

# Natural Refrigerant Training Summit

Building a Sustainable Workforce

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## R290 Overview of Micro Distributed Systems & Plug-In Units

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AHT Cooling Systems USA, Inc.



NORTH AMERICAN  
Sustainable  
Refrigeration  
Council

**AHT**   
*a member of **DAIKIN** group*

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# WORLDWIDE



ROTTENMANN, Österreich

1983



CHANGSHU, China

2007



NAVEGANTES, Brasilien

2014/15



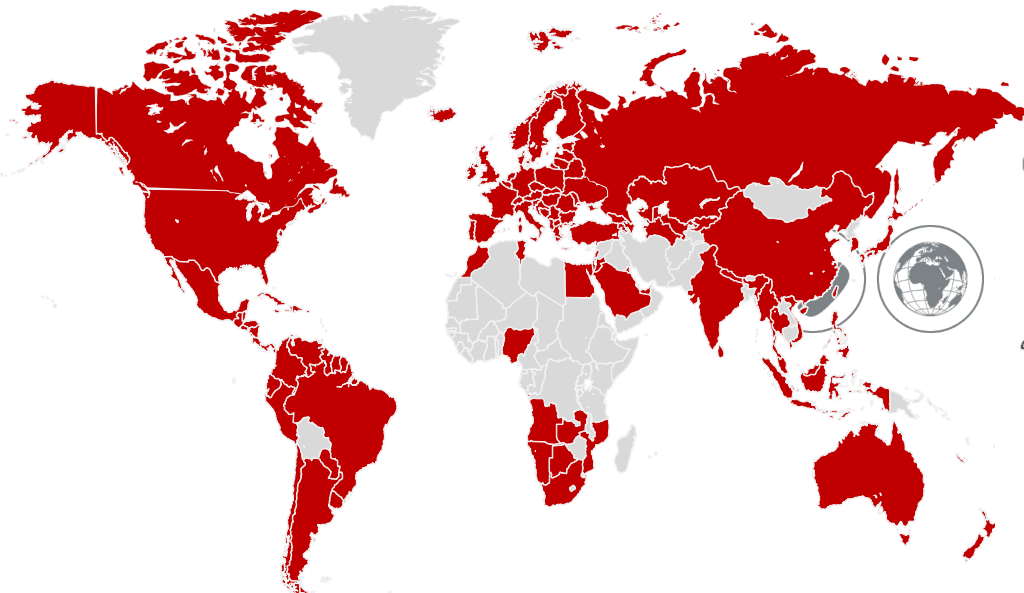
CHARLESTON, Usa


2017


AT YOUR HAND:

**24/7** IN MORE THAN  
**115** COUNTRIES

WHEREVER HELP IS  
NEEDED!





 **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

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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<sub>2</sub> Condensing Units
- A2L Remote Systems
- Scroll, Semi-hermetic, Hermetic
- Condensers & Evaporators



### DAIKIN REFRIGERATION

- Specialized CO<sub>2</sub> Equipment
- Integrated Refrigeration and HVAC Solutions
- Innovation, Research and Design Centers Supporting All Regions and Companies



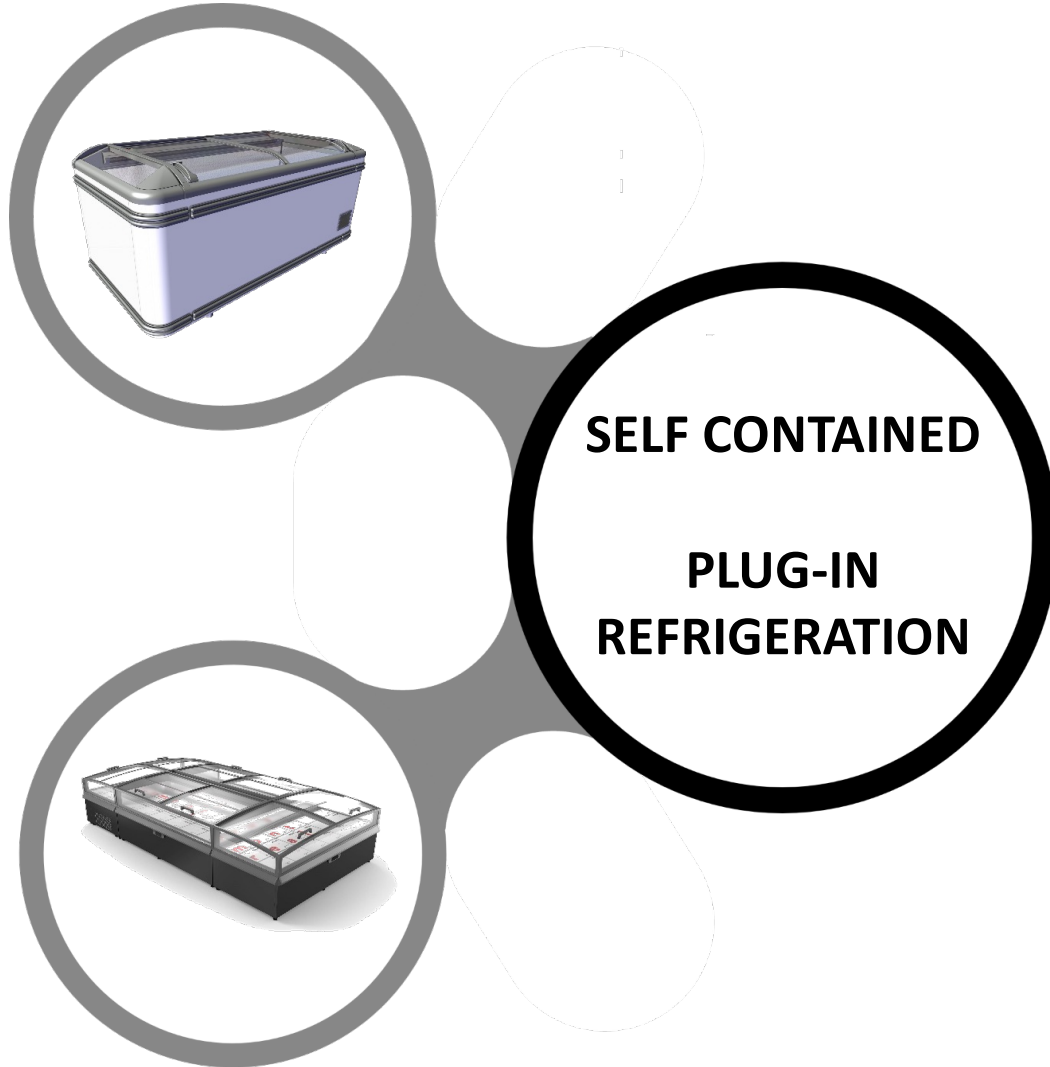
### CO<sub>2</sub> REFRIGERANT SOLUTIONS

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

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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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# 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 units 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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**Air Cooled – Plug in  
Multi-Deck Cases**



