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Shaping Tomorrow's Built Environment Today

Micro-Distributed Store Solution with Propane as a Refrigerant

Micro-Distributed Store Solution

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Rich is responsible for strategy development and delivering new distributed refrigeration solutions to the food retailing industry. He also provides day-to-day product portfolio management at Hussmann Corporation. Rich has a Bachelor's Degree in Biology and a Masters in Business Administration

Micro-Distributed Store Solution

Today's Agenda

Micro-Distributed Solution Overview

System Design Details

Regulatory Environment

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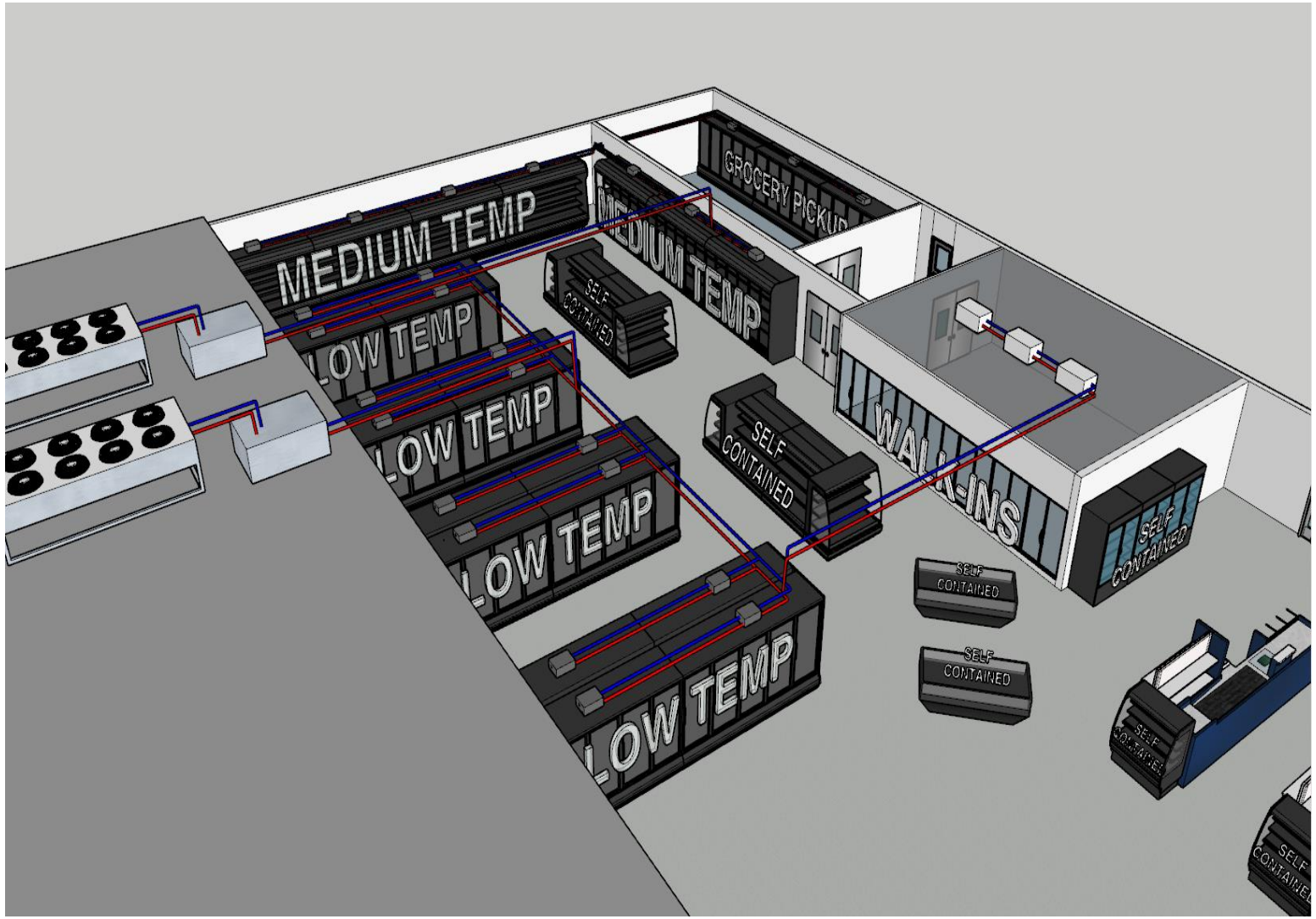
Micro-Distributed Store Solution



