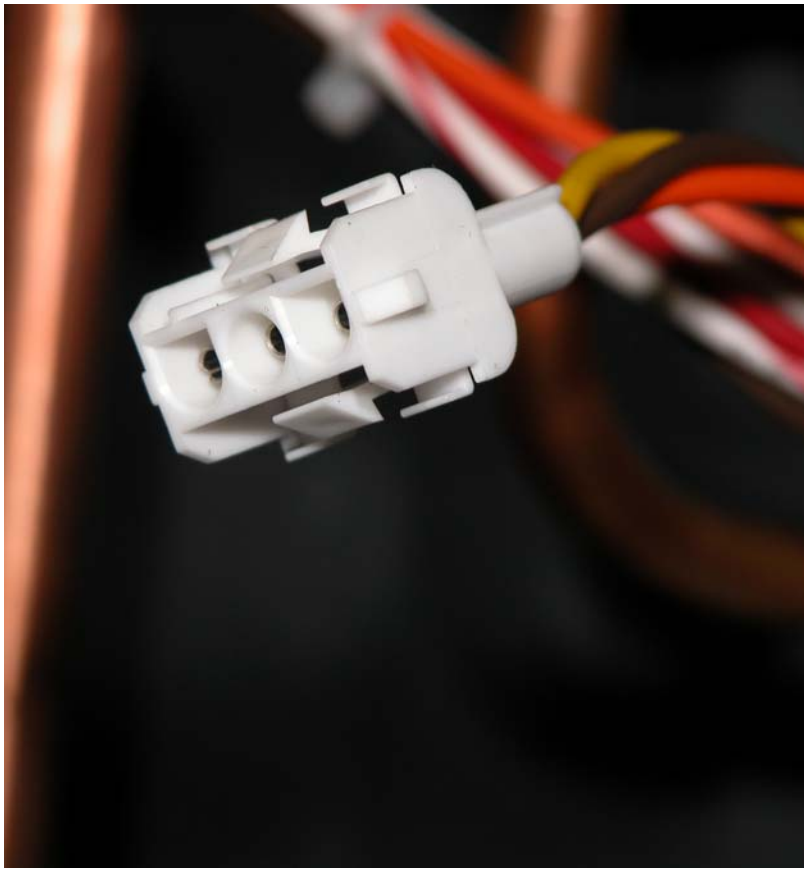
# Service Diagnosis

- What happens if?
- Vapor Inlet Valve Does Not Open
  - Vapor line hot
  - Discharge pressure increases
  - Low side pressure does not change
  - No ice release - large slabs of ice
  - 2 blink refrigeration light



# Service Diagnosis

- What happens if?
- Control wire becomes unplugged
  - CP unit does not operate
  - Exceeds maximum freeze time
    - Controller shows continuous refrigeration diagnostic light



# Service Diagnosis

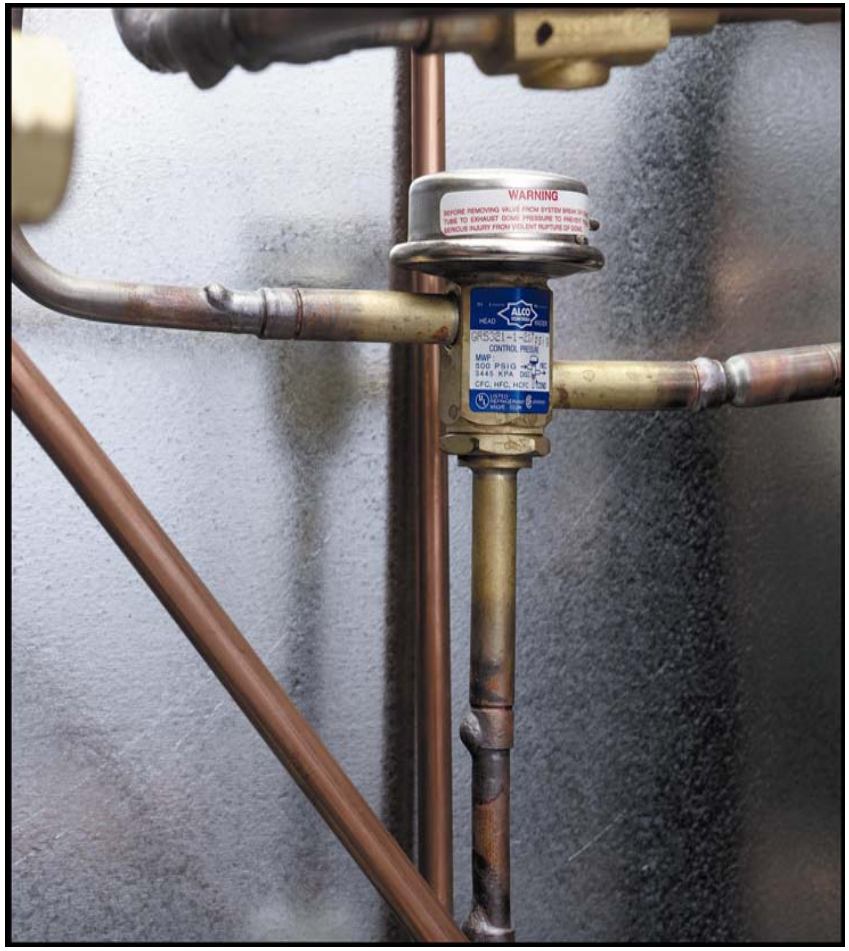
- What happens if?
- Condenser by pass valve does not open
  - High pressure cut out opens
    - Note: High discharge pressure during harvest will not be present at liquid connection
  - Ice may release, but slowly