- 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

## 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 SV198	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

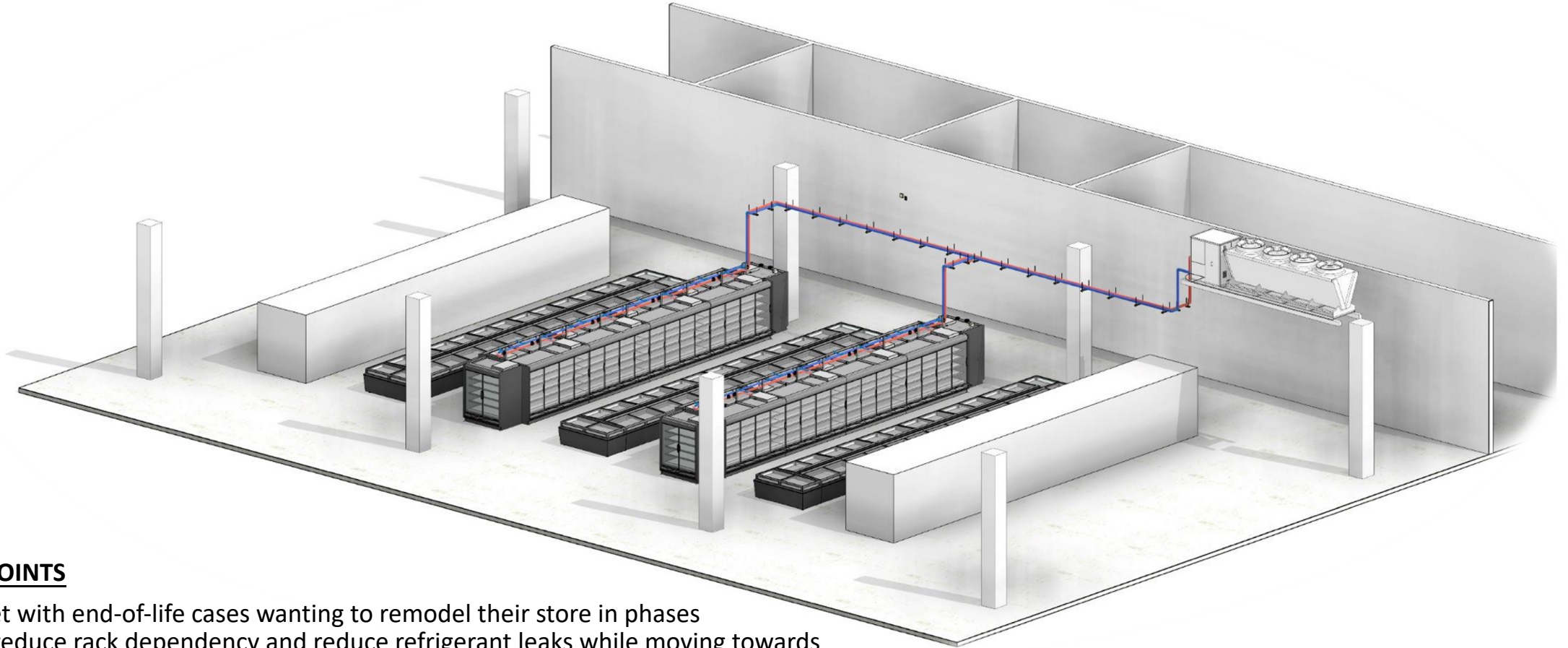


\*5.29 (oz) = 147.98g



# PHASED REMODEL OF FROZEN DOORS (Micro Distributed Frozen Doors with Plug In)

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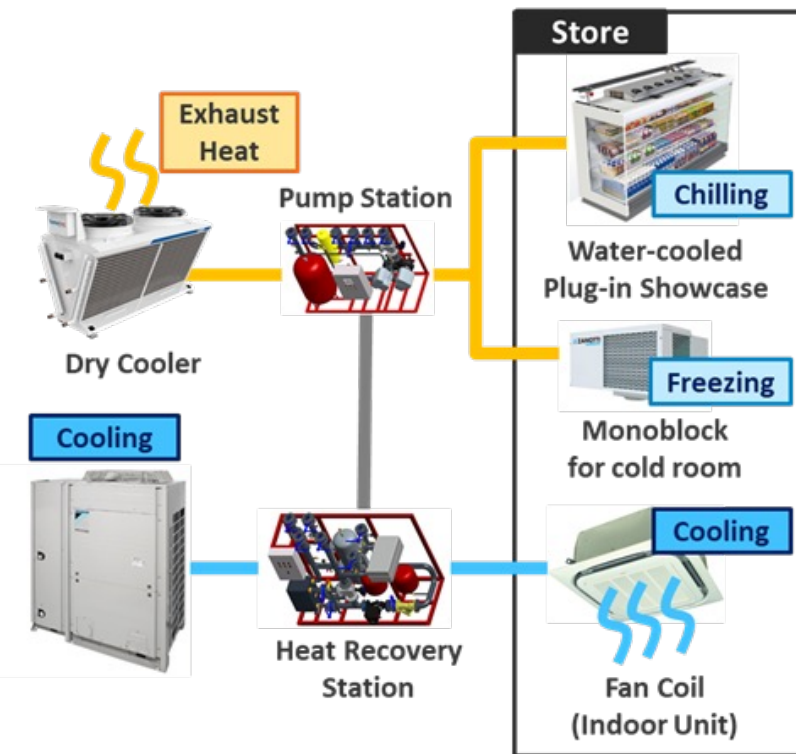


## PROJECT KEY POINTS

- Supermarket with end-of-life cases wanting to remodel their store in phases
- Wanted to reduce rack dependency and reduce refrigerant leaks while moving towards natural refrigerant solution
- Needed phased scope to limit downtime and customer inconvenience
  - Phase 1 – Remove existing equipment/Installation of Dry Cooler
  - Phase 2 – Installation of Bunker runs
  - Phase 3 – Installation of Glass Door Freezers
- Oversized Fluid Cooler/heat exchanger for future expansion project
- If you have an existing rack we can retrofit utilizing a plate heat exchanger.

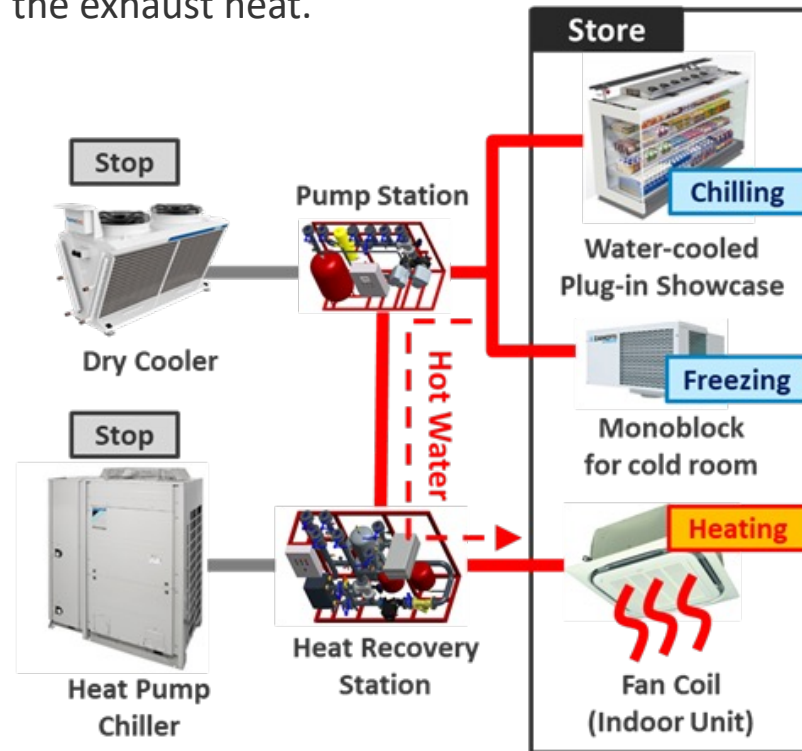
**1) Cooling Operation**

Exhaust heat from the display cases and monoblocks are disposed outdoors through circulating water. Cooling is handled by a heat pump chiller independently.



