Natural Refrigerant Training Summit

Building a Sustainable Workforce

AHT / R290 / SPI

Clay, Trey, Michael, Juergen

AHT Cooling Systems

NORTH AMERICAN Sustainable Refrigeration Council

NORTH AMERICAN Sustainable Refrigeration Council

Natural Refrigerant Training Summit

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North American Sustainable Refrigeration Council (NASRC)

Mission Create sustainable future for supermarket refrigeration by removing barriers to natural refrigerant adoption

501c3
Non-Profit Organization

150+
Members

51,000+
Food Retail Locations

Goals

- **Build sustainable workforce**
- Increase funding options
- Increase education & awareness

Natural Refrigerants

Carbon Dioxide
R744

Propane
R290

Ammonia
R717

NORTH AMERICAN Sustainable Refrigeration Council

Need help? Look for NASRC staff!

Danielle Wright
Executive Director

Morgan Smith
Program & Communications Director

Jeanne Ackerman
Membership & Communications Coordinator

NORTH AMERICAN Sustainable Refrigeration Council

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NORTH AMERICAN Sustainable Refrigeration Council

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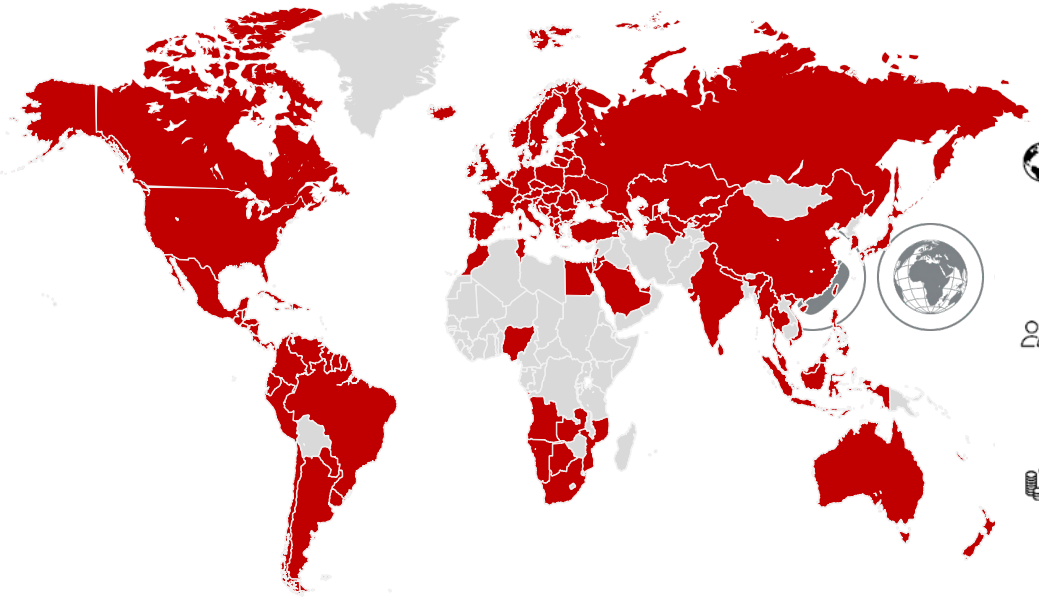
WORLDWIDE

ROTTENMANN, *Österreich*
1983

CHANGSHU, *China*
2007

NAVEGANTES, *Brasilien*
2014/15

CHARLESTON, *Usa*
2017



64%
Market share in Europe,
approx. 33% globally

+ 1,900
FTE staff

+ 4,700
Customers worldwide

$640 M USD
EUR 580 m
Net sales in 2021

4
Manufacturing sites
in Austria, China, Brazil and USA

115
Countries served via
own subsidiaries and partners

AT YOUR HAND:

24/7 IN MORE THAN
115 COUNTRIES

WHEREVER HELP IS
NEEDED!

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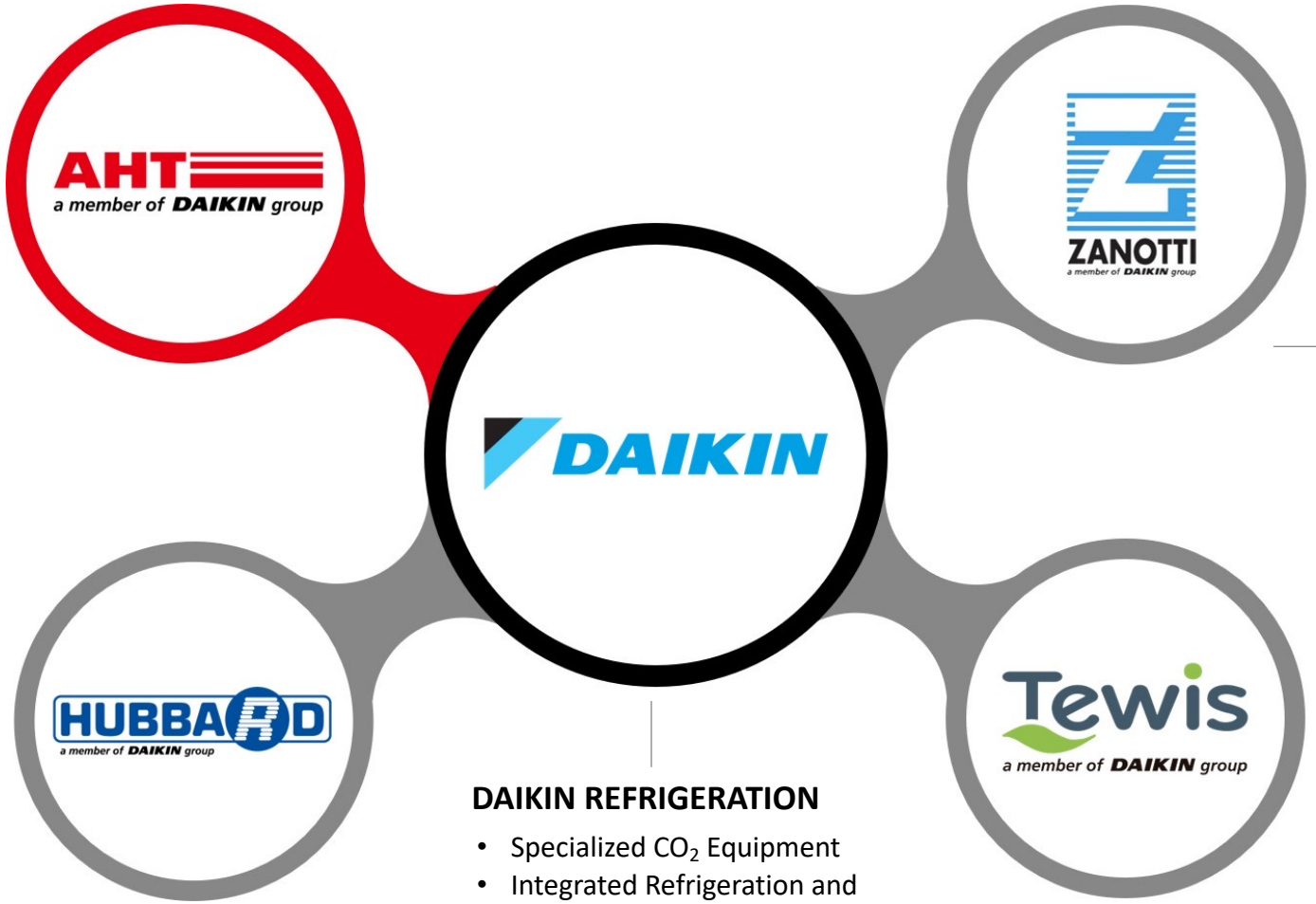
DAIKIN REFRIGERATION GROUP



COMMERCIAL REFRIGERATION

- R290 Multideck Systems
- R290 Multi-Temp Merchandisers
- R290 Food & Beverage Merchandisers

REFRIGERATION SOLUTIONS

- Remote Systems – Racks/Packs
- Cold Room Solutions
- Transport Refrigeration
- Industrial Refrigeration

REFRIGERATION SOLUTIONS

- Remote Systems – Racks/Packs
- Cold Room Solutions
- CO_2 Condensing Units
- A2L Remote Systems
- Scroll, Semi-hermetic, Hermetic
- Condensers & Evaporators

DAIKIN REFRIGERATION

- Specialized CO_2 Equipment
- Integrated Refrigeration and HVAC Solutions
- Innovation, Research and Design Centers Supporting All Regions and Companies

CO_2 REFRIGERANT SOLUTIONS

- Commercial & Industrial
- Trans-Critical Rack Systems
- Controls & Switchboards

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Propane History

- **1995 - AHT started with first R290 activities** in the field of research and development with “green” refrigerants.
- R290 technology has been proven in the field in Europe and Asia, and it has been in North American market since 2008.
- R290 has excellent thermodynamic properties leading to high energy efficiency and low charges which allows for smaller heat exchangers and piping dimensions.
- All AHT R290 cooling and freezing circuits are so called “hermetically sealed“ systems with the lowest leakage rate on the market of less than <1%.
- Compared to CO2 Refrigerant, R290 is also usable with higher ambient temperature and guarantees higher temperature stability. It has also been proven as a safe alternate refrigerant.
- Being an organic compound (hydrocarbon), R290 has low ozone depletion potential and a negligible direct global warming effect.

• To date AHT has over **9000 stores operating with R290 globally**, with more than **100 stores operating in North America.**

R290 is a proven refrigerant!

R290 produced since 2008: over 2.000.000 units

✓ **625,700 Jumbos**

✓ **50,400 Kinleys**

✓ **84,700 Ventos**

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AHT REFRIGERATION SOLUTIONS

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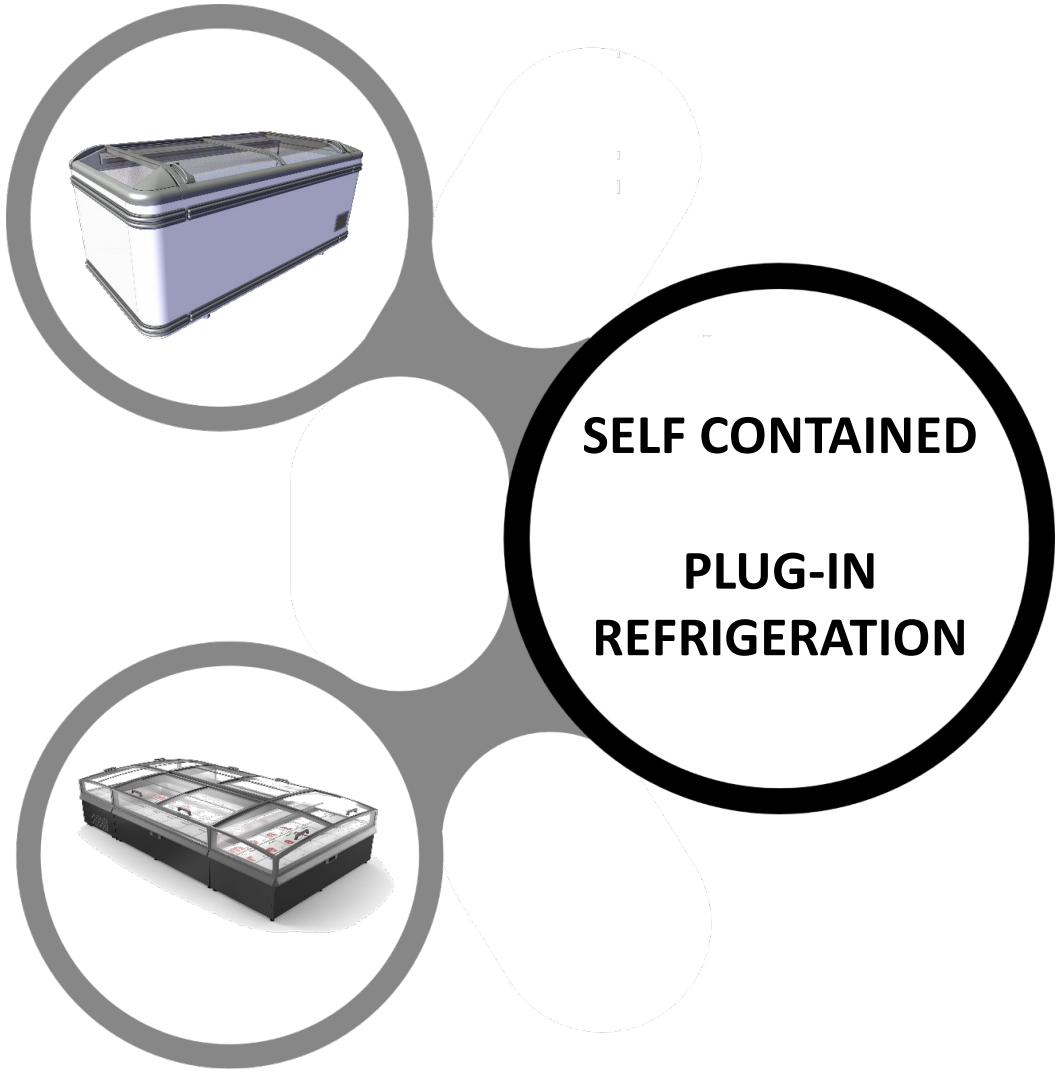