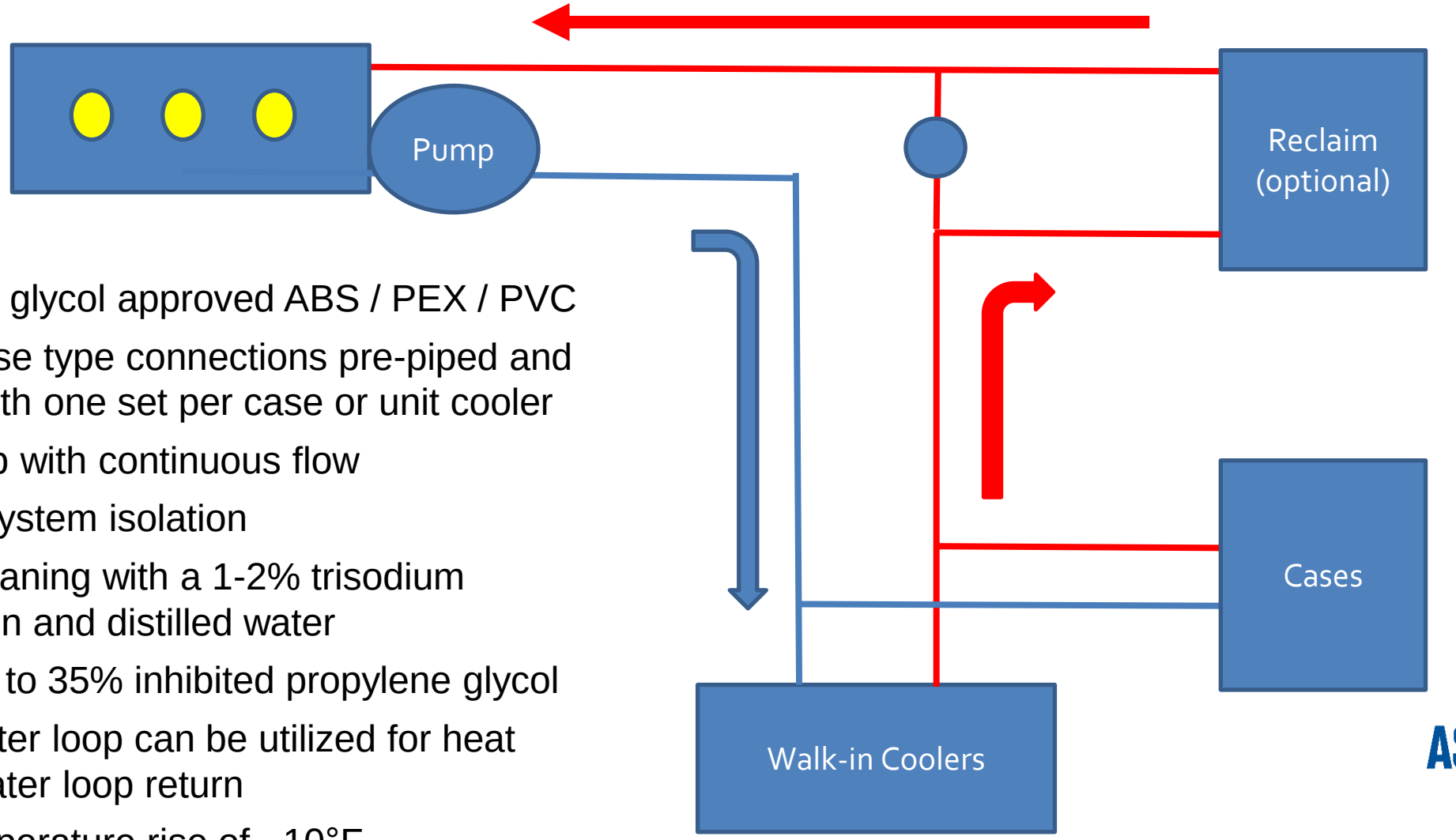
- Fluid Cooler
- Redundant Pumps
- Water-Loop
- Merchandisers
- Walk-in Coolers and Freezers
- Self-Contained Merchandisers
- Backroom Storage

Micro-Distributed Store Solution

Heat of Rejection Components

- HFC- free fluid cooler options based on ambient conditions of the store geographic location
  - Air-cooled (Dry) fluid cooler
  - Adiabatic fluid cooler – Warmer ambient
  - Evaporative fluid cooler – Warmest ambient
- Fluid cooler monitored and controlled via store supervisory system, not the case controller
- Pumping station circulates fluid continuously in closed loop; controlled via store supervisory system
- Cooling fluid operational setpoints between 50°F-115°F for case inlet water temperatures