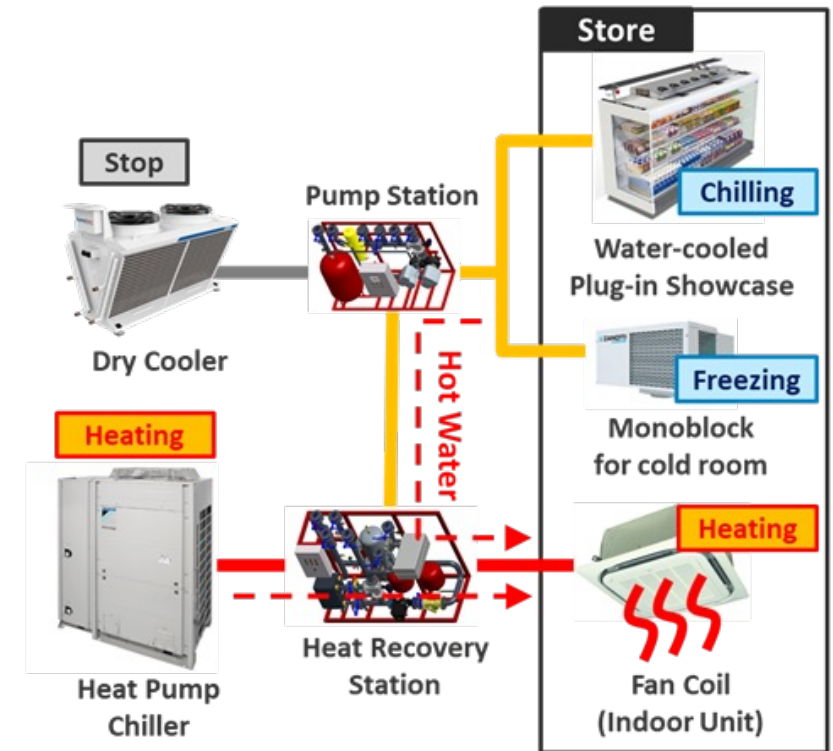
**2) Heating Operation (100% Heat Recovery)**

Exhaust heat from the showcases and Monoblocks heats the circulating water and the hot water flows to the fan coil unit to heat the store (heat exchange). The most energy-efficient operation mode, in which heating is performed using only the exhaust heat.



**3) Heating Operation (Partially Heat Recovery)**

If the exhaust heat from the showcase and Monoblocks are not sufficient to produce enough heat for heating the store, heat pump chiller operates as a supplement.



Recovering exhaust heat from refrigeration equipment (Showcases and Monoblocks) and using it for store heating makes the whole store energy efficiency improved.

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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**

Refrigerants / Brand Name	Type	Composition	IPCC AR4 (2007)		IPCC AR6 (2021)		PFAS
			GWP 100 years	Real GWP 20 years	GWP 100 years	Real GWP 20 years	
<b>R143a</b>	HFC	100% R143a	4470	5890	5810	7840	Yes
<b>R125</b>	HFC	100% R125	3500	6350	3740	6740	Yes
<b>R134a</b>	HFC	100% R134a	1430	3830	1530	4140	Yes
<b>R32</b>	HFC	100% R32	650	2330	771	2690	No
<b>R404A</b> Freon 404A	HFC	44% R125 / 4% R134a / 52% R143a	3922	6010	4728	7208	Yes
<b>R407A</b> Freon 407A	HFC	20% R32, 40% R125, 40% R134a	2102	4538	2262	4890	Yes
<b>R410A</b> Freon 410A	HFC	50% R125 / 50% R32	2075	4340	2255	4715	Yes
<b>R407C</b> Freon 407C	HFC	23% R32 / 25% R125 / 52% R134a	1768	4115	1908	4457	Yes
<b>R452A</b> Opteon XP41	HFC/HFO	11% R32 / 59% R125 / 30% R1234yf	2137	4003	2292	4273	Yes
<b>R449A</b> Opteon XP40	HFC/HFO	24.3% R32 / 24.7% R125 / 25.7% R134a / 25.3% R1234yf	1390	3119	1504	3383	Yes
<b>R448A</b> Solstice N40	HFC/HFO	26% R32 / 26% R125 / 21% R134a / 7% R1234ze / 20% R1234yf	1379	3062	1494	3321	Yes
<b>R449C</b> Opteon XP20	HFC/HFO	20% R32 / 20% R125 / 29% R134a / 31% R1234yf	1245	2847	1346	3087	Yes
<b>R452B</b> Opteon XL55	HFC/HFO	67% R32 / 7% R125 / 26% R1234yf	681	2006	779	2275	Yes
<b>R454B</b> Opteon XL41	HFC/HFO	68.9% R32 / 31.1% R1234yf	448	1606	531	1854	Yes
<b>R513A</b> Opteon XP10	HFC/HFO	44% R134a / 56% R1234yf	629	1686	673	1823	Yes
<b>R450A</b> Solstice N13	HFC/HFO	42% R134a / 58% R1234ze	601	1611	643	1742	Yes
<b>R454C</b> Opteon XL20	HFC/HFO	78.5% R1234yf / 21.5% R32	140	502	166	580	Yes
<b>R455A</b> Solstice L 40X	HFC/HFO	75.5% R1234yf / 21.5% R32 / 3% R744	140	502	166	580	Yes
<b>R744</b>	Natural	CO <sub>2</sub>	1	1	1	1	No
<b>R600a</b>	Natural	Isobutane	<1	<1	<1	<1	No
<b>R290</b>	Natural	Propane	<1	<1	<1	<1	No
<b>R1270</b>	Natural	Propylene	<1	<1	<1	<1	No
<b>R717</b>	Natural	NH <sub>3</sub>	0	0	0	0	No
<b>R718</b>	Natural	H <sub>2</sub> O	0	0	0	0	No
<b>R729</b>	Natural	Air	0	0	0	0	No

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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: C<sub>3</sub>H<sub>8</sub>

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.

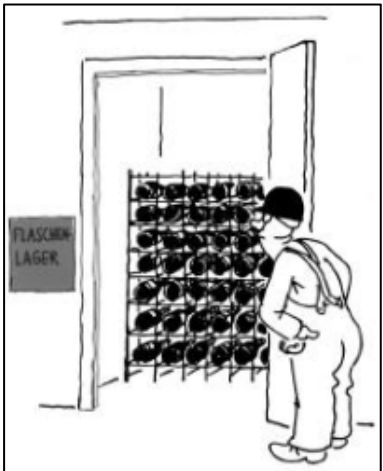


One standard propane gas grill tank  
equals over 60 self-contained  
circuits of refrigeration!