- Entirely self-contained system
- Single connection point
- Refrigeration line(s) not required
- No condensate drain(s) required
- Semi-auto defrost
- 110/120 (60 HZ)

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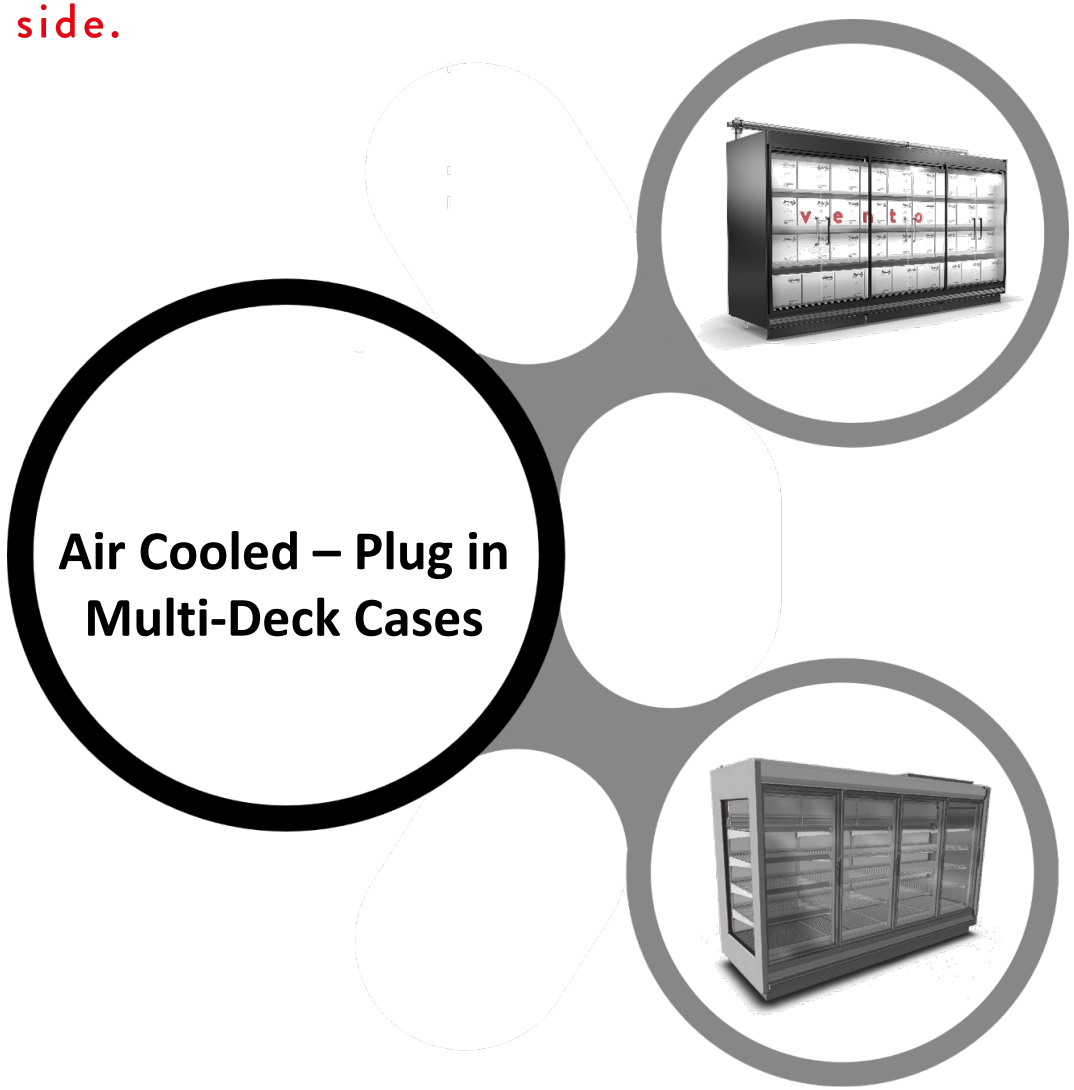

- Self-contained plug-in system
- Refrigeration line(s) not required
- **NO RCU or Rack Required**
- 208-230 volt, 3Phase
- Requires condensate drain or pump to remove water

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Product Portfolio

Bunker Cases

- R290 system
- 6 & 7ft wide island options
- Self contained multi temp spot merchandiser
- Little to no maintenance
- Improved energy efficiency

Kinley Gen 5 Paired with Bunker Case Island

- R290 system
- 7ft and 8ft lengths
- Low Temp Overhanging Cabinet
- Upgraded Semi-Automatic defrost now faster and more stable
- Updated condensation system
- Improved energy efficiency

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AHT R290: MULTIDECKS AVAILABLE IN AIR COOLED

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CASE DESIGN

- Less than 5.29 oz (150g) of refrigerant per circuit
- Single Evaporator spans the full length of the cabinet for each circuit
- Compressor management via Pack-Controller (Dynamic load adjustment) improves Energy Efficiency – only 1-3 compressors operating at a single time once the unit reaches its set point
- Reduce product loss with redundancy using multiple R290 compressors
- Plug & Chill allows cases to be cooling within four hours
- Lighting and integrated motorized night blinds designed to improve energy savings and reduce store operating costs.
- Cases available for Deli/Dairy, Produce, Fresh Meat, Vertical Frozen and low-profile applications.

PRODUCT NAME	DIMENSIONS (L x D x H) In	R290 CHARGE PER CIRCUIT (oz)	TOTAL # CIRCUITS PER UNIT	TOTAL R290 CHARGE (oz)	kWh/24h
VENTO 250 L7	101.6 x 45.7 x 83.3	5.22	2	10.44	29
VENTO 375 L7	150.8 x 45.7 x 83.3	5.22	3	15.66	43
VENTO Plus L7 250	101.6 x 45.7 x 83.3	5.22	2	10.44	16.2
VENTO Plus L7 375	150.8 x 45.7 x 83.3	5.22	3	15.66	24.3
VENTO Freeze 156 (2dr)	65.5 x 45.7 x 83.8	5.22	1	5.22	23.1
VENTO Freeze 312 (4dr)	127 x 45.7 x 83.8	5.22	3	15.66	52.8
VENTO SV 198	81 x 39.3 x 67.1	5.22	2	10.44	45.13
VENTO SV 250	101.6 x 39.3 x 67.1	5.22	2	10.44	54.11

*5.29 (oz) = 147.98g

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Typical R290 Micro Distributed System with R290 Plug In Cases

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Questions & Comments

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Natural Refrigerants

Which refrigerants are counted as Natural Refrigerants?

NH3	Ammonia	R717
CO2	Carbon dioxide	R744
H2O	Water	R718

Hydrocarbons (Commonalities of these substances: Highly flammable!)

CH4	Methane	R-50
C2H6	Ethane	R-170
C2H4	Ethylene	R-1150
C3H8	Propane	R-290
C3H6	Propene	R-1270
C4H10	n-Butane	R-600
C4H10	Isobutane	R-600a
C5H12	n-Pentane	R-601
C5H12	Isopentane	R-601a
C5H12	Neopentane	R-601b

Commonalities of natural refrigerants:

ODP (Ozone Depletion Potential): 0

GWP (Global Warming Potential): < 3

Compared to CFCs: ODP:1 GWP: 10,720

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What is R290?

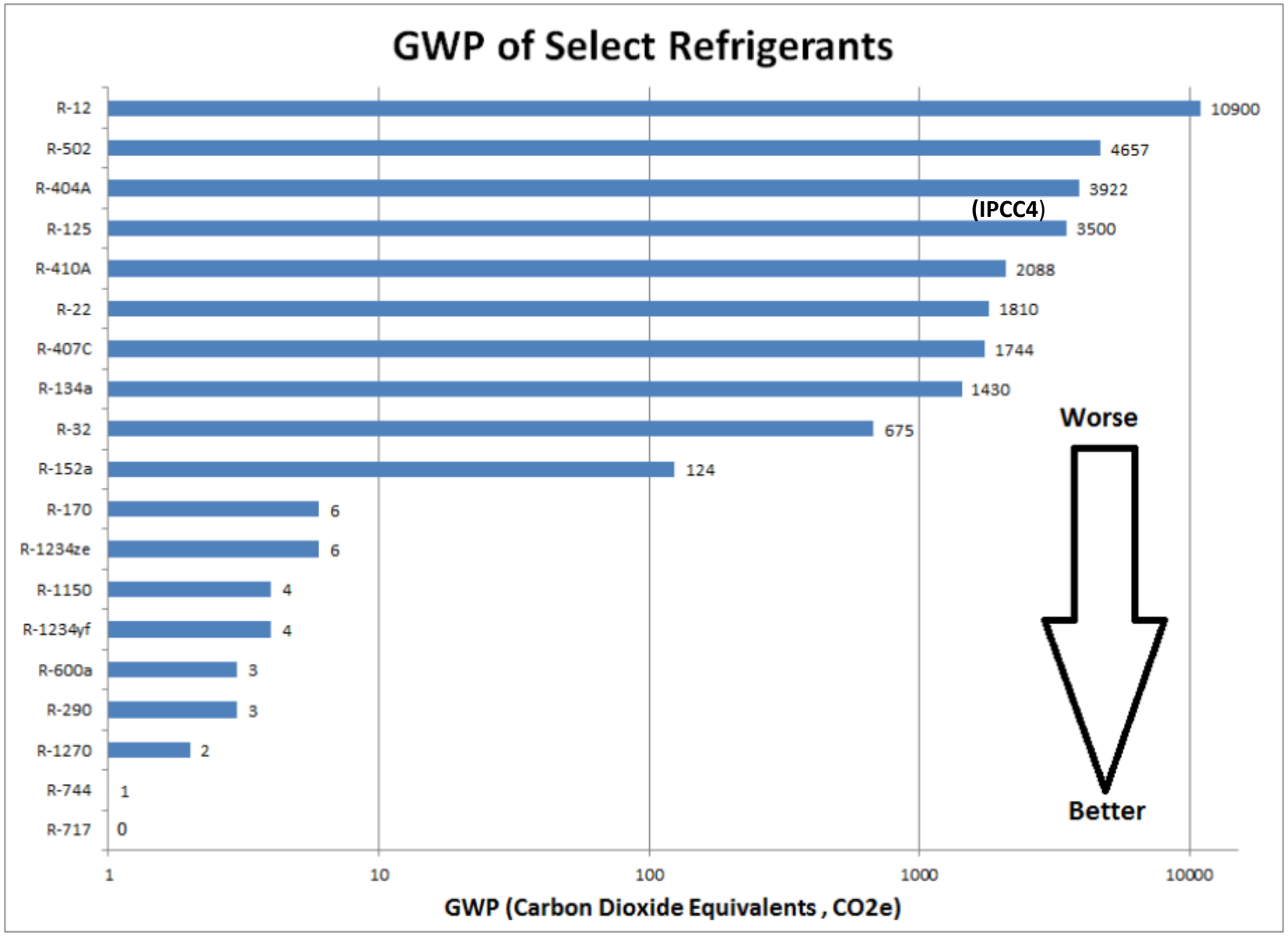
Global warming potential

GWP is a measure of how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to carbon dioxide.

Carbon dioxide has a GWP of exactly 1 - since it is the baseline unit to which all other greenhouse gases are compared.

IPCC6 GWP 0.02 R290 of 100 year

IPCC6 GWP 1 R744



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What is R290?

Characteristics

The gas originates from the extraction and processing of natural gas or crude oil and can be stored and transported in liquid form.

Chemical formula: C3H8

Risks:

- Displaces air and impairs breathing
- Flammable gas

The propane for kitchen use or the cylinder for your BBQ-Grill is propane, but it is NOT R290!

- R290: Purity Level ≥ 99.5% |Propane: Purity Level < 97.5%
- R290: Very low levels of unsaturated hydro-carbons
- R290: Moisture < 10 ppm
- R290: Non-condensables < 1.5% by volume
- R290: is odorless! | Propane: Scent is added, so has odor.

Gas/vapor heavier than air. May accumulate in confined spaces, particularly at or below ground level.

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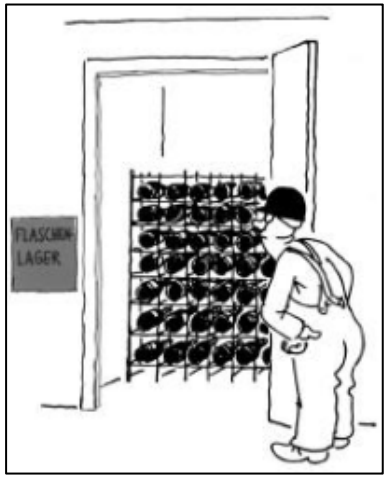
Storage Of Flammable Gasses

- Gas bottles need to be protected against stronger warming, fire, dangerous corrosion, mechanical damage and unauthorized access.
- The compressed gas tank must be stored upright or lying and secured.
- Liquid gas tanks must be stored upright.
- When they are stored in basements, sufficient ventilation must be ensured.
- Valves must be protected with protective caps.
- Transferring gasses in storage rooms is not permitted!