Micro-Distributed Store Solution



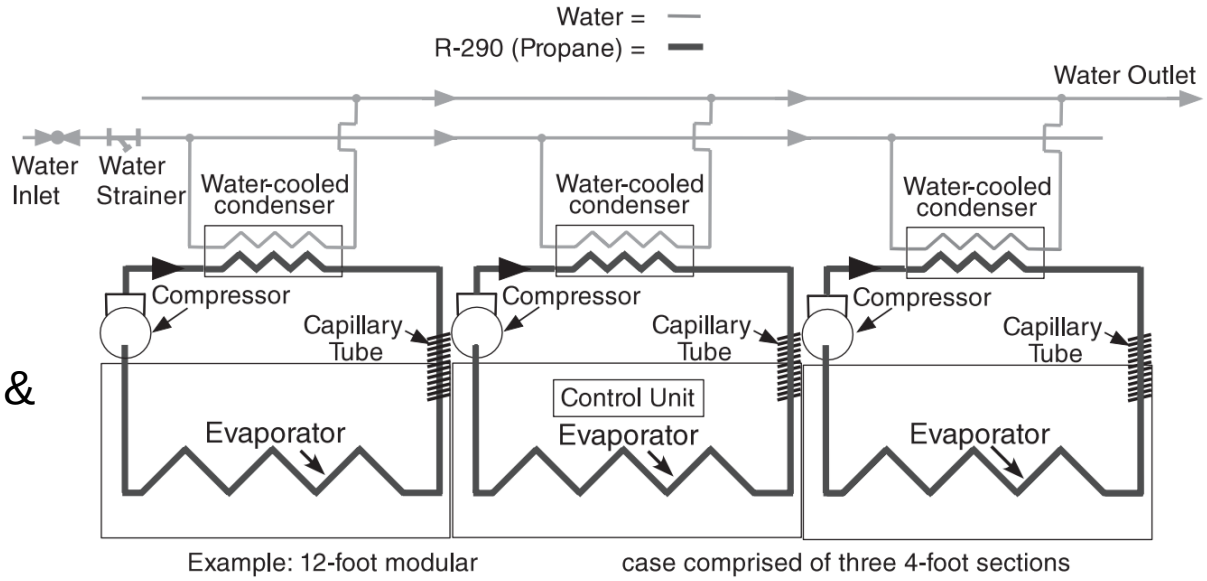
Water Loop

- Type M copper or glycol approved ABS / PEX / PVC
- NPTF Garden hose type connections pre-piped and ready to attach with one set per case or unit cooler
- Closed water-loop with continuous flow
- Hand valves for system isolation
- Piping system cleaning with a 1-2% trisodium phosphate solution and distilled water
- Rejection fluid up to 35% inhibited propylene glycol
- Heat rejection water loop can be utilized for heat reclaim via hot water loop return
- Inlet to outlet temperature rise of ~10°F

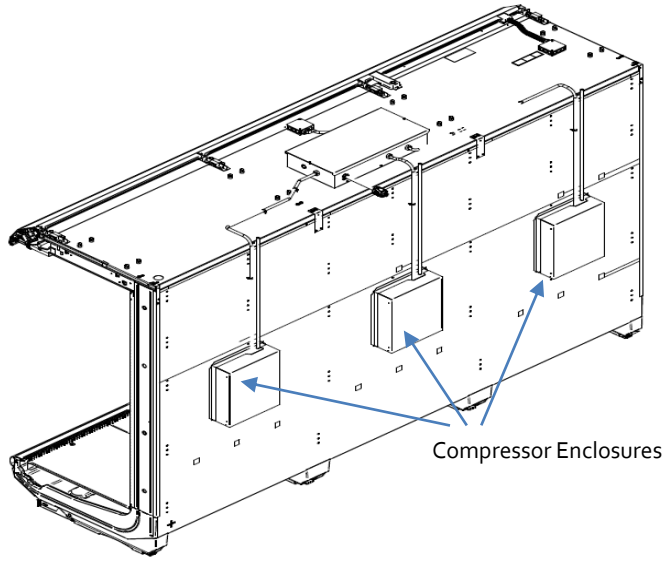
Micro-Distributed Store Solution

Merchandisers

- Each circuit has 150g or less of propane
- Designed to perform with inlet water temp 50-115°F
- DOE designated self-contained cases; charged and leak-tested at the factory; NEMA plug
- Pre-piped water-loop connection including in-line strainer & auto-balancing valve; one set per case
- Preset flow rates optimized by case type and length:
  - 2.5 gpm for 5-door Reach-In
  - 6 gpm for 12’ open Multi-Deck
- No propane sensors or refrigerant valves
- Solid-state, intrinsically safe components in dispersion area
- Compressor protection through:
  - Phase monitoring
  - High-pressure and low-pressure cut-out switches
  - Discharge line high-temperature cut-out switch
- No communication from store controller needed for protection