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

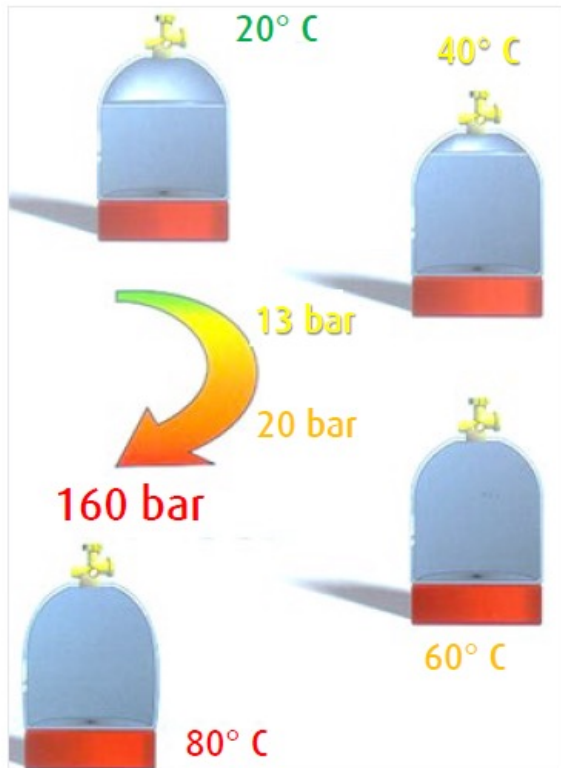
## Storage Of Flammable Gasses

- 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!



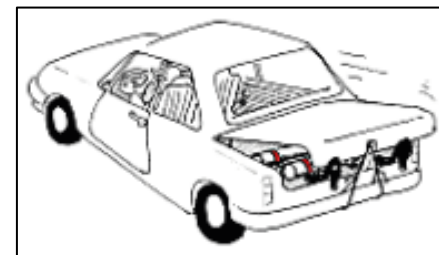


# Storage Of Flammable Gasses



## 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



# Classification Of Units According Zones And Filling Volume

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

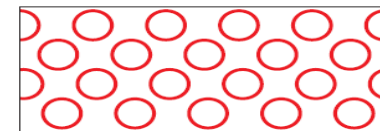
**Zone 1 – 2 (according ATEX) eg.: VENTO GREEN , GD HP, chillers**

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:**

<b>Zone 0</b>	Flammable gas is constantly present or present for a longer period of time more than 1000 hours per year
<b>Zone 1</b>	It is likely that flammable gas will be present during normal operation more than 1000 hours per year
<b>Zone 2</b>	Flammable gas is unlikely to be present during normal operation more than 1000 hours per year



**Zone 0**



**Zone 1**



**Zone 2**

# 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 less than 150g, others like Heat pumps, Chillers could have significantly more



<b>Refrigerant:</b>			
Type	R410A / GWP 2088		
Quantity	2,40 / 5,011	kg / ton CO <sub>2</sub> eqv	
Max work pressure HP:	4,5 (45)	MPa (Bar)	
Max work pressure LP:	2,8 (28)	MPa (Bar)	
Test pressure:	3,1 (31)	MPa (Bar)	
Contains fluorinated greenhouse gases covered by the Kyoto Protocol in a hermetically sealed system			
<b>Electrical:</b>		<b>Physical:</b>	
Voltage	400V 3N~ 50Hz	Weight:	167 kg
Max Operating Current:	6 A	Size:	1100x1070x612 (mm)
Max Current Compressor:	5 A		
<b>COP A2/W35: (acc. to EN 14511)</b>		<b>Compressor working range</b>	
Power Input:	0,91 kW	<b>Water supply</b>	At air temp.
Heating Capacity:	4,03 kW	60 °C (max)	-25 °C (min)
COP:	4,43	65 °C (max)	-4 °C
<b>COP A1/W35: (acc. to EN 14511)</b>		65 °C (max)	36 °C (max)
Power Input:	0,99 kW		
Heating Capacity:	4,77 kW		
COP:	4,82		

## Flammable Refrigerants General Precautions

- ✓ R290 is odorless!
- ✓ Provide adequate ventilation
- ✓ Monitor gas concentration
- ✓ In case of leakage, eliminate all ignition sources
- ✓ Keep concentrations well below lower explosion limits
- ✓ Consider the risk of potentially explosive atmospheres
- ✓ Prevent from entering sewers, basements and confined spaces, or any place where its accumulation can be dangerous.
- ✓ Evacuate/secure working area => Place signs of service works, warn others on ignition sources: make sure no one plugs, unplugs, connects or disconnects any type of power plug while you are servicing the unit! Cell-phones, electronic devices could also be sources of ignition!
- ✓ Monitor the concentration of the released product.



# 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.)



## 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.



# 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.





# 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



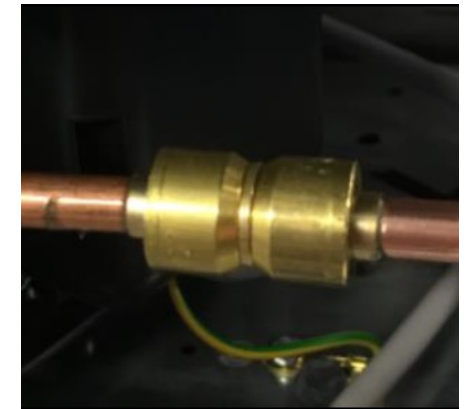
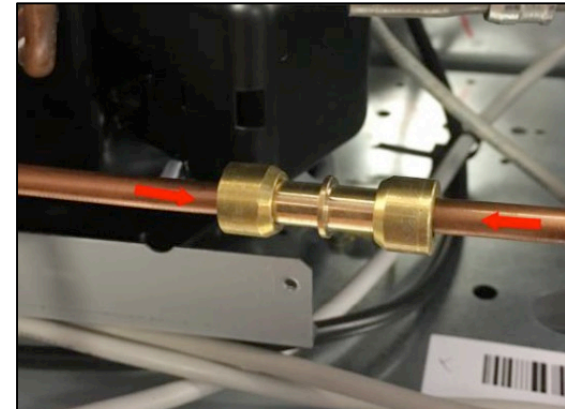
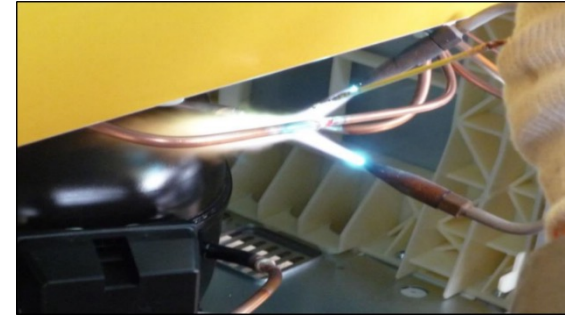
Thread Adapter  
All flammable refrigerant cylinders are left-threaded!