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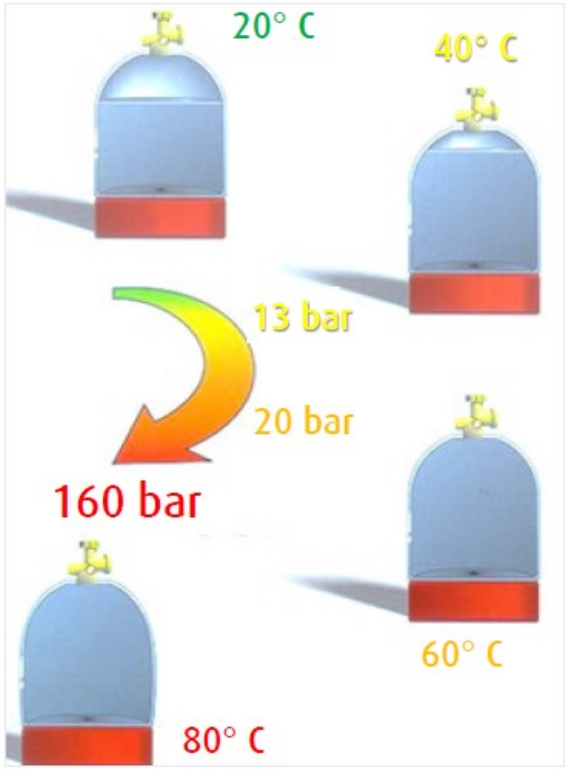
Storage Of Flammable Gasses



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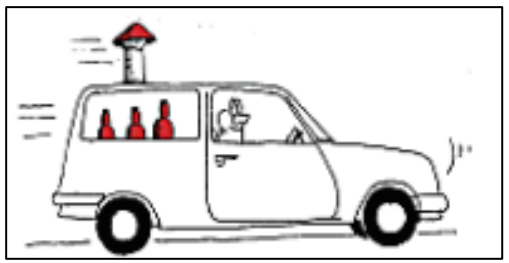
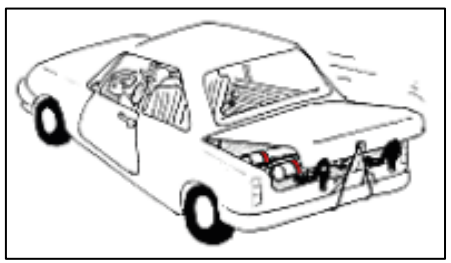
Transport In Motor Vehicle

- It is only permitted to transport small quantities of gasses in vehicles.
- For larger quantities, at least 2 ventilation openings of 4x4in. or 100x100mm are required.
- Ventilation openings must not be sealed or closed
- Bottles must be secured adequately
- Valves must be closed, and caps must be screwed on
- Transport with fittings screwed on is not permitted
- A fire extinguisher must be present for flammable gasses





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Classification Of Units According Zones And Filling Volume

Units with a flammable filling volume of less than 150g: < 5.3 oz future under approvment 17.63 oz

*for the future, larger filling quantities are already being coordinated in various countries.

No zone (according ATEX) eg. : household refrigerators, AHT freezers, VENTO GREEN MC

Units of this classification may be operated according to **please refer to local regulations**. E.g. for EU DIN EN 60335-2-89 and DIN-EN-378 if:

- electrical equipment is insulated
- the unit has been equipped with the respective information signs

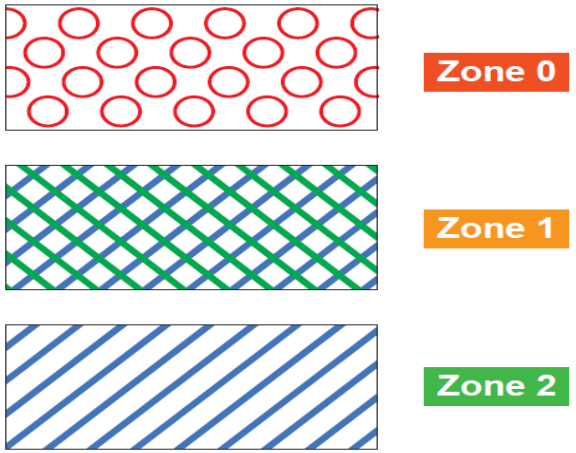
Units with a flammable filling volume of more than 150g: > 5.3 oz

Zone 1 – 2 (according ATEX) eg.: VENTO GREEN , GD HP, chillers

Unit is subject to standard EN 1127-1 or alternatively guideline 99/92/EC (ATEX 137). The following additional conditions, among others, must be complied with for operation:

- gas warning device with acoustic alarm in the event of leaking gas
- individual acceptance onsite by a certified test center
- fire extinguishers nearby and in sufficient numbers
- fire alarm system

Classification of units according explosive atmosphere:	
Zone 0	Flammable gas is constantly present or present for a longer period of time more than 1000 hours per year
Zone 1	It is likely that flammable gas will be present during normal operation more than 1000 hours per year
Zone 2	Flammable gas is unlikely to be present during normal operation more than 1000 hours per year



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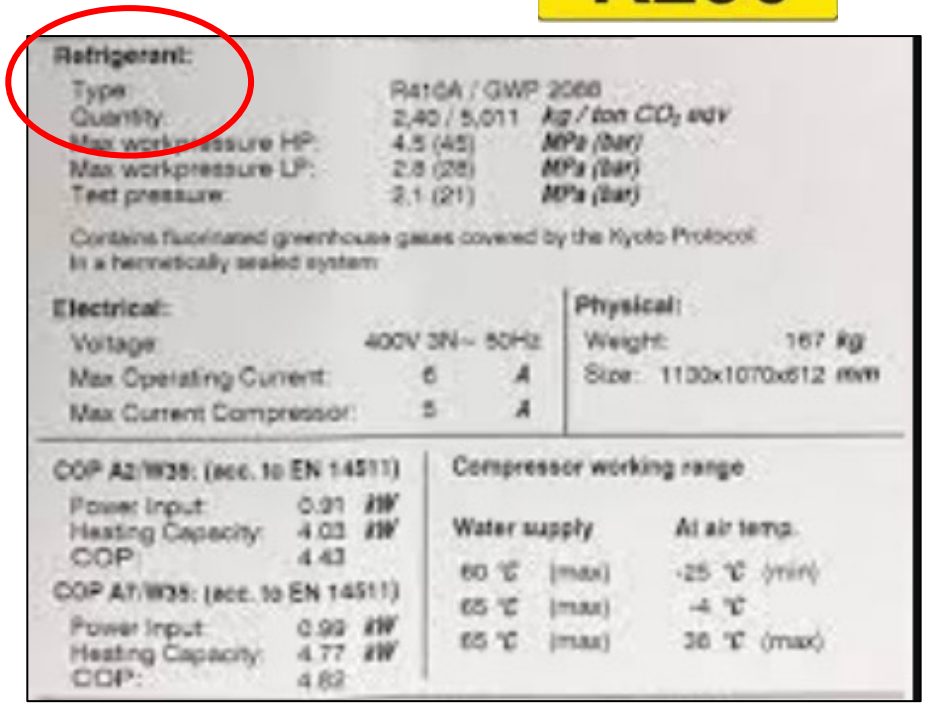
Flammable Refrigerants General Precautions

- ✓ **Do I need a certification or specialized training to service R290?**
  - This depends on local legislation. Check your local legislation.
  - It is strongly recommended that a local Hands-On Training on R290 is followed locally.
- ✓ **Is special labeling on equipment required?**
  - Yes, the unit has to be labelled with a clear indication that it is an R290 Unit.
- ✓ **What is the amount of R290 that is in the unit I'm serving?**
  - Please have a look on the type plate
  - plug in cabinets do have normally les than 150g, others like Heat pumps, Chillers could have significantly more



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Flammable Refrigerants Safety Precautions When Repairing

- ✓ **Exclude (electrical) ignition sources**
  - Disconnect the electric circuits of the unit and neighboring units
  - Smoking is forbidden during the repair!
- ✓ **Exclude explosive atmosphere**
  - Attention to residual gas (Even after flushing with nitrogen residual gas has to be expected)
  - Ensure that the room has adequate ventilation.
  - Pay attention to drains in the floor, basement windows, air shafts or the like.
- ✓ **Exclude unauthorized presence**
  - Please have a look during the work that nobody unattended is in the area (eg.: close the area with a warning tape, that no untrained personnel, or bystanders are in the area.)

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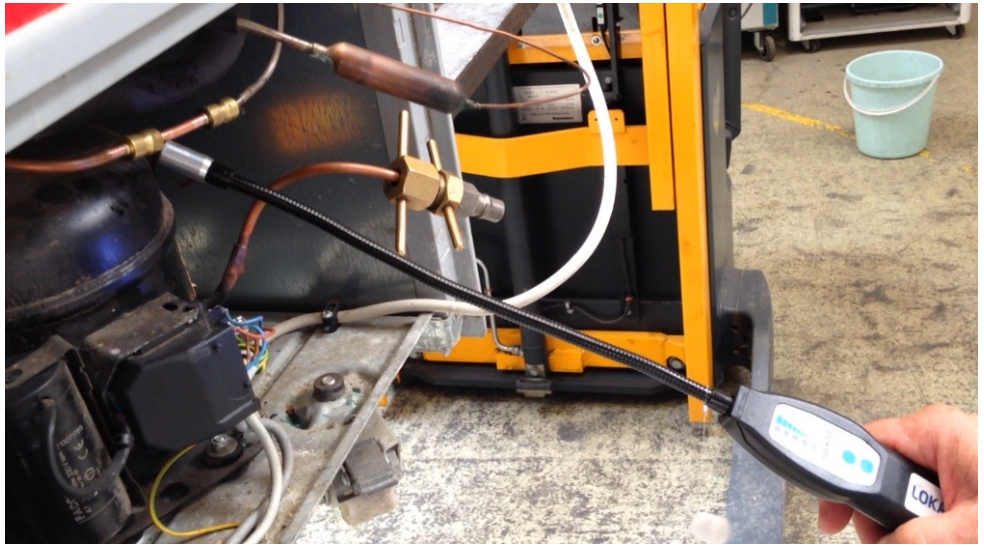
Flammable Refrigerants Leak Detection

- ✓ Make sure electronic leak detector is ON immediately after you enter service area.
- ✓ R290 is heavier than air and will accumulate in the deepest part when there's a leak.
- ✓ Do not turn the leak detector OFF until you leave the service area when the work is done.
- ✓ Use an electronic leak detector dedicated for combustible gases.
  - Any other type leak detector or halide leak detectors ARE NOT ALLOWED for servicing R290!
  - Any leak test dyes ARE NOT ALLOWED for servicing R290!
  - Soap bubbles may still be used but electronic leak detector is a must to give service to an R290 unit.
- ✓ Sampling of the soldered and pressed joints with a leak detection device for each at least 5 sec.



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Flammable Refrigerants Service Tools
Refrigerant Recovery

- ✓ **R290 is to be vented, what then?**
  - DO NOT VENT R290 inside a building under any circumstance.
  - DO NOT VENT R290 in a public area, explore surroundings for any trace of ignition sources, open flames, smoking areas. Please remember that cell phones, electronic devices might also be an ignition source.
  - You HAVE TO inform everyone in the immediate area that you are venting flammable gas to the atmosphere.
  - ENSURE all local legislations are fulfilled!
  - DO NOT VENT into a low-lying area where R290 might accumulate. Remember, it is heavier than air!
  - After venting, purge the system with dry nitrogen at least for 10 seconds to displace any trapped R290 in the system. Trace amounts of R290 will remain trapped in the POE oil of the compressor!
- ✓ **Legislation-wise, since R290 has ODP=0 and GWP=3, there is no obligation to recover R290. However, it is recommended to recover R290 with suitable equipment.**
- ✓ **After recovery, purge the system with dry-nitrogen at least for 10 seconds to displace any trapped R290 in the system.**
  - Recovery device/cylinder should be suitable for use with hydro-carbons!
  - Recovery device/cylinder should be explosion proof!
  - Recovered refrigerant should be delivered to disposal-companies.

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Flammable Refrigerants Service Tools

What are the standard refrigeration service tools when working with R290?

Brazing Set

Dry-Nitrogen, Regulator, Hoses

Vacuum Pump

All equipment should be Explosion-proof equipment

Lokring Unions

Lokring Wrench

Alternative for brazing. This is not a standard refrigeration tool. Check if can be used!

Thread Adapter
All flammable refrigerant cylinders are left-threaded!