Example: 12-foot modular case comprised of three 4-foot sections



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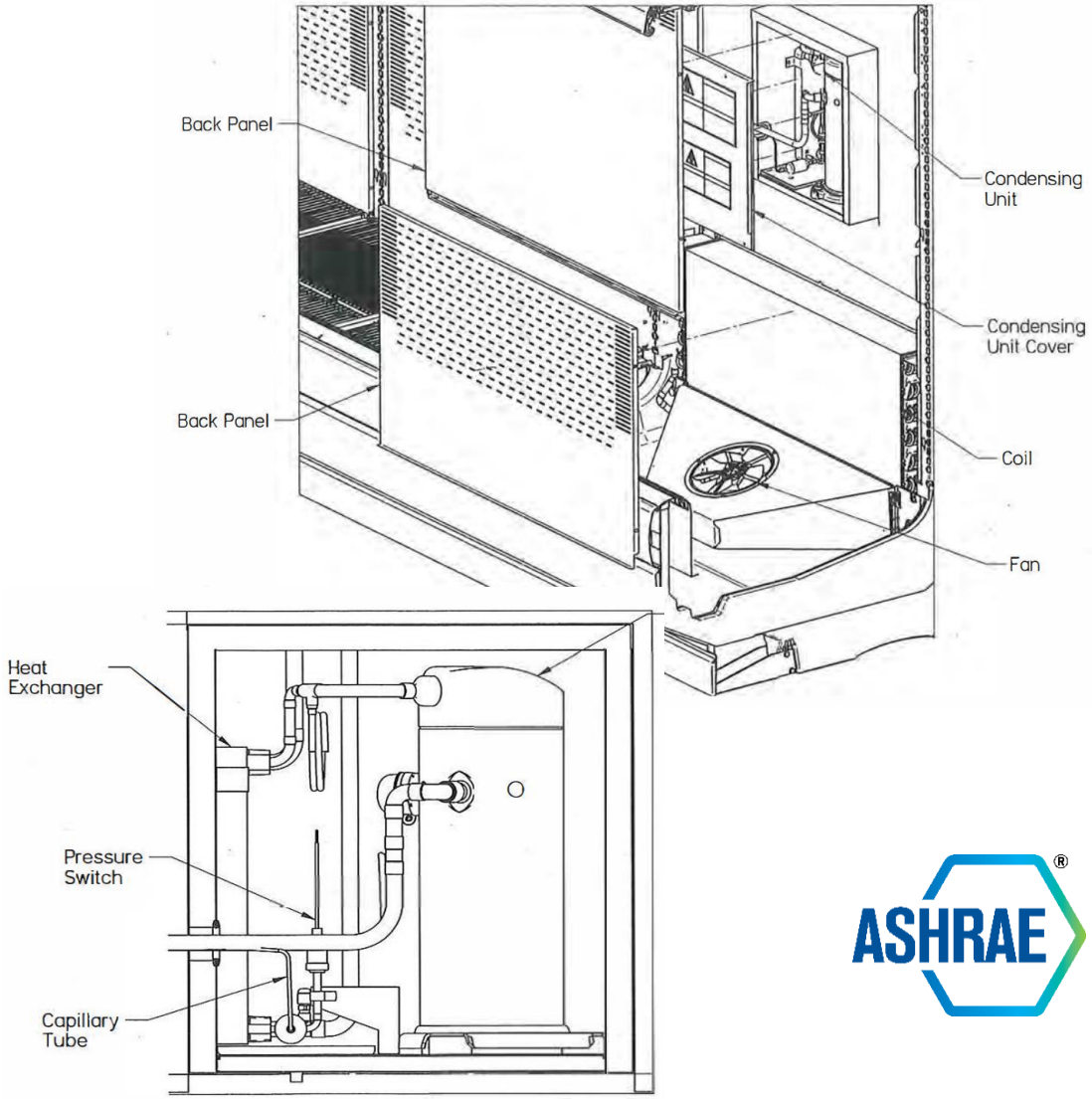