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

# Repair Of Flammable Refrigerant Units

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

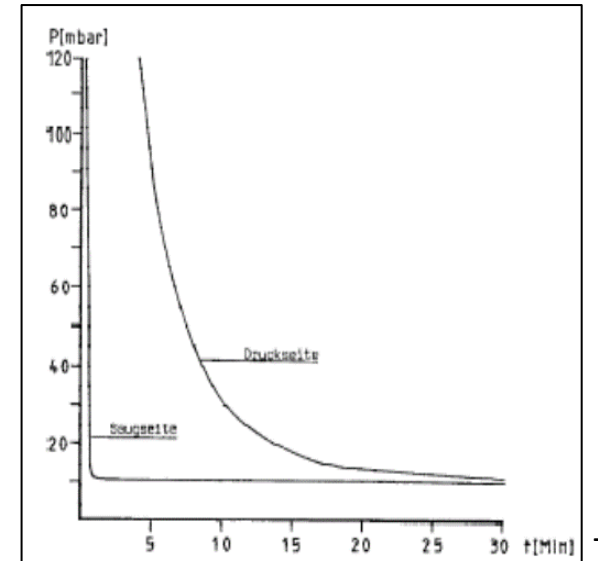
- An **estimated 80%** of the **errors** in refrigerant systems are **not in the cooling circuit.**
- Exchange of components, only with certified and specified components.
- Never use torches when removing system components. Use a pipe cutter instead.
- Electrical components should be spark-free and 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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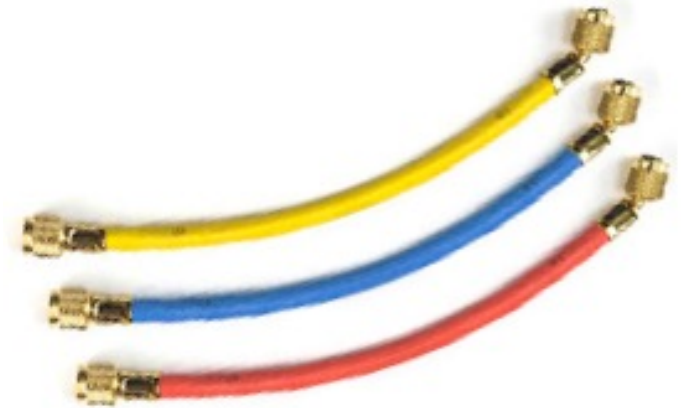
# Flammable Refrigerants Pressure Test & Vacuum

- ✓ 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 hygroscopic 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.



## 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,  $\pm 30$  gram charge for instance would affect normal operation conditions drastically!
- ✓ Your scale should be a gram scale.



# 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.



# 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!**



Naturally  
at your  
side.

# 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



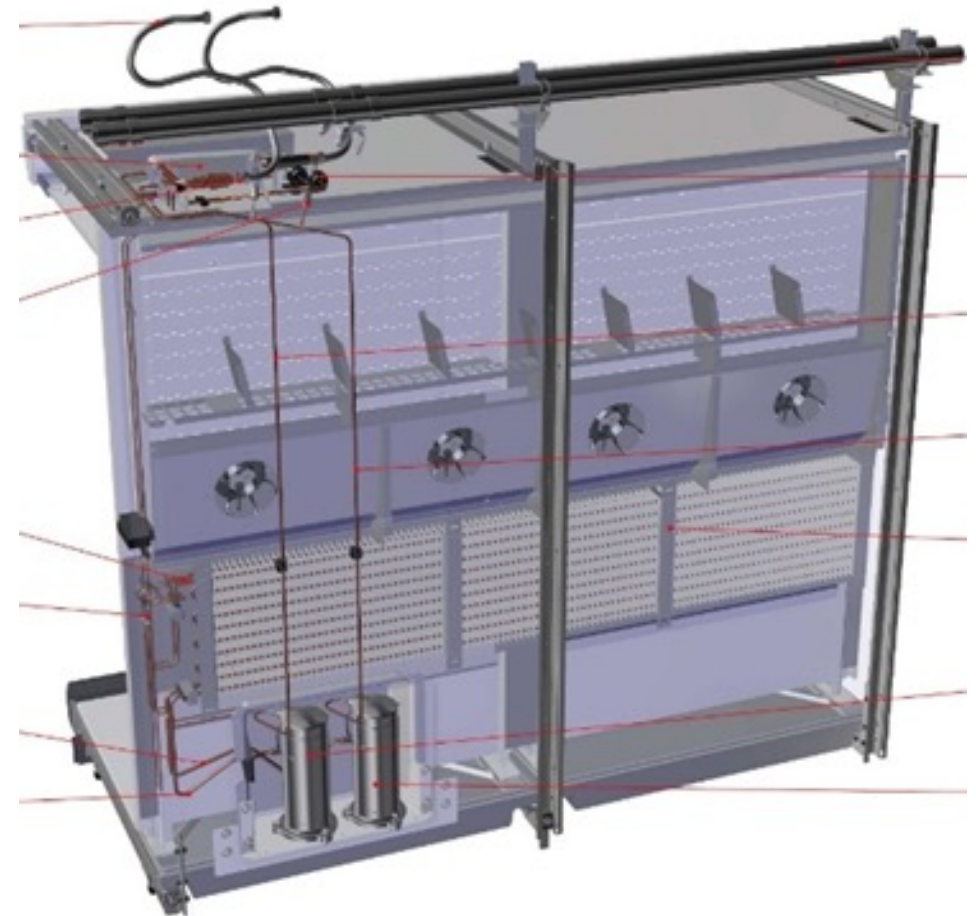
Promotion Coolers

AC COOLER

## R290 – Water Cooled Equipment

### Best Practices - Case Design Standards

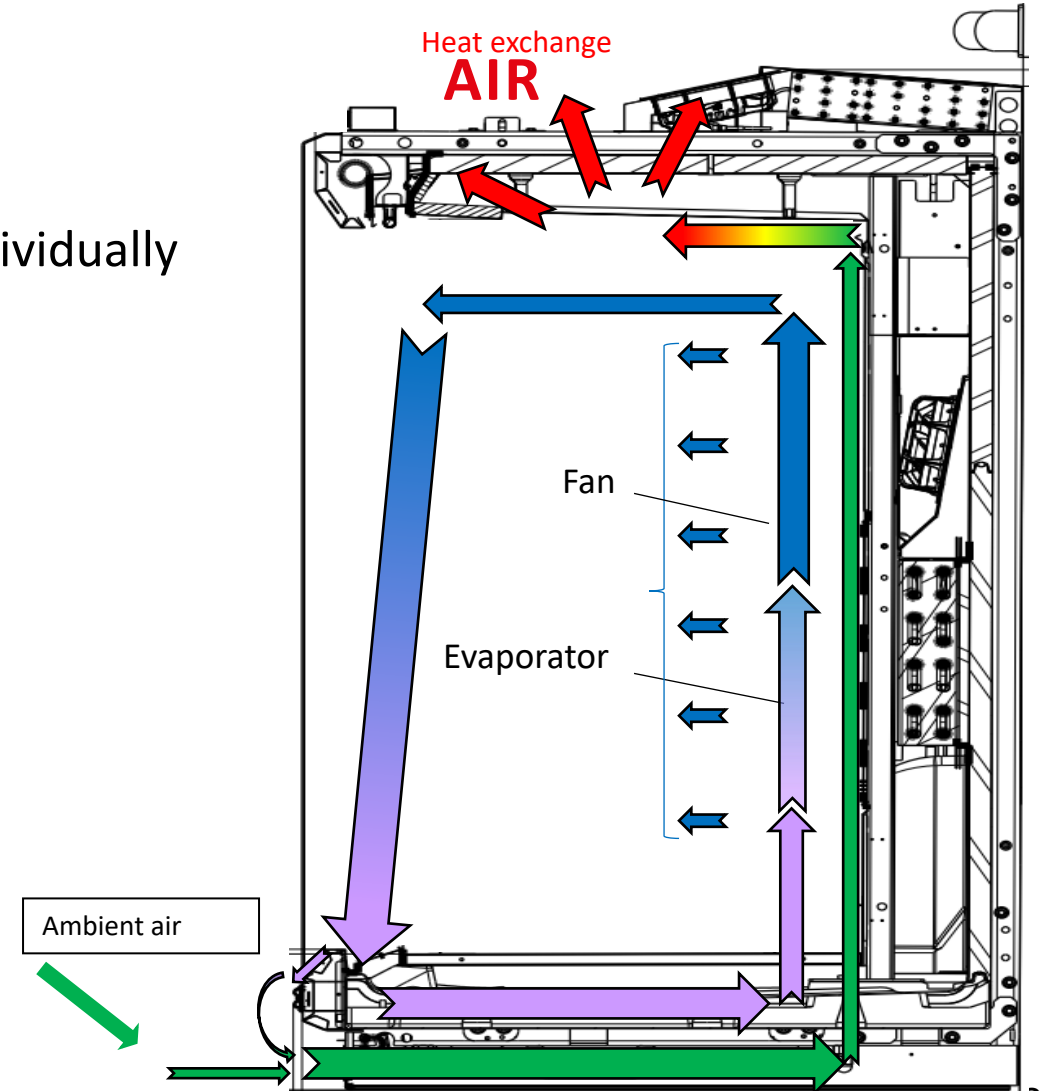
- ❖ Based on Cabinet Type/Design, unit could consist of 1 to 3 R290 Compressors with less than 150g < 5.2 oz of refrigerant per circuit
- ❖ Single Evaporator with Independent circuits, heat exchangers and Expansion Valves
- ❖ Soft-Start Modules, fitted to each compressor; reduces Start-up Noise
- ❖ Compressor 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