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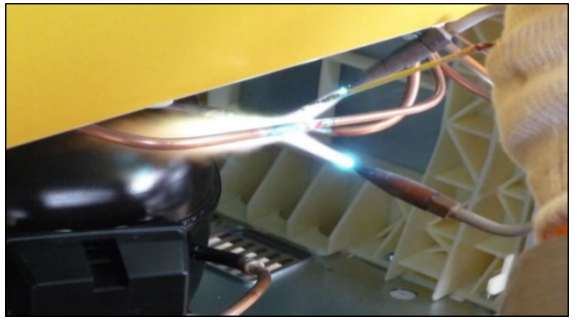
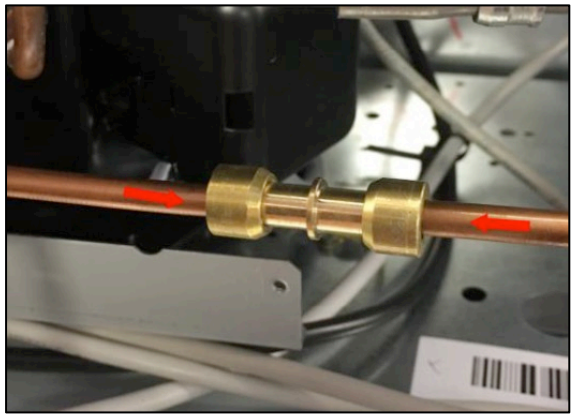
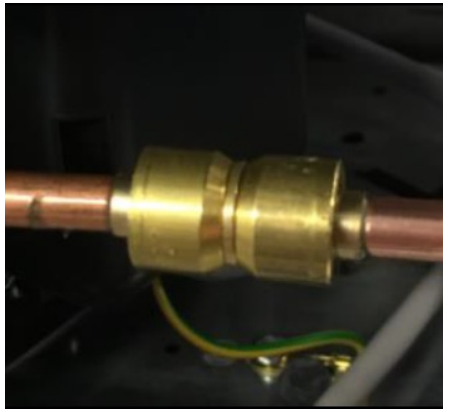
Repair Of Flammable Refrigerant Units

Extreme caution is required at the beginning and throughout the repairs to hydrocarbon systems!

- An **estimated 80%** of the **errors** in refrigerant systems are **not in the cooling circuit**.
- Exchange of components, only with certified and specified components.
- Never use torches when removing system components. Use a pipe cutter instead.
- Electrical components should be spark-free and are certified for being a non-sparking component..
- After disposal of the refrigerant, residual gas is to be expected (even after flushing with nitrogen), because it can bond with oil, which can then liberate the gas.
- Open pipelines carefully; pay attention to floor drains (seal them if necessary).
- If soldering is necessary, dispose of the protective gas filling; evacuate the unit with a vacuum pump. Afterwards solder in the replacement part while flushing with nitrogen.
- Suggestion: instead of brazing use Lokring- connectors. With this connectors you can manufacture a hermetic bond without flame.
- Ensure adequate ventilation during the work, especially during the start-up



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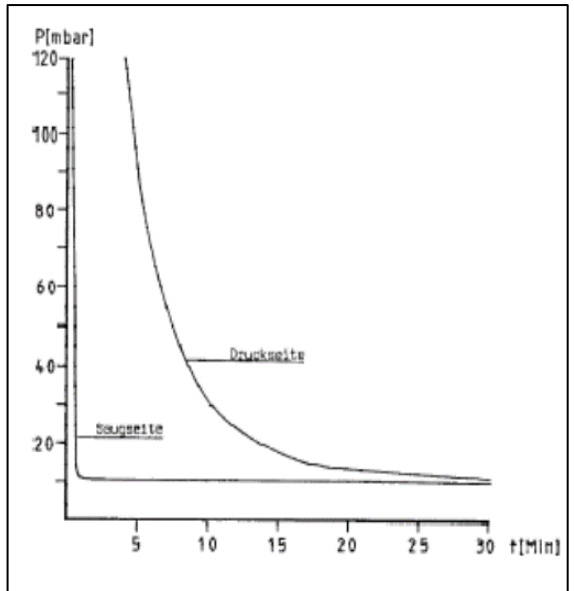
Flammable Refrigerants Pressure Test & Vacuum

- ✓ Using the service port with the piercing valve, perform a pressure test with nitrogen.
- ✓ When no leaks have been found, vacuum the system until you reach 0,3 mbar vacuum level.
- ✓ R290 uses POE type oil which is very hydroscopic and absorbs moisture very quickly. It could be required to break the vacuum 3-4 times with dry-nitrogen before performing final evacuation to 0,3 mbar.
- ✓ Evacuate the cabinet long enough. No Refrigerant should left into the Tubes and into the Compressor. The time required for this process depends on the amount of refrigerant. This takes up to 15 minutes or more. The compressors must be shaken briefly at least once during draining so that as much refrigerant as possible, which is bound in the oil, is released.



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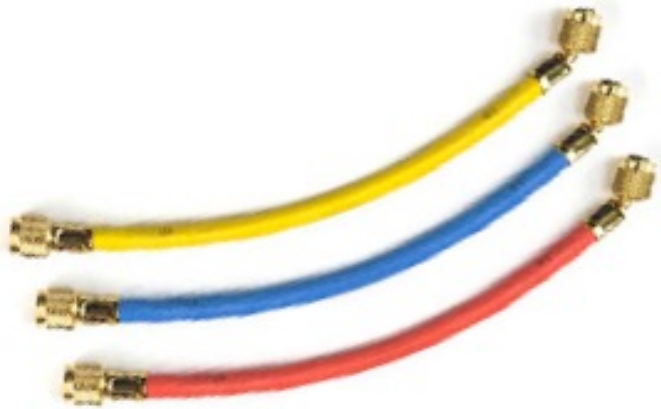
Flammable Refrigerants Charging

- ✓ Charge cylinders are not allowed with R290.
- ✓ Prior to charging, make sure there are no leaks. Check the vacuum level during evacuation.
- ✓ Hoses should be as short as possible to minimize the amount of refrigerant in them. Since the refrigerant amount in PLUG IN CABINETS are normally max 150 grams, ±30 gram charge for instance would affect normal operation conditions drastically!
- ✓ Your scale should be a gram scale.



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Safety First Aid Measures

General

- Contact with evaporating liquid may cause frostbite or freezing of skin.
- In case of frostbite spray with water for at least 15 minutes.
- Apply a sterile dressing. Get medical attention.

Skin contact

- High concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness.
- Victim may not be aware of asphyxiation. Remove victim to uncontaminated area wearing self contained breathing apparatus.
- Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

Eye contact

- Rinse the eye with water immediately.
- Remove contact lenses, if present and easy to do.
- Continue rinsing. Flush thoroughly with water for at least 15 minutes.
- Get immediate medical assistance. If medical assistance is not immediately available, flush an additional 15 minutes.

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Safety Summary

Safety Summary:

- Switch off all electrical devices in the danger zone!
- Detection and removal of ignition sources (static discharge, capacitor, cell phones, hot surfaces, etc.)
- Separate the danger area and set up warning signs.
- Use a mobile gas extraction system (to not release refrigerant in the environment!)
- Use a gas detection system to identify the leak.
- Keep a fire extinguisher nearby.
- Use your personal protective equipment (PPE).

These procedures only take a short time!

As a service technician, you not only avoid injuries, but also avoid additional legal consequences!

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Questions & Comments

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Product and SPI System

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AHT PLUG IN PORTFOLIO

- ✓ All AHT Units are delivered pre-charged with R290
- ✓ Units are hermetically sealed with refrigeration cycle leak rates **< 1%**
- ✓ Volume of Refrigerant depends on the unit. Filling amount is between 3.9 -5.3 oz per circuit.

Freezers & Refrigerators

MONTREAL
MIAMI
PARIS
SYDNEY
IBIZA
Manhattan

Overhead cabinets

KINLEY XL

Multidecks

VENTO
KALEA

Chests

IBIZA
RIO
SAO PAULO

Promotion Coolers

AC COOLER

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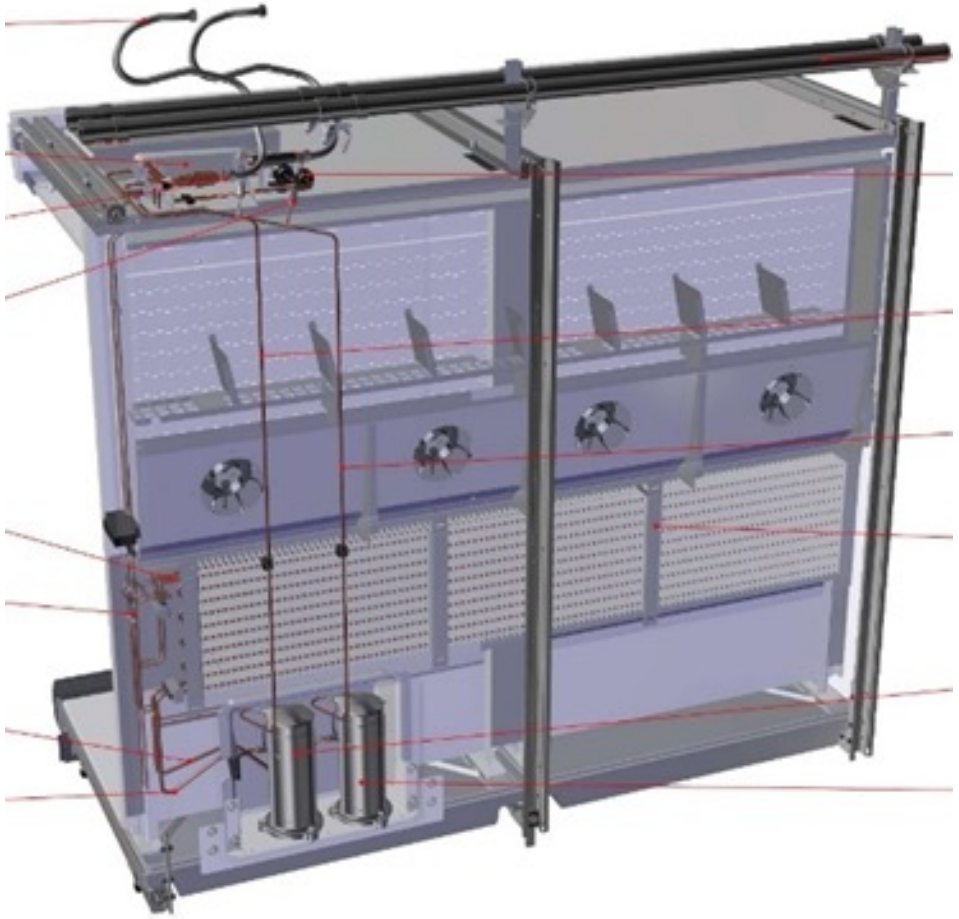
R290 – Water Cooled Equipment

Best Practices - Case Design Standards

- Based on Cabinet Type/Design, unit could consist of 1 to 3 R290 Compressors with less than 150g < 5.2 oz of refrigerant per circuit
- Single Evaporator with Independent circuits, heat exchangers and Expansion Valves
- Soft-Start Modules, fitted to each compressor; reduces Start-up Noise
- Compressor Management via Pack-Controller (Dynamic load adjustment) improves Energy Efficiency – only 1-3 compressors operating at a single time
- Reduced risk of Product Loss; fail safe operation through independent circuits
- Low Start-up current and immediate cooling within hours
- Quick Connect Supply and Return Hoses
- Lighting Controls allow for Day/Night Set-Up with simple Daisy Chain Connection
- Integrated Motorized Night Blind for Open Cases can also be incorporated into day/Night mode to further improve Energy Savings
- Standard Deli/Dairy, Produce, Fresh Meat, Vertical Frozen and Semi Vertical available

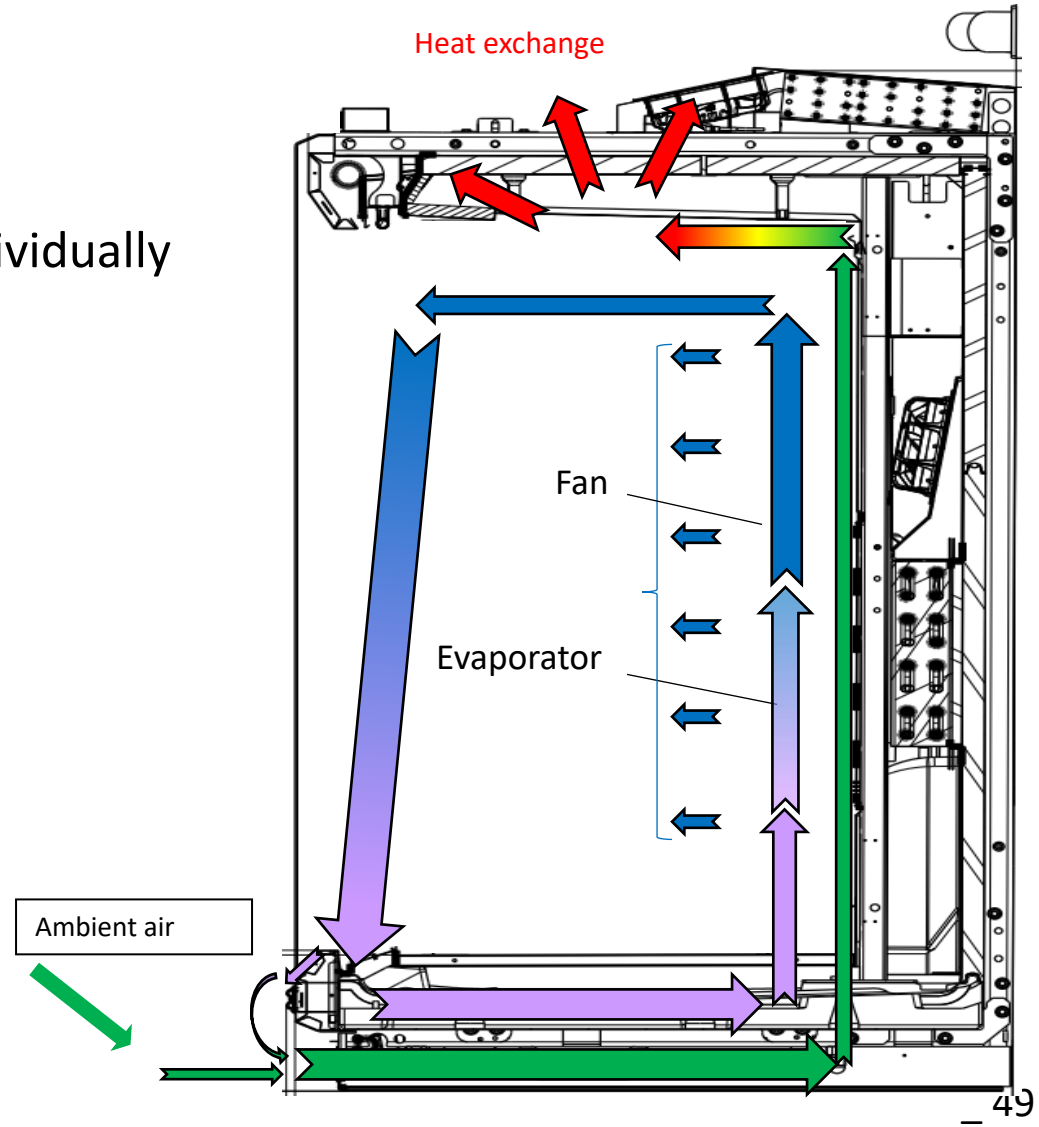


Air Cooled Unit

AIR

- The devices are independent of a brine system and can be individually positioned in the market.