# Service Diagnosis

- What happens if?
- Receiver inlet valve does not close during harvest
  - Very little change
- If it sticks closed
  - Hi discharge pressure cut out opens
  - Controller shows continuous diagnostic light

# Service Diagnosis

- What happens if?
- Headmaster is stuck in bypass
  - Very little liquid flow to TXVs
  - Long freeze cycle
  - Controller shows continuous refrigeration diagnostic light



# Service Diagnosis

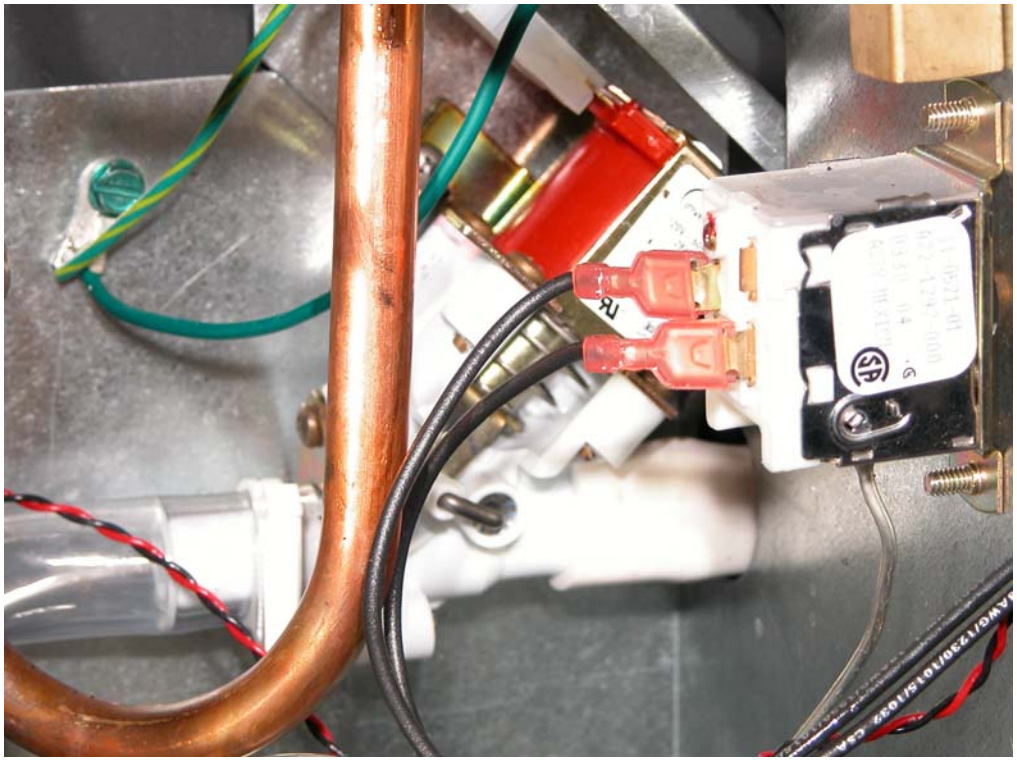
- What happens if?
- There is a refrigerant leak
  - No change until refrigerant level drops below the operational threshold for the ambient
    - Headmaster will try to maintain minimum discharge pressure - but will be hissing as gas flows through
    - Ice formation will be poor
    - Low capacity/long freeze cycle will result
  - Add charge to confirm, if ice making resumes with normal discharge pressure there is a leak

# Service Diagnosis

- What happens if?
- There is no water to the ice making section
  - Water is part of the recipe for ice!
  - Controller will stop unit operation but retry filling every 20 minutes until water is restored