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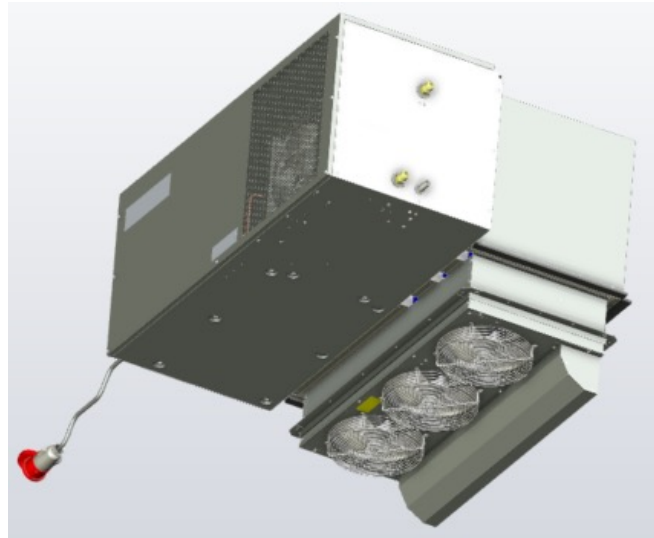
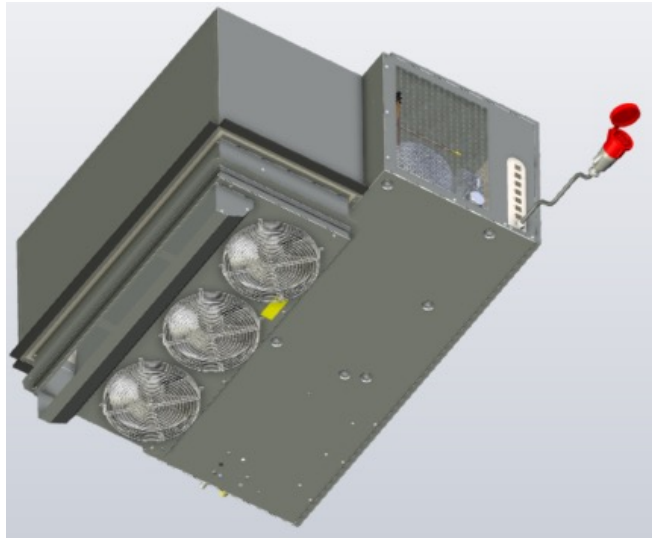
# Air Cooled Unit

- 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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## Zanotti Ceiling Aggregate Monoblock

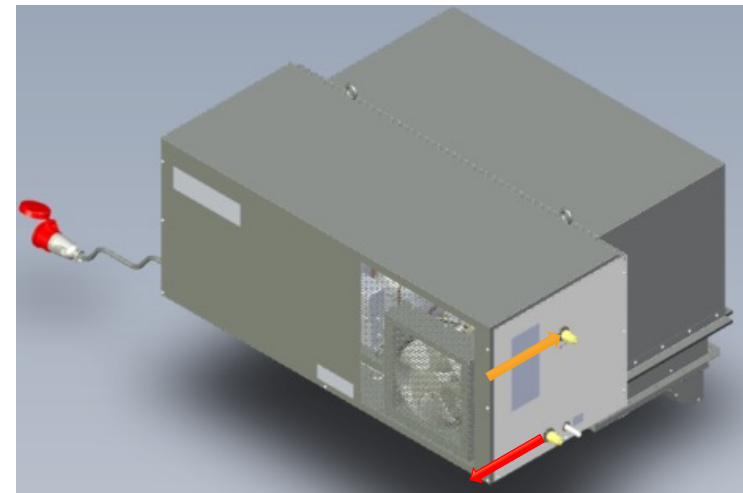
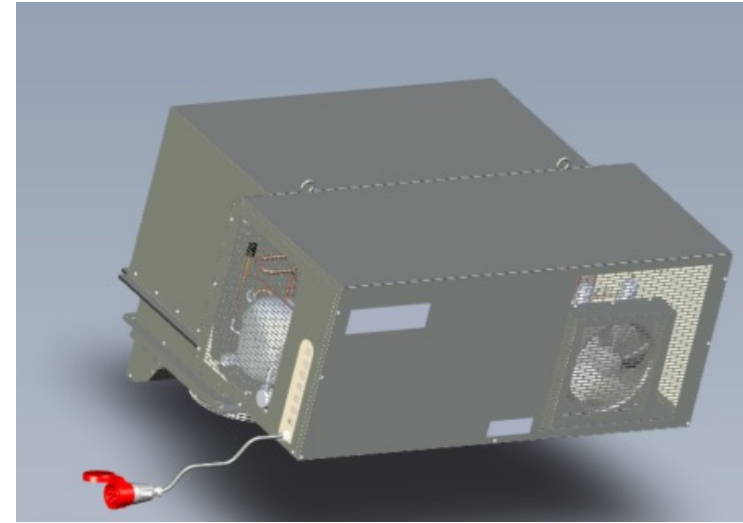