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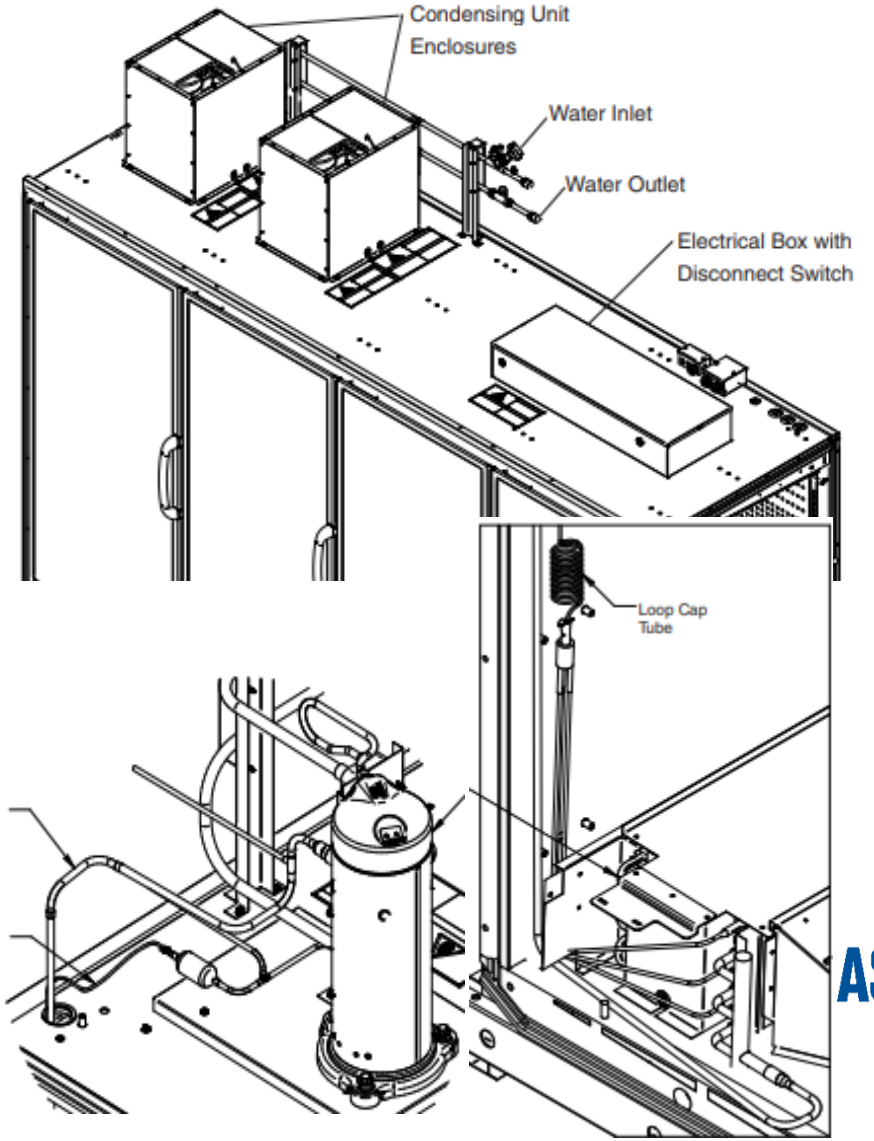