- The waste heat is emitted by air heat exchanger on top of the refrigerator directly into the market.



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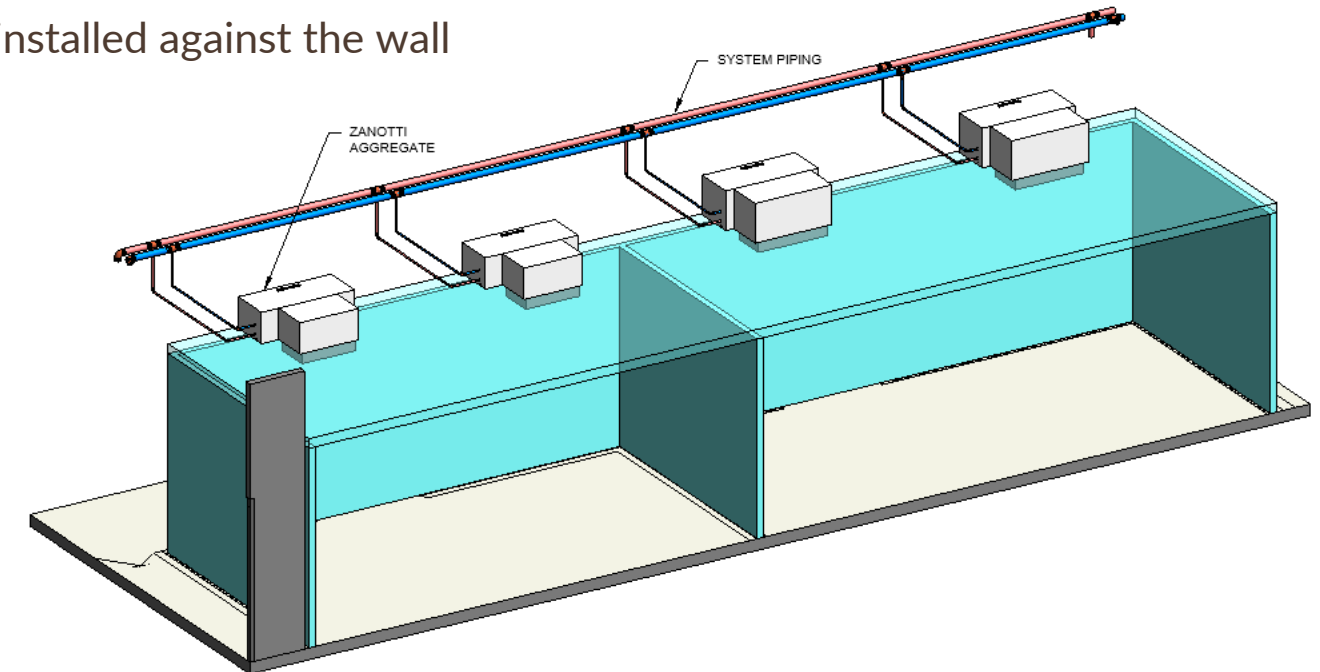
R290 – Walk In Cooler Applications

Integrated with Sales Floor Waterloop System

- Available in Condensed Water AND Air version
- Low Temp Models with BTU range of 4,000 to 20,000
- Medium Temp Models with BTU range of 3,000 to 9,000
- Helps reduce overall height of Walk In Cooler
- Low profile \ not installed against the wall
- Configuration determined by Walk In Cooler Footprint
- No Drains inside Cold Rooms
- Penetrations can be aligned with all cold Room Panel manufacturers
- Integrated Control Panels, No major commissioning or Start Up



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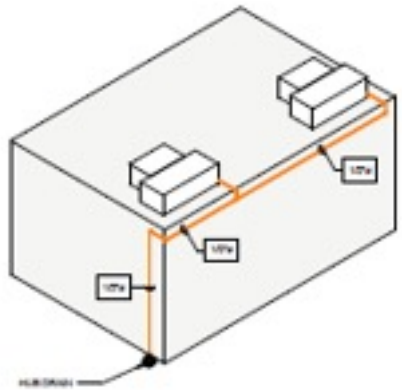
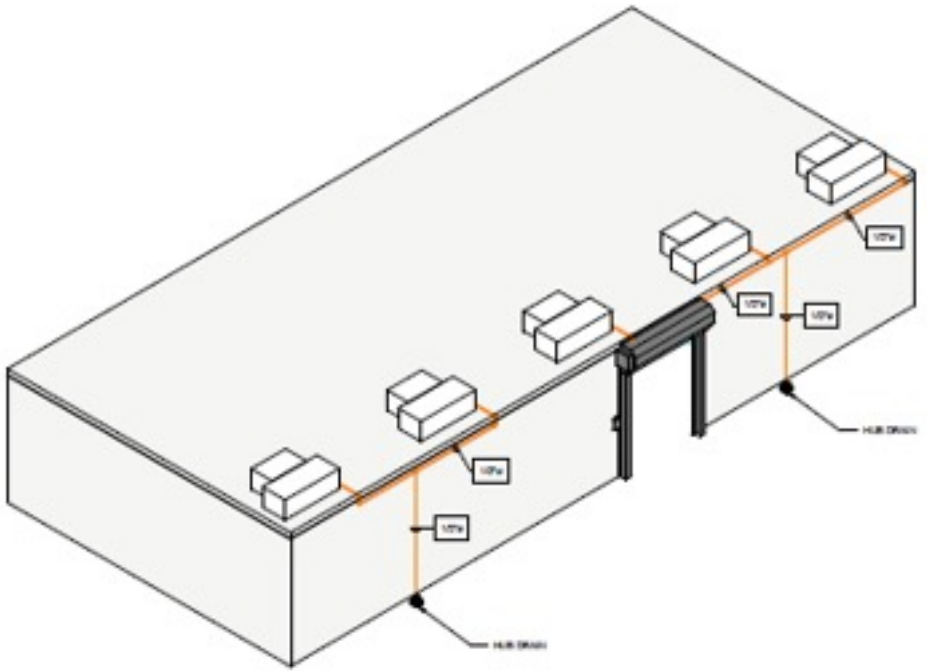
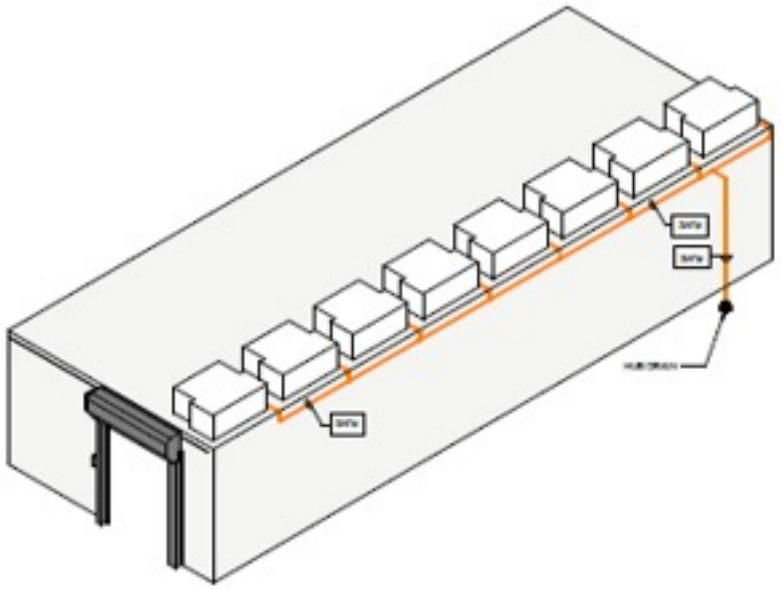
Monoblock Condensate Lines







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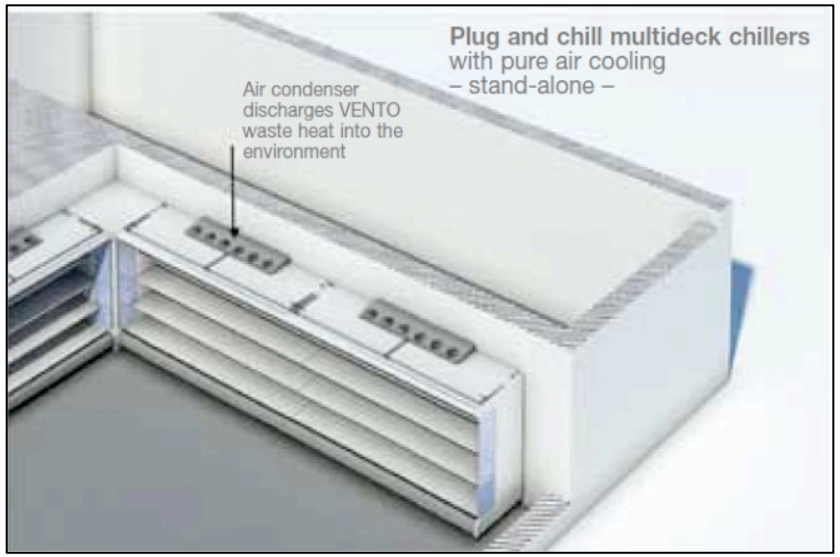
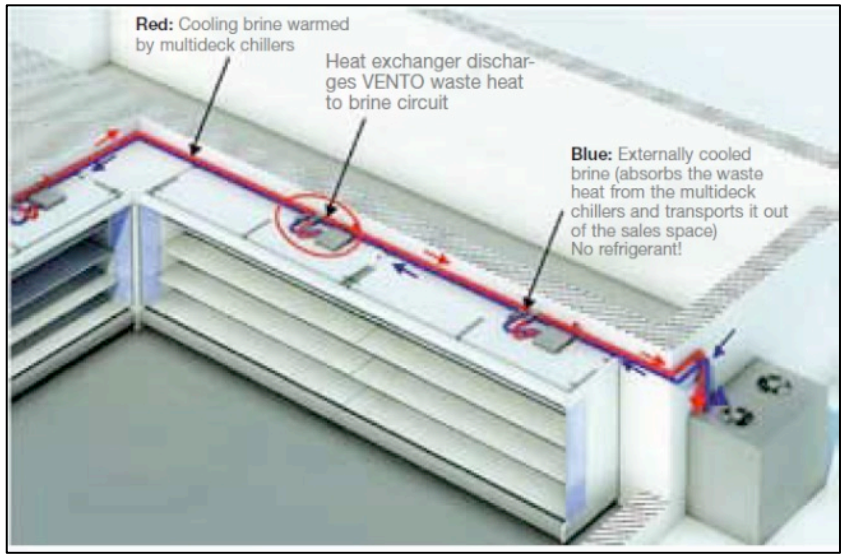
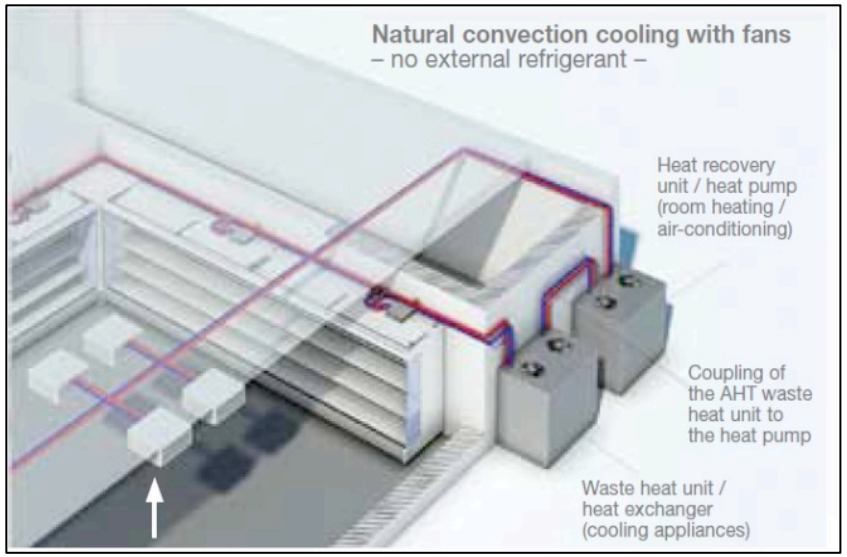
VENTO SYSTEM & HOW IT WORKS