*Compact units are used for the supply of cold in the cold rooms*

*Plus cooling aggregates (-5°C ... +5°C)*

*Deep freezing aggregates (-25°C ... -15°C)*

Electric connection

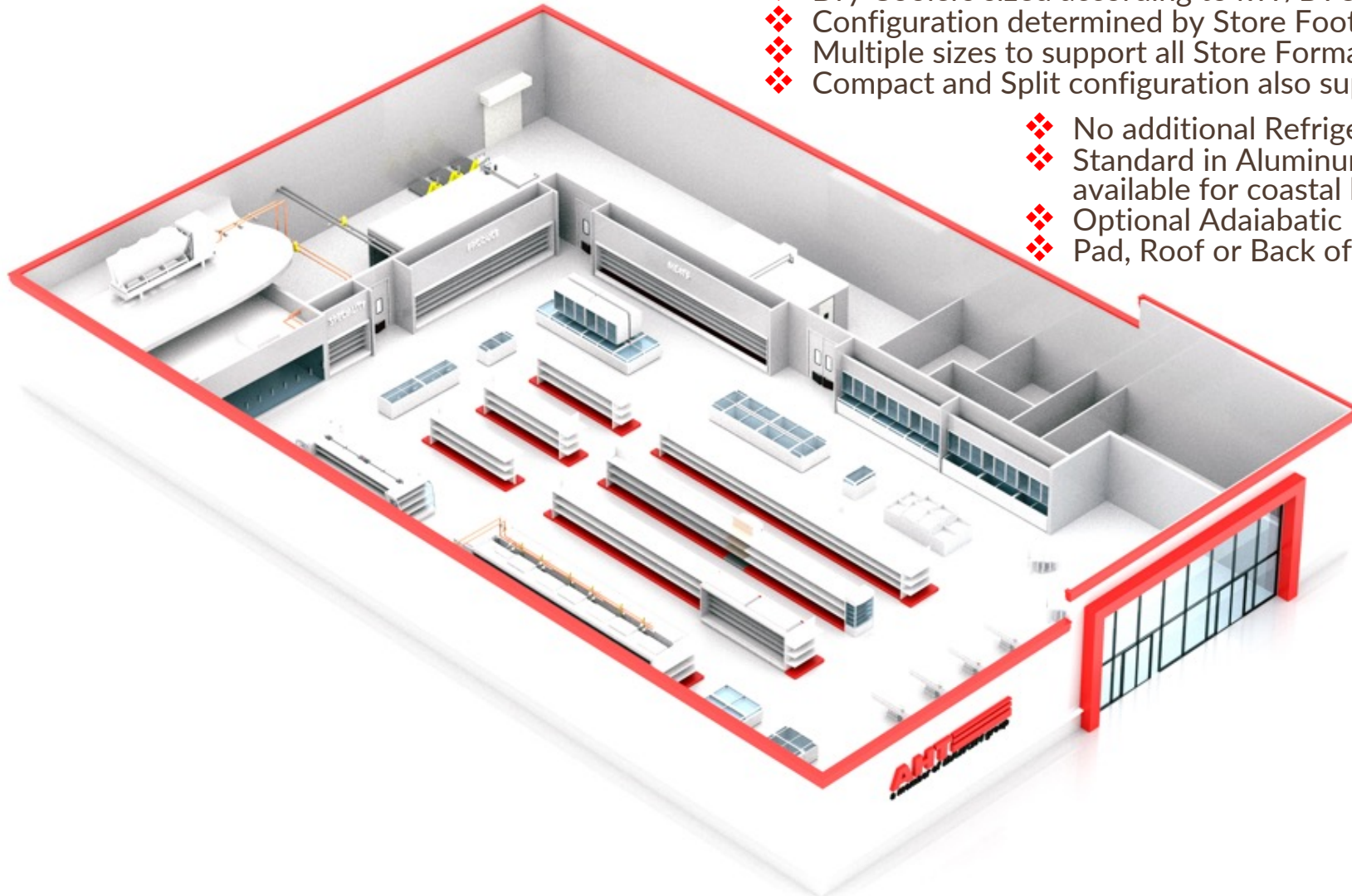


Water connection

# 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

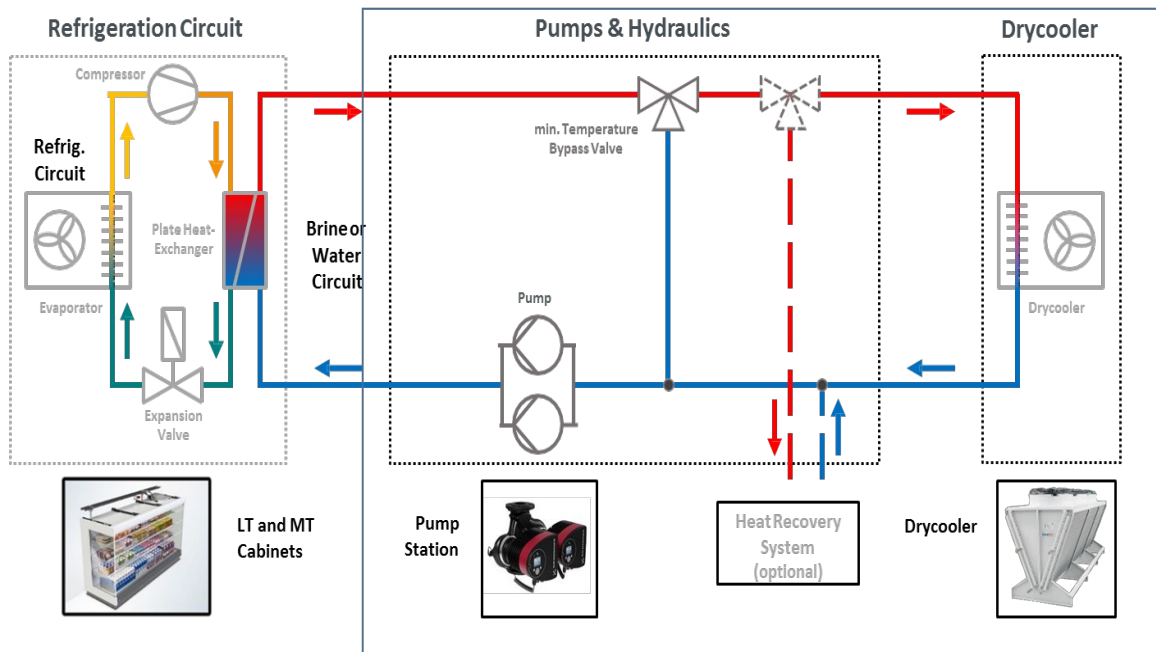
- ❖ No additional Refrigerant needed
- ❖ Standard in Aluminum; Epoxy and Electrofin Coatings are available for coastal locations
- ❖ Optional Adiabatic Functionality Pad, Roof or Back of House Installation



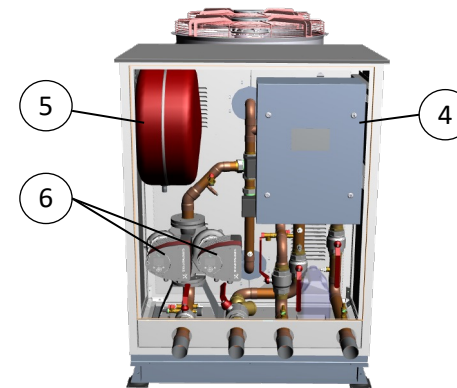
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# Basetec Waste Heat Unit (Fluid Cooler)