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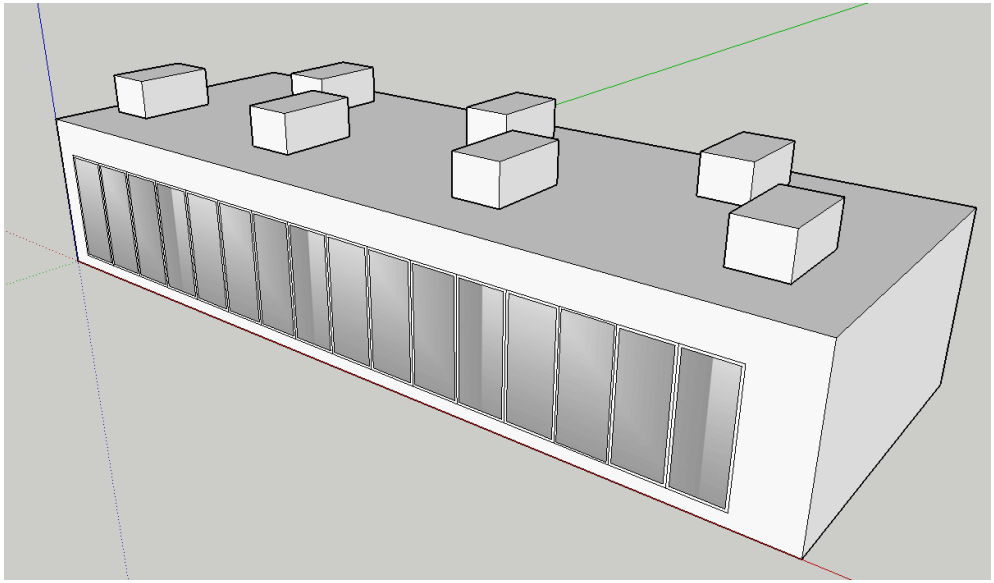
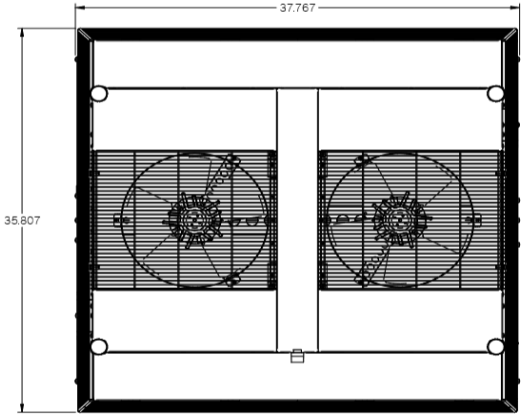
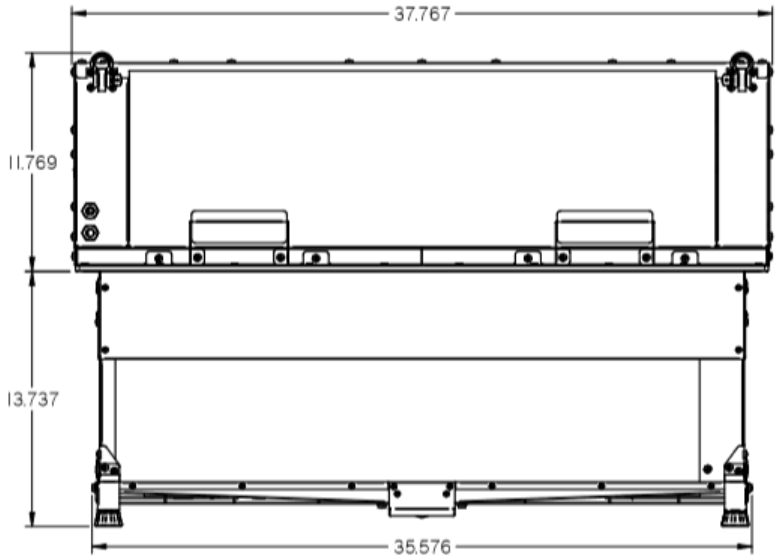
WICF

- Designed to perform with inlet water temp 50-115°F
- Charged and leak-tested at the factory; NEMA plug
- Pre-piped water-loop connection including in-line strainer & auto-balancing valve; one set per unit
- Area propane sensors for WICF may be required by AHJ
- Solid-state, intrinsically safe components in dispersion area
- Variable Speed compressor protected through:
  - High-pressure and low-pressure cut-out switches
  - Discharge line high-temperature cut-out switch
- Mono-Block consists of compressor, heat exchanger and evaporator coil
- Preset flow rates
- Mounts through ceiling panel