AIR: Direct heat discharge into the sales space assists store heating during heating periods

- Minimal installation work
- Increased customer comfort No cold air in front of the refrigerated shelves
- No additional investments
- No building alterations
- Outstanding product protection

WATER: Ready for installation

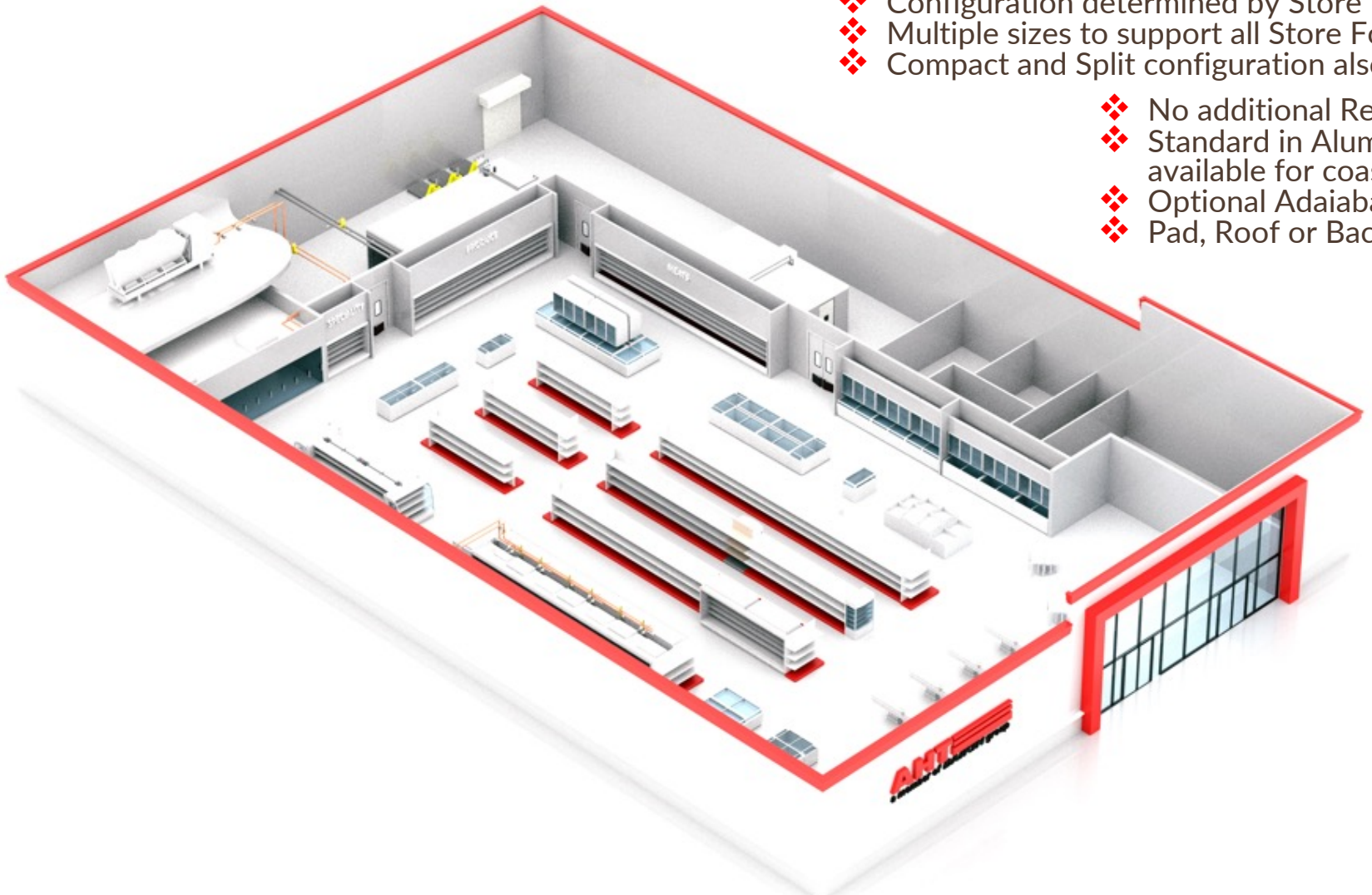
Water pipes are preinstalled on the VENTO multidecks; no alterations to the sales floor

- Optimized energy consumption
- External waste heat unit
- Easy to expand at any time
- Flexible Water chillers can be easily added or expanded
- Extremely low use of refrigerants

HEAT RECOVERY:

- The waste heat from the multidecks can easily be used for heating the store
- Central cooling, air-conditioning system and heating are possible
- Various heating systems can be connected to the water circuit

System Design & Options



- Dry Coolers sized according to kW/BTU Heat Transfer of units
- Configuration determined by Store Footprint
- Multiple sizes to support all Store Formats
- Compact and Split configuration also supports multiple store formats
  - No additional Refrigerant needed
  - Standard in Aluminum; Epoxy and Electrofin Coatings are available for coastal locataions
  - Optional Adaiabatic Functionality
  - Pad, Roof or Back of House Installation

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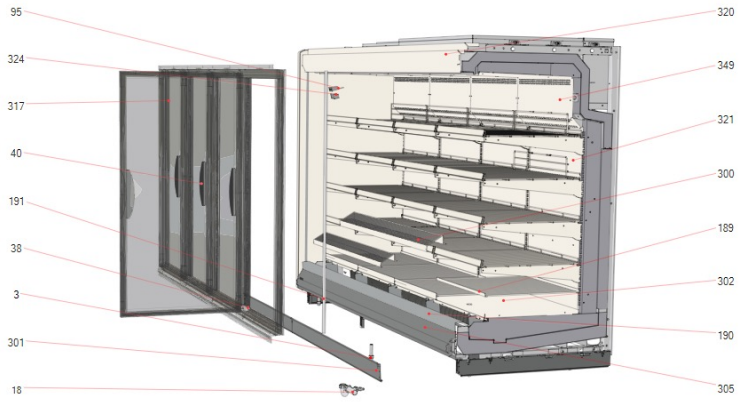
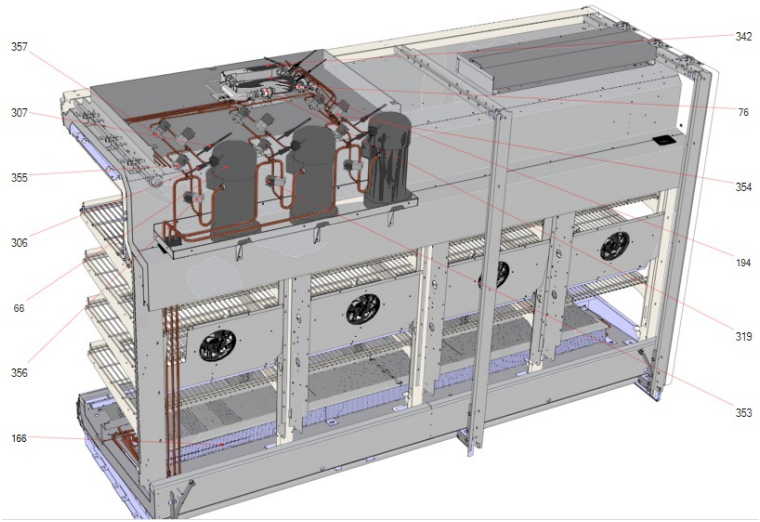
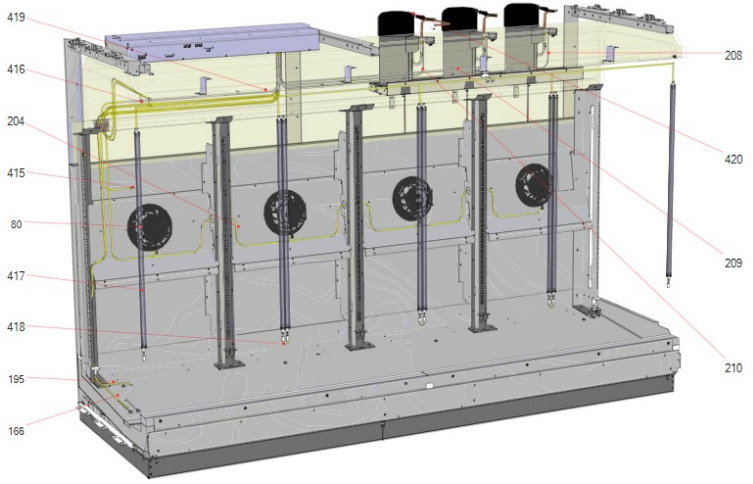
Spare Parts VENTO Freeze







Item no.	Description
3	base mounted 117,5mm
18	siphon 6/4xDN40
35	hydraulic hinge Cisaplast right
40	handle glass door Kinley XL G4 grey7045
95	solar thermometer (°F) TF-LCD white
189	floor grid Vento Freeze 650 white9010
190	alu-cover strip right Cisa GD Frezze 312
191	alu-cover strip Cisa Freeze Multiplexing
300	return air grill 650 Vento Freeze 3125 white9010
301	kickplate set front Freeze 3125 NCS6500
302	floor shelf 650 Vento Freeze white9010
305	base cover Vento Frezze 3125 NCS6500
318	glassdoor Freeze + reedswitch right UB
320	canopy steel Vento Frezze 3125 white9010
321	backwall Vento Freeze V2 white9010
324	holder Solarthermometer Vento Roll-In white9010
349	top cover 700 Vento Frezze white 9010

Item no.	Description
66	compressor ZB11 KAU TF5 XXP USA
76	filter dryer DML 1.52x2/2x 46bar
166	evaporator Freeze 3125 3Cycle
194	micro-plate heat exchanger Vento D22-20 T24006-011
306	pressostat suction pressure PS3-A1U 0,1-1,0bar
307	pressostat high pressure PS4 W1ATEX 3200+TYCO
319	balancing valve Caleffi 1,6m³/h yellow V2
342	micro heat plate exchanger H22-C-40-L T24006-012
353	inductro magnet valve Vento DMF 2800mm
354	magnet valve NO 6mm 500RB 2T2 FLR
355	magnet valve NC 6mm 110RB 2T2 FLR
356	magnet valve NO 12mm 500RB 5T3 FLR
357	magnet valve NC 10mm 200RB 3T3 FLR

Item no.	Description
	Controlling board 3Cycle SA D10 Freeze UL V3
80	fan diagonal EBM Typ K1G200-AA73-12
166	sensor temperature air in Freeze 1 ECN-D60
195	sensor temperature defrost Freeze 2 ECN-D60
204	connection cable fan Freeze 4700mm
208	cable compressor Freeze K1 4pole white
209	cable compressor Freeze K2 4pole blue
210	cable compressor Freeze K3 4pole black
327	fuse PCB radial TR5 4A T x10
415	sensor temperature product Vento Freeze 3 ECN-N3
416	sensor temperature air out Vento Freeze ECN-N60
417	LED tube SAPS Vento 1300mm 24V10,8W 5000K
418	cable connection LED Vento Freeze
419	cable LED Vento Freeze 5500mm
420	cable pressure switch Freeze K1 PS3-N60