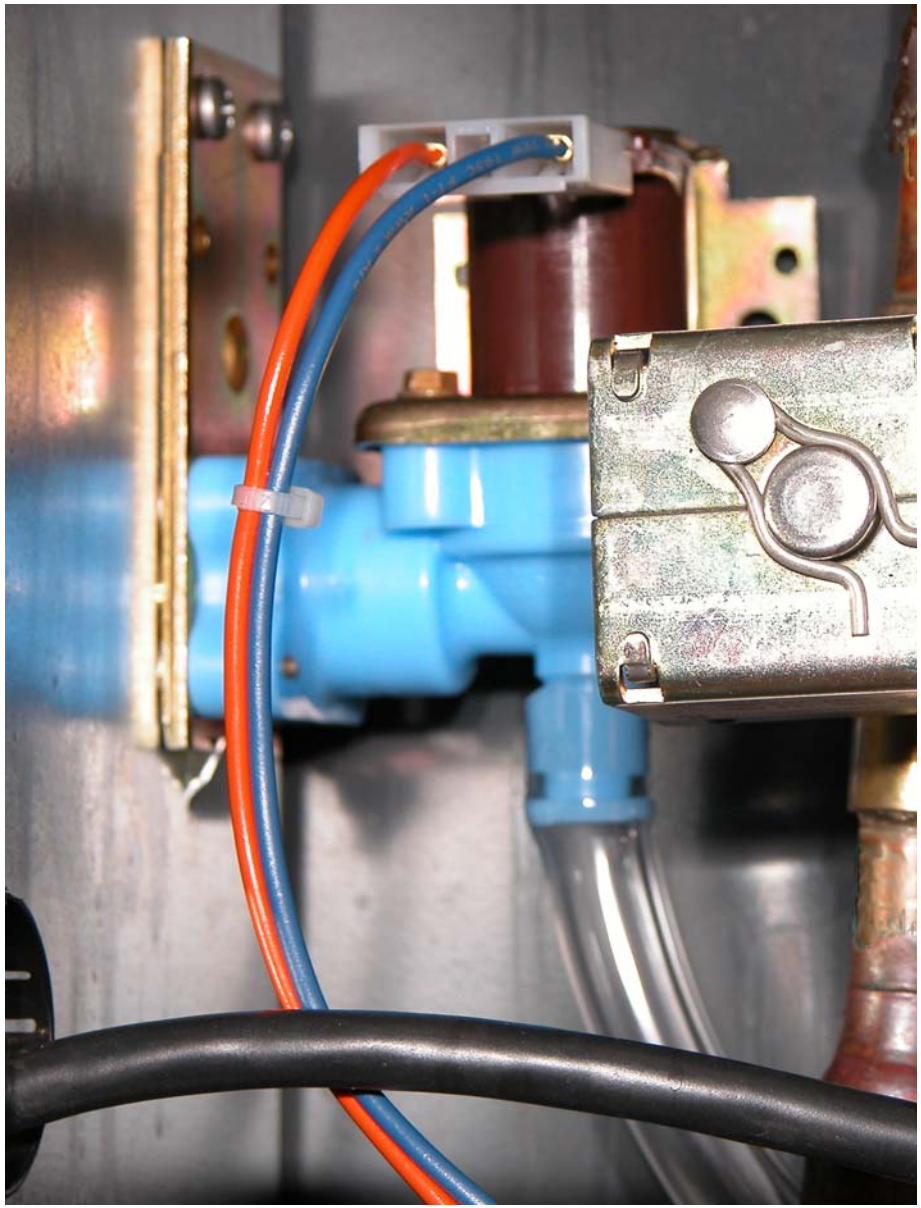
# Service Diagnosis

- What happens if?
- The purge valve leaks through
  - May result in small cubes
  - Short freeze cycle
  - May have long harvest cycle



# Service Diagnosis

- What happens if?
- The inlet water valve leaks through
  - Keeps adding water (heat load) to reservoir
  - Result is a long freeze cycle



# Service Diagnosis

- What happens if?
- The condenser fan stops
  - CP unit's hi pressure cut out will open
  - Maximum freeze time will be exceeded
  - CME unit will shut system off
  - Controller will display continuous refrigeration diagnostic light

# Service Diagnosis

- What happens if?
- The CPR valve fails
  - Pressure during harvest will not be at the pre-set point
    - 55 to 60 PSIG
  - Will not hold an adjustment
  - No external symptom
- CPR setting should be checked if compressor is replaced

# Service Diagnosis

- What happened if?
- The controller is showing a one blink refrigeration diagnostic light
  - This indicates that the ice harvest was very slow and the controller timed-out on maximum harvest time
  - Ice was sensed by the control system
  - Likely causes include
    - Beginning to freeze up

# Service Diagnosis

- What happened if?
- The controller is showing a two blink refrigeration diagnostic light
  - This indicates that the ice harvest was very slow and the controller timed-out on maximum harvest time
  - Ice was NOT sensed by the control system
  - Likely causes include
    - Freeze up
    - Vapor inlet valve did not open
    - Ice sensor can’t “see” ice well

# Service Diagnosis

- What happened if?
- The controller is showing a continuous refrigeration diagnostic light
  - Maximum freeze time exceeded
  - Dirty condenser coil
  - Fan motor inoperative

# Service Diagnosis

- What happened if?
- The controller is showing a two blink water diagnostic light
  - Slow or no water fill
    - Possible clogged water filters
  - Low water level - leaks out
  - Water level sensor not working or harness connection poor

# Service Diagnosis

- What happened if?
- The controller is showing both diagnostic lights on continuously
  - This indicates that the temperature sensors are not working or not plugged in. They need to be plugged back in or replaced.
  - The ice machine will operate without the thermistors working, but it is limited in its diagnostics that way

# Summary

- Eclipse is a three part ice making system
  - Ice making head
  - Compressor Package
  - Condenser
- There are 6 systems
  - 600
  - 800
  - 1000
  - 1300
  - 1600
  - 2000