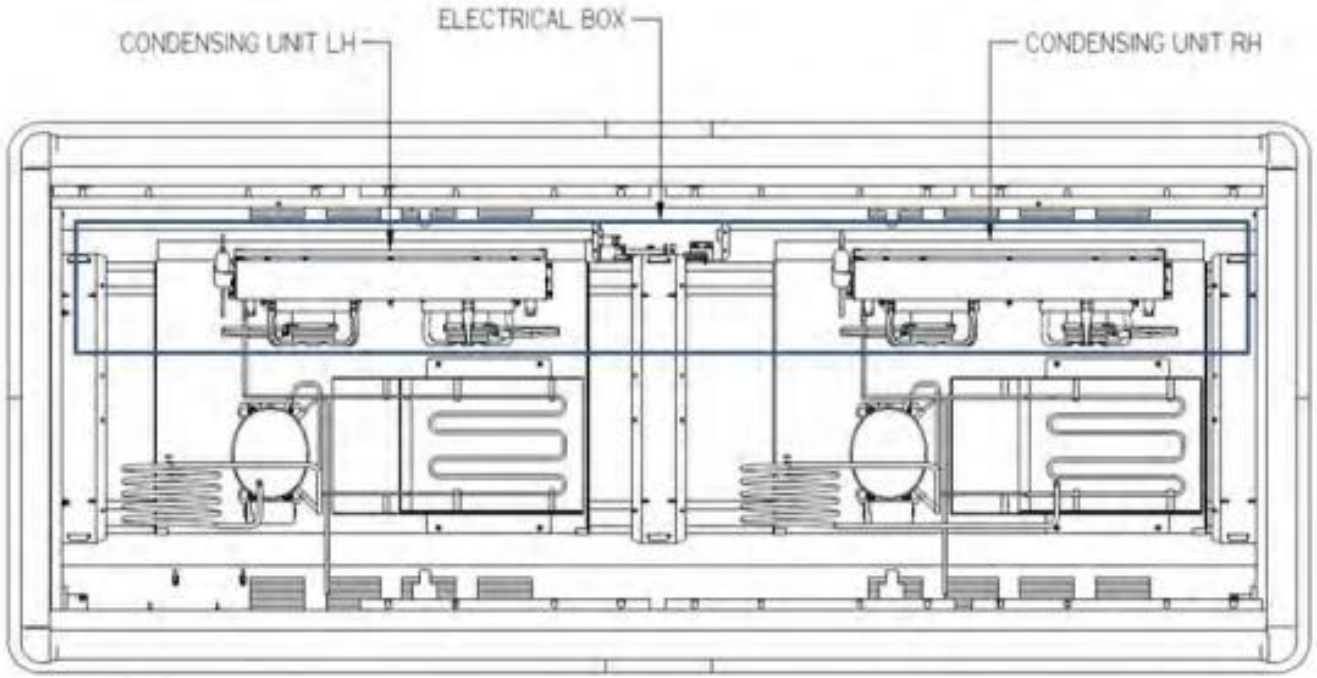


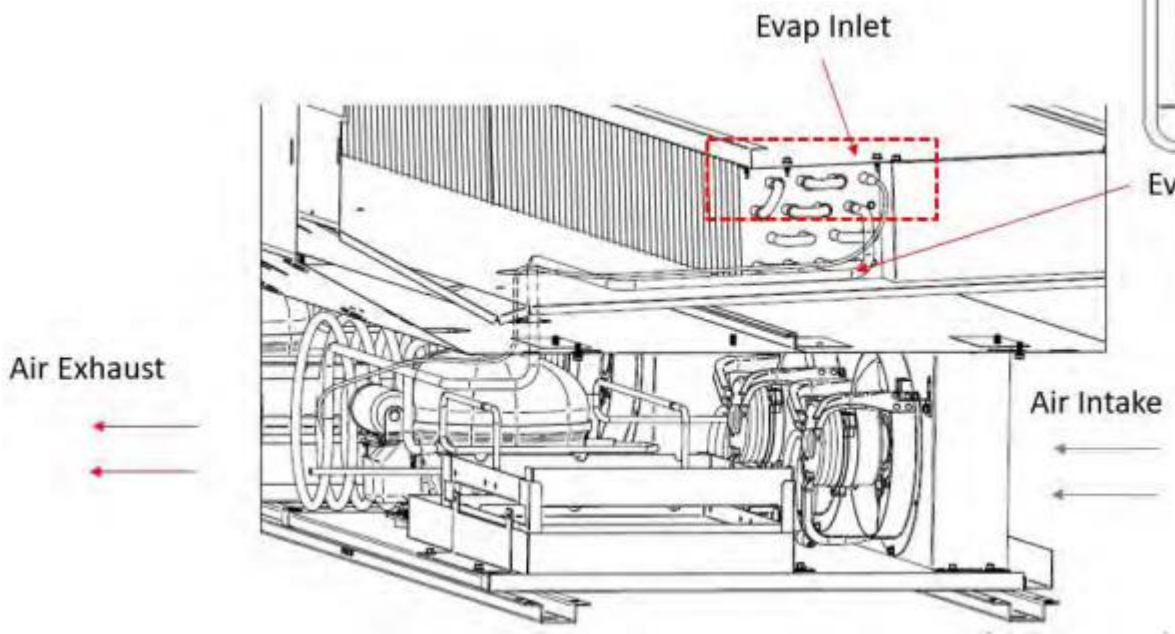


Micro-Distributed Store Solution

Air Cooled Propane Merchandisers

- Ambient air
- Charged and leak-tested at the factory; NEMA plug
- Solid-state, intrinsically safe components in dispersion area
- Fixed and variable speed compressor protected through high- and low-pressure cut-out switches





Micro-Distributed Store Solution

Case Studies

Installation Example #1:

- 346 R-290 condensing units (150g each)
- 1,319,806 Total Heat of Rejection refrigeration
- 400 Ton Packaged chiller with cooling tower for HVAC and refrigeration condensing
- 45 F water for refrigeration condensing; 55 F for HVAC; 65 F for radiant slab cooling/heating
- Doors and lids on all display cases
- “Packaged” condensing units for walk-ins (300 grams per unit)