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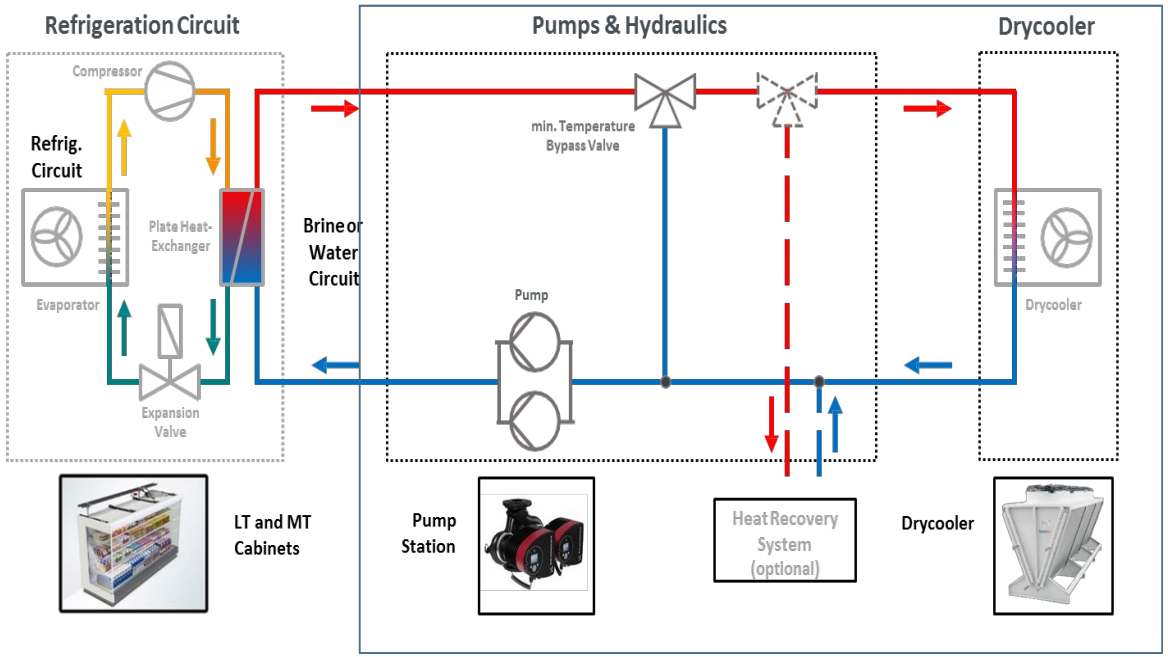
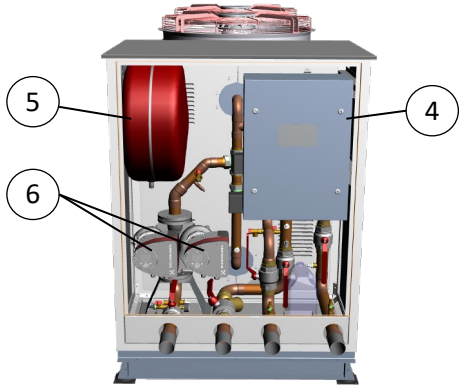
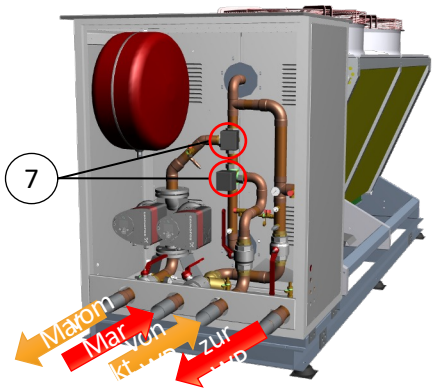
Basetec Waste Heat Unit (Fluid Cooler)

- System Operating between 62F and **118F** supply temp.
- Single Manifold, Dual Pump operates on 12hr Duty Cycle
- Optional: Heat Recovery based on HVAC Setup
- Optional: Adiabatic for Markets with Higher Ambient Conditions/Environments
- Standard in Aluminum; Epoxy and Electrofin Coating for Coastal



1... Fans
2... Pump station
3... Condenser/dry-cooler





4... Control box

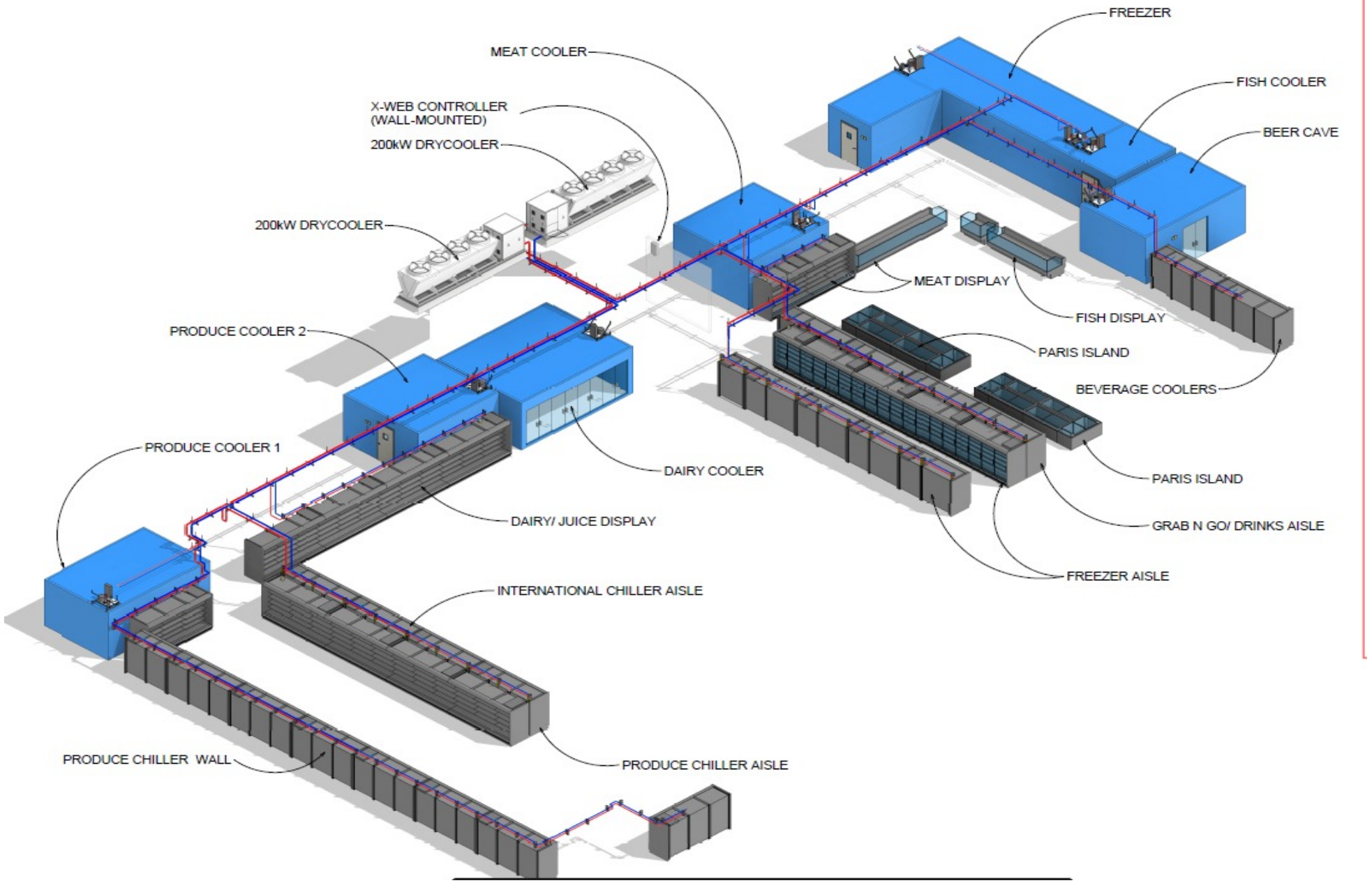
5... Expansion vessel

6... Circulating pump

7... 3-way mixer valve

Uitz Andreas

Store Layout



Hans Juergen Freidl

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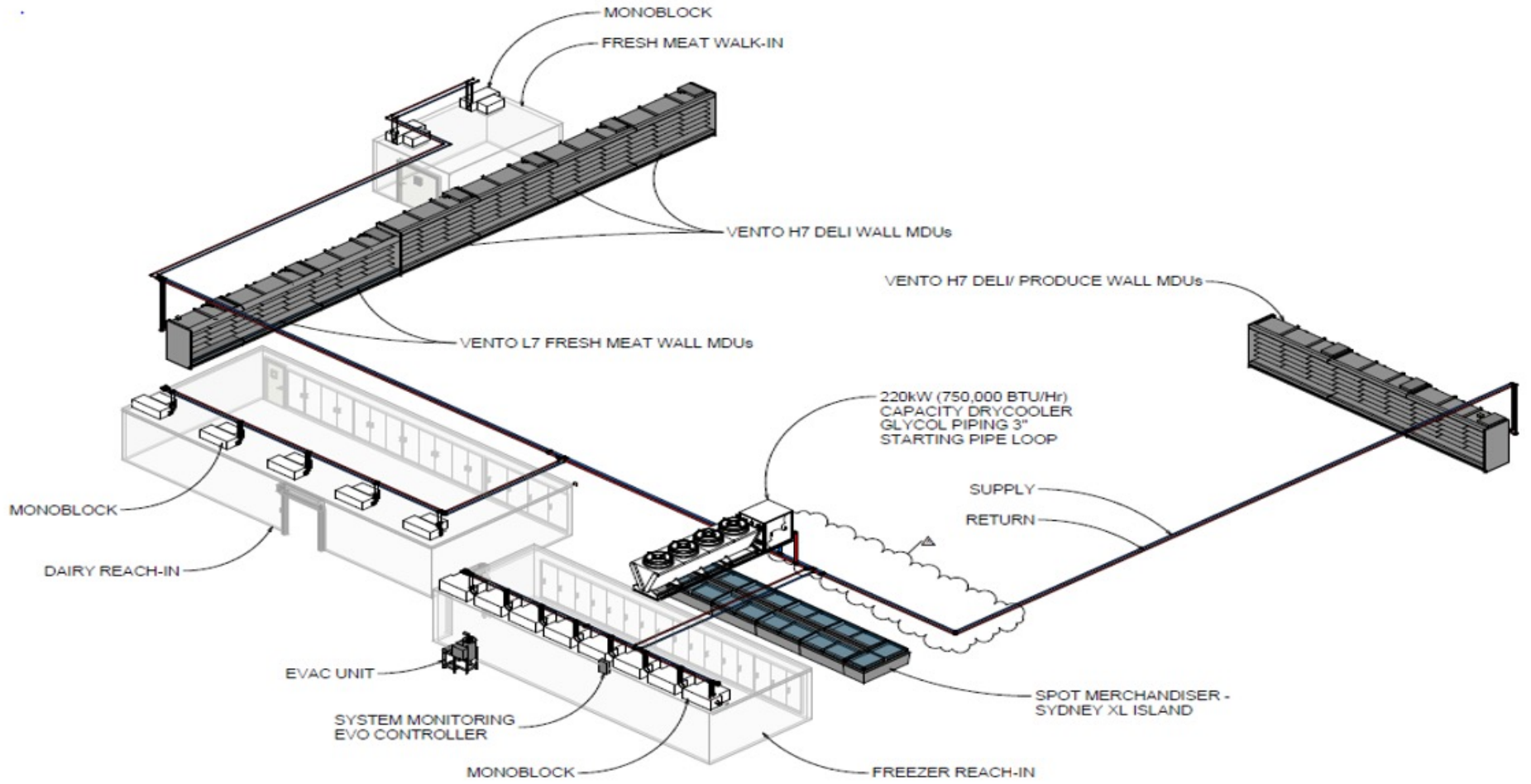
Store Layout

- What is the reason why we need to use glycol in our system?
- Which glycol must/should be used?



SYSTEM OVERVIEW

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Energy Efficiency

Midsize Supermarket

- 2 Water Loops
- 39 Cases on Water Loop
- 48 Cases Plug In
- 3 Cold Rooms (LT/MT)
- > 50lb Refrigerant

Department	LN FT/Doors	Total lb of R290	Total kWh/24h	Estimated total kWh/24 cost
Dairy	96	8	232	27.84
Fresh Meat	36	3	87	10.44
Deli	48	4	116	13.92
Produce	72	5	145	17.4
Frozen Doors	72	18	954	114.48
Multi Temp Horizontal Merchandiers	48	4	54	6.48
Walk-In Refrigeration Units	12	4	80.3	9.636
Dry Cooler	2	N/A	160	19.2
				$219.396 Calculate with $0.12
		46	1828.3	

Small Format

- 1 Water Loop
- 20 Cases on Water Loop
- 24 Cases Plug In
- 2 Cold Rooms (LT/MT)
- > 30lb Refrigerant

Department	LN FT/Doors	Total lb of R290	Total kWh/24h	Estimated total kWh/24 cost
Dairy	24	4	116	13.92
Fresh Meat	16	2	58	6.96
Deli	36	2	58	6.96
Produce	36	4	78	9.36
Frozen Doors	38	11	583	69.96
Multi Temp Horizontal Merchandiers	24	2	27	3.24
Walk-In Refrigeration Units	7	2.4	44	5.28
Dry Cooler	1	N/A	80	9.6
				$125.28 Calculate with $0.12
		27.4	1044	

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Piping Dimension Plan Based On Store Layout