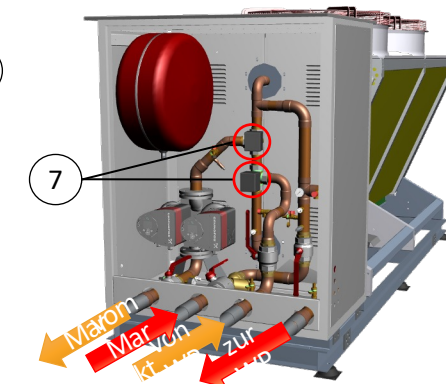
- ❖ System Operating between 62F and 118F supply temp.
- ❖ Single Manifold, Dual Pump operates on 12hr Duty Cycle
- ❖ Optional: Heat Recovery based on HVAC Setup
- ❖ Optional: Adiabatic for Markets with Higher Ambient Conditions/Environments
- ❖ Standard in Aluminum; Epoxy and Electrofin Coating for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



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



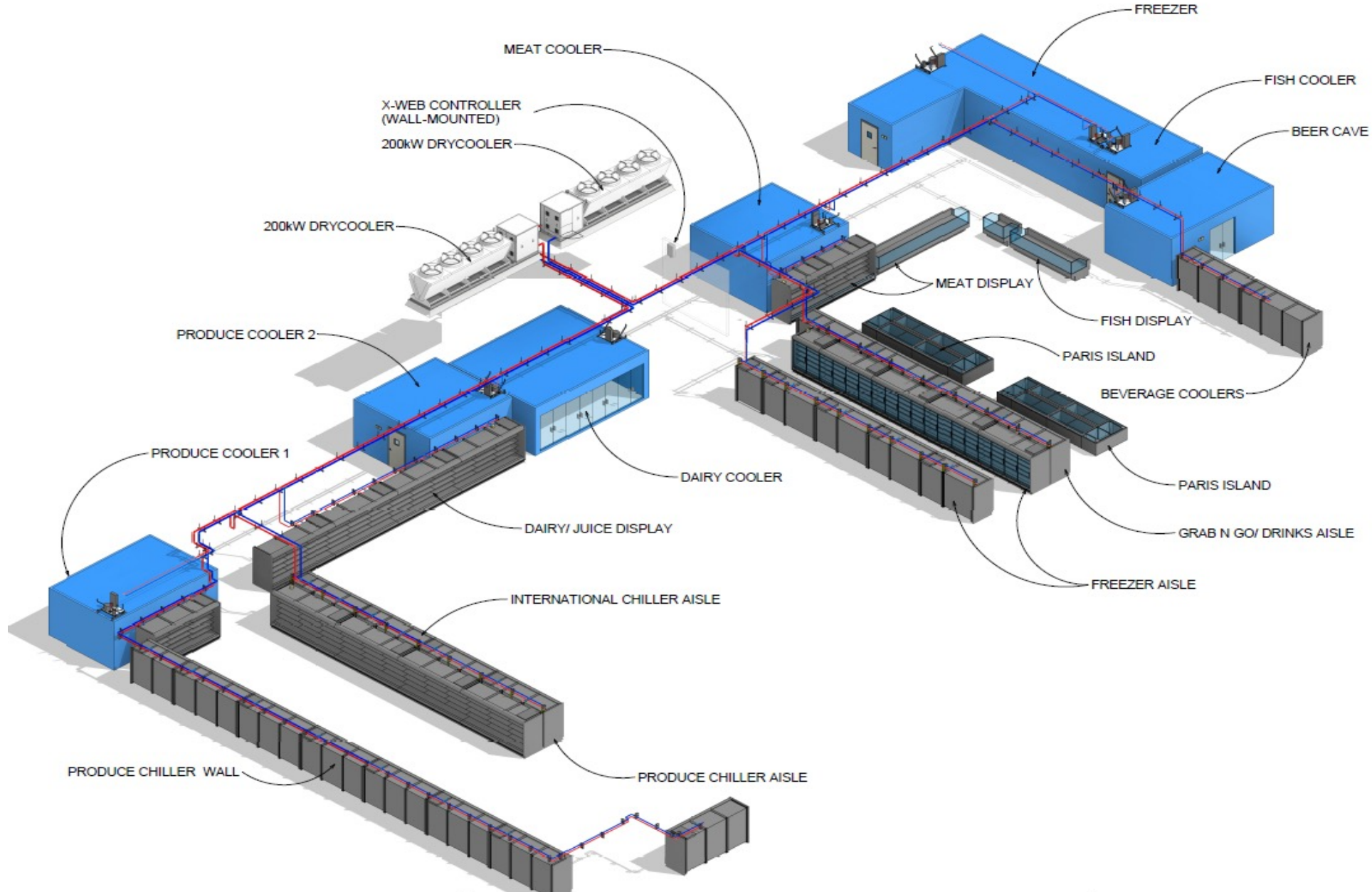
- 4... Control box
- 5... Expansion vessel



- 6... Circulating pump
- 7... 3-way mixer valve

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# Store Layout



## R290 - A Viable Solution For Retailers

Category	Plug-In (AIR)	Semi-Plug-In (WATER)	Remote
Format Suitability	Suitable for small store formats and expansion, 2 <sup>nd</sup> location (<15,000ft <sup>2</sup> )	Suitable for small and medium size store formats (<60,000ft <sup>2</sup> )	Suitable for big store formats (>60,000ft <sup>2</sup> )
Refrigeration Cycle	<b>Factory tested and sealed refrigeration cycle</b> <ul style="list-style-type: none"> <li>Factory quality checked</li> <li>Reduced leakage</li> <li>Predefined set-up</li> </ul>	<b>Factory tested and sealed refrigeration cycle</b> <ul style="list-style-type: none"> <li>Factory quality checked</li> <li>Reduced leakage</li> <li>Predefined set-up</li> </ul>	<b>On site finalization of refrigeration cycle</b> <ul style="list-style-type: none"> <li>Limited factory checks</li> <li>Quality dependent on on-site labor</li> <li>System set-up on site</li> </ul>
Installation	<ul style="list-style-type: none"> <li>Quick and easy installation, flexible to deploy and rearrange</li> <li>Almost no installation cost</li> </ul>	<ul style="list-style-type: none"> <li>Simple installation procedure, just Supply &amp; return water piping</li> <li>Medium installation cost</li> </ul>	<ul style="list-style-type: none"> <li>Rather complicated installation, highly skilled labor necessary</li> <li>High installation cost</li> </ul>
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



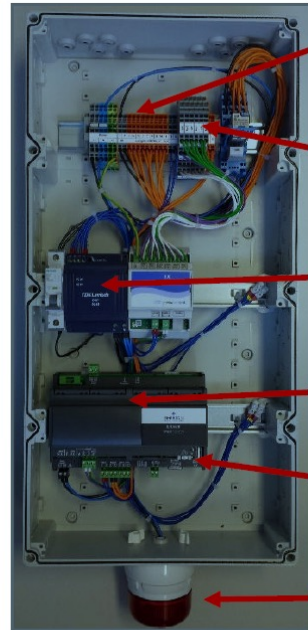
**BACnet MS/TP and IP VAV  
Controller Installation and  
Operation Manual**



## AHT Control Box Hardware Overview

The control box comes already preassembled and prewired. No modifications need to be 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

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# Questions & Comments



# Share Your Feedback!



**To receive an electronic training certificate:**

1. Scan or visit [nasrc.org/session-surveys](https://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.

## R290 Overview of Micro Distributed Systems & Plug-In Units

Jim Standeford & Dan May  
AHT Cooling Systems USA, Inc.