Results:

- Energy is on par with other same size stores
- No known R-290 leaks to date (6+ years)
- Ensure the water/glycol supply is clean and checked periodically for proper chemistry; early compressor failures

(Greenchill: January 2019)

Installation Example #2:

- 76 R-290 condensing units (150g each)
- 750,000 Total Heat of Rejection refrigeration
- Air-cooler (dry) fluid cooler
- 41 - 118F water for refrigeration condensing
- Door low temp and open medium temp cases
- “Packaged” condensing units for walk-ins
- Fully stocked merchandisers and WICF
- “Stress-Test” entire system; Monitored cases:
  - Discharge air
  - Product temperature probes
  - Alarms/Safety devices

Results:

- Fluid Coolers averaged 112.1°F during test
- All cases held discharge air throughout test
- Product temperatures all within range

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Refrigerant Codes and Standards – U.S.

Revisions to Support A3 Charge Sizes **Above 150g** in Commercial Refrigerators

Complete | Under Revision | No Activity

Refrigerant Standards	Safety Standards	Model Building Codes & Other	State and Local Codes
ASHRAE 34 Designation and Safety Classification of Refrigerants	**ASHRAE 15 Safety Standard for Refrigeration Systems** Application of equipment	**ICC IBC / IFC / IMC**	**State, County & City Building Codes**
EPA SNAP* Significant New Alternatives Policy Program	**UL 471†** Commercial Refrigerators & Freezers	**IAPMO UMC**	**Insurance Company Rules**
	UL 60335-2-89 Commercial Refrigerating Appliances	**NFPA 1 and NFPA 101**	

*150g approved
>150g request submitted
(won't happen until UL acts)

†471 to be replaced by -2-89 in 2022

2010 - ? | 2014 - 2021 | 2024, 2027 | 2024 – 2029+

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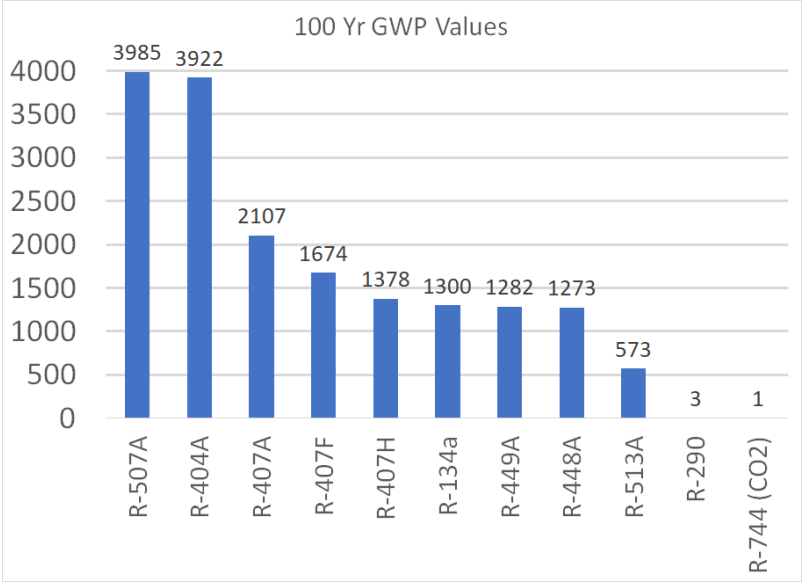
Regulatory Environment

CARB

- Completed adoption of SNAP 20 & 21
- Proposed additional regulation January 1, 2022
  - New systems in new facilities; refrigerant with GWP <150 in systems >50lbs
  - New systems in existing facilities
    - Retail food: company-wide reduction targets for systems >50 lbs
      - Less than 1,400 GWP weighted average or
      - Achieve a 55% or greater reduction in their Green House Gas potential (GHGp) below 2019 levels by 2030
    - Non-retail
      - 1,500-2,200 GWP in 2022 for industrial refrigeration
      - 750 GWP in 2024 for ice rinks



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Regulatory Environment

- U.S. Climate Alliance states are committed to taking real, on the ground action that urgently addresses the climate challenge. In becoming an Alliance member, states commit to:
  - Implement policies to reduce greenhouse gas emissions
  - Track and report progress
  - Accelerate new and existing policies to reduce carbon pollution and promote clean energy
- Members include (now 25): California, Colorado, Connecticut, Delaware, Hawaii, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nevada, New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Puerto Rico, Rhode Island, Vermont, Virginia, Washington, Wisconsin

Thank You!