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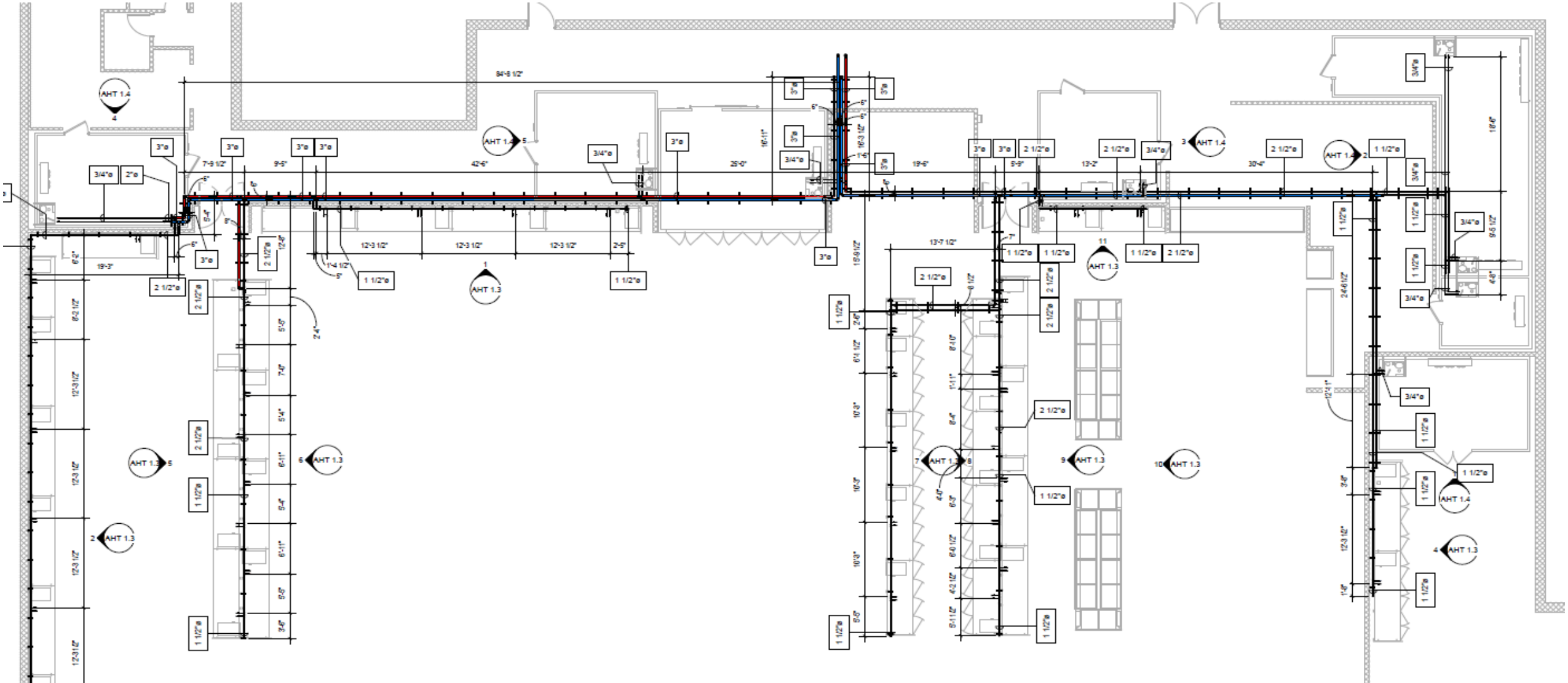
*What do you need to consider when you are pipe dimensioning?



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Electric Specification

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*How many devices can be connected on one fuse?

*What is an RCCB ?

AHT EQUIPMENT SPECIFICATION SCHEDULE

TAG #	PRODUCT CODE	EQUIPMENT MODEL	QTY.	TYPE	MANUFACTURER	FINISH	DIMENSIONS (LxWxH)	WEIGHT	Kw DEMAND	CONDENSER MEDIUM	REFRIGERANT TYPE	NOMINAL CURRENT	TOTAL NOMINAL CURRENT	VOLTAGE SUPPLY	CIRCUIT BREAKER	BREAKER QUANTITY	CONNECTION TYPE	CASE LIGHTING NOMINAL CURRENT	CASE LIGHTING VOLTAGE SUPPLY	CASE LIGHTING CIRCUIT BREAKER	CASE LIGHTING CONNECTION TYPE
C1.0.4	361466	Vento Market Light Control Box	5	Controller	AHT Cooling	N/A	-	-	0	-	-	-	0	110 VAC/1PH/60HZ	10A	5	5/15P	N/A	N/A	N/A	N/A
R1.0	540038	Vento 375 L7	24	Multi-Deck Unit	AHT Cooling	RAL9005	147" X 45" X 83"	1334	7.8	PROPYLENE GLYCOL	R290	12.7A	304.8	208 VAC/3PH/60HZ	20A	24	L15/20P	N/A	N/A	N/A	N/A
R1.1	540055	Vento 375 L7 GD	2	Multi-Deck Unit	AHT Cooling	RAL9005	147" X 45" X 83"	1334	7.8	PROPYLENE GLYCOL	R290	12.7A	25.4	208 VAC/3PH/60HZ	20A	2	L15/20P	N/A	N/A	N/A	N/A
R1.2	540054	Vento 250 L7	1	Multi-Deck Unit	AHT Cooling	RAL9005	98" X 45" X 83"	1032	5.3	PROPYLENE GLYCOL	R290	8.5A	8.5	208 VAC/3PH/60HZ	20A	1	L15/20P	N/A	N/A	N/A	N/A
R1.3	540064	Vento Freeze 156 L7 Bi-Parting	2	Multi-Deck Unit	AHT Cooling	RAL9005	61.5" X 45.7" X 83.8"	1301	3.5	PROPYLENE GLYCOL	R290	5.3A	10.6	208 VAC/3PH/60HZ	20A	2	L15/20P	N/A	N/A	N/A	N/A
R1.4	540041	Vento Freeze 312 L7 LH-Swing	8	Multi-Deck Unit	AHT Cooling	RAL9005	123" X 45.7" X 83.8"	2121	7	PROPYLENE GLYCOL	R290	10.1A	80.8	208 VAC/3PH/60HZ	20A	8	L15/20P	N/A	N/A	N/A	N/A
R1.5	540035	Vento 250 L7 Plus	2	Multi-Deck Unit	AHT Cooling	RAL9005	98" X 45" X 83"	1032	5.3	PROPYLENE GLYCOL	R290	8.5A	17	208 VAC/3PH/60HZ	20A	2	L15/20P	N/A	N/A	N/A	N/A
R2.0	373501	Paris 185 NAM	4	Bunker/ Coffin	AHT Cooling	RAL9005	73" X 33.5" X 33"	-	0	AIR COOLED	R290	3.6A	14.4	110 VAC/1PH/60HZ	20A	4	L5/15P	1.1A	110-120 VAC/60Hz	5A	5/15P
R2.1	373502	Paris 210 NAM	8	Bunker/ Coffin	AHT Cooling	RAL9005	83" X 33.5" X 33"	-	0	AIR COOLED	R290	3.6A	28.8	110 VAC/1PH/60HZ	20A	8	L5/15P	1.1A	110-120 VAC/60Hz	5A	5/15P
C1.0	364230	X-Web Control Box CPL. Xweb EVO V3 UL	1	Controller	Emerson	N/A	-	-	0	-	N/A	-		110 VAC/1PH/60HZ		0	HARD-WIRE	-	-	-	-
C1.0.1	340392	X-Web Temp & Humidity Sensor Dixell XH50P-12	1	Controller	Emerson	N/A	-	-	0	-	N/A	-		-		0	HARD-WIRE	-	-	-	-
C1.0.2	363811	MDEX External Antenna 15m	1	Controller	Emerson	N/A	-	-	0	-	N/A	-		-	-	0	-	-	-	-	-
C1.0.3	364229	Robustel Router R3000-3P	1	Controller	Emerson	N/A	-	-	0	-	N/A	-		110 VAC/1PH/60HZ	-	0	-	-	-	-	-
C2.0	548336	XR-75 Controller	7	Controller	Emerson	N/A						-				0					
C2.1	548337	OEM Temperature Probe	7	Controller	Emerson	N/A						-				0					
R9.0	548294	200 kW Dry Cooler	2	Drycooler	Guntner	N/A	21'-8" X 4'-0" X 5'-11"	3735	0	PROPYLENE GLYCOL	N/A	54.15A	108.3	208 VAC/3PH/60HZ	65A	2	HARD-WIRE	-			
R7.0		GAL-0110.1	4	Evaporator	Guntner/ Heatcraft	N/A	50" X 18.5" X 15.25"	73	4.1	PROPYLENE GLYCOL	R448	8.26A	33.04	208 VAC/3PH/60HZ	COMBINED EVAP/CONDENSER CONNECTED TO 20A CIRCUIT	0	HARD-WIRE				
R7.1		GAL 0180.1	2	Evaporator	Guntner/ Heatcraft	N/A	68" X 18.5" X 15.25"	118	6.8	PROPYLENE GLYCOL	R448	13.89A	25.78	208 VAC/3PH/60HZ	COMBINED EVAP/CONDENSER CONNECTED TO 20A CIRCUIT	0	HARD-WIRE				
R7.2		GDL-0240.1	2	Evaporator	Guntner/ Heatcraft	N/A	87" X 18.5" X 15.25"	204	8.4	PROPYLENE GLYCOL	R448	24.35A	48.7	208 VAC/3PH/60HZ	COMBINED EVAP/CONDENSER CONNECTED TO 30A CIRCUIT	0	HARD-WIRE				
R8.0		ZWN-010X6C	4	Condenser	Guntner/ Heatcraft	N/A		151		PROPYLENE GLYCOL	R448	7.2A		208 VAC/3PH/60HZ	20A	4	HARD-WIRE	-	-	-	-
R8.1		ZWN-025X6C	2	Condenser	Guntner/ Heatcraft	N/A		153		PROPYLENE GLYCOL	R448	12.3A		208 VAC/3PH/60HZ	20A	2	HARD-WIRE	-	-	-	-
R8.2		ZWN-045L6C	2	Condenser	Guntner/ Heatcraft	N/A		185		PROPYLENE GLYCOL	R448	13.5A		208 VAC/3PH/60HZ	30A	2	HARD-WIRE	-	-	-	-
R10.0		SERVICE CASE 4'	1	OEM	Others	TBD	REF. PRODUCT SPEC.		0			-				0					
R10.1		SERVICE CASE 12'	1	OEM	Others	TBD	REF. PRODUCT SPEC.		0			-				0					
R10.2		SERVICE CASE 18'	1	OEM	Others	TBD	REF. PRODUCT SPEC.		0			-				0					

TOTAL = 706.12 AMPS

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R290 - A Viable Solution For Retailers

Category	Plug-In (AIR)	Semi-Plug-In (WATER)	Remote
Format Suitability	Suitable for small store formats and expansion, 2nd location (<15,000ft²)	Suitable for small and medium size store formats (<60,000ft²)	Suitable for big store formats (>60,000ft²)
Refrigeration Cycle	**Factory tested and sealed refrigeration cycle** • Factory quality checked • Reduced leakage • Predefined set-up ✓	**Factory tested and sealed refrigeration cycle** • Factory quality checked • Reduced leakage • Predefined set-up ✓	**On site finalization of refrigeration cycle** • Limited factory checks • Quality dependent on on-site labor • System set-up on site ✗
Installation	• Quick and easy installation, flexible to deploy and rearrange • Almost no installation cost ✓	• Simple installation procedure, just Supply & return water piping • Medium installation cost =	• Rather complicated installation, highly skilled labor necessary • High installation cost ✗
Start-Up / Commissioning	None Required, units are preset from factory ✓	1 Day System Start Up, units pull down to temp once plugged in ✓	Complex Start-up requires high level technicians and time to set-up system ✗
Maintenance	Almost maintenance free, due to factory quality and industrialized production ✓	Almost maintenance free, due to factory quality and industrialized production ✓	Costly maintenance and service required as part of business model =
Services	Remote services ✓	Remote services ✓	Remote services ✓
Refrigeration Charge	Very low refrigerant charges ✓	Very low refrigerant charges ✓	High refrigerant charges ✗
Running Costs	Low running cost, due to low maintenance and medium energy consumption ✓	Low running cost, due to low maintenance and low energy consumption ✓	Medium running cost, due to high maintenance and low energy consumption =

Advantage Neutral Disadvantage

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Refrigeration Monitoring Systems

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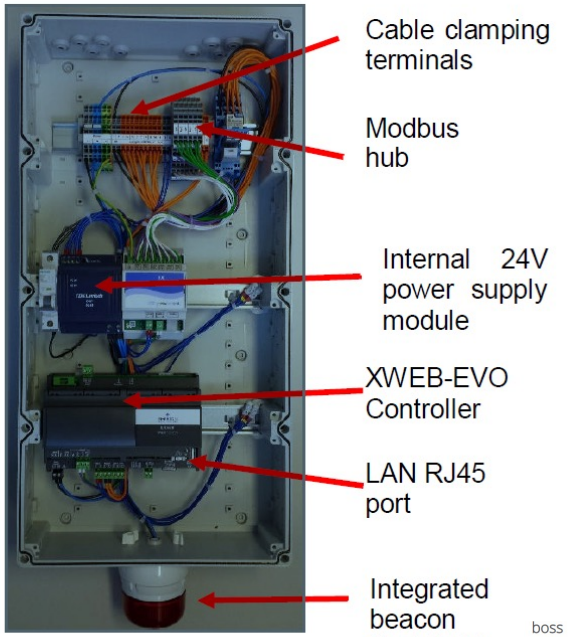
AHT Control Box Hardware Overview

The control box comes already preassembled and prewired. No modifications need to done inside the control box prior to installation. Only the exterior cabling connections to the cooling systems and sensors need to be installed.

TO OPEN unscrew these 6 connections carefully with a flat screw-driver



Cable clamping terminals

Modbus hub

Internal 24V power supply module

XWEB-EVO Controller

LAN RJ45 port

Integrated beacon flash light

boss

Carel

BACnet MS/TP and IP VAV Controller Installation and Operation Manual

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Questions & Comments

Share Your Feedback!

To receive an electronic training certificate:

1. Scan or visit nasrc.org/session-surveys
2. Provide your name and email at the end of the survey

Please Note: *You will not receive a certificate unless you share your name on the survey form.*

Presentation Title

Presenter Name

Affiliation/Company

NORTH AMERICAN Sustainable Refrigeration Council