



# NY - GEO 2024

APRIL 8-9 | ALBANY NY



# The Refrigerants, They Are A-Changin'

## Perspectives on HFC refrigerant phase down

**Moderator:** Jay Egg / [Egg Geo, Inc](#)

**Panelists:** Suzanne Hagell / [NYS DEC - Office of Climate Change](#)

Adrian Perez / [Ecoforest \(Spain\)](#)

Tim Hammond / [WaterFurnace \(USA\)](#)

Jason Filler / [Stark Tech](#)

POLICY & PROGRAMS - 1:30 PM

***The Refrigerants, They Are  
A-Changin'***

# The Refrigerants, They Are A-Changin'

Perspectives on HFC refrigerant phase down:

Hydrofluorocarbons (HFC) are a chemical compound commonly found in today's refrigerants, and widely used in heat pumps. The NYS Department of Environmental Conservation's (DEC) Office of Climate Change is proposing amendments to 6 NYCRR Part 494, "Hydrofluorocarbon Standards and Reporting." The proposed regulation includes prohibitions, reporting, and other requirements regarding the sale, use, and supply of HFCs and new products and systems that contain HFCs. The goal of this proposed rule is to implement recommendations of the NYS Climate Action Council Scoping Plan necessary to achieve the required statewide GHG emission limits and net zero goal outlined in the NYS Climate Act. This session offers a range of perspectives on the HFC phase down. We'll hear the challenges faced by regulators, heat pump manufacturers and an equipment distributor. The panel includes a European heat pump manufacturer who will update us on the impacts of the aggressive HFC phase down seen in their country.

**Suzanne Hagell, Chief, GHG Mitigation / NYS Dept. of Environmental Conservation (DEC) Office of Climate Change**



My work portfolio is broad, but my primary responsibility is to identify opportunities for reducing net greenhouse gas emissions, including from all economic sectors of the state. My previous experience and education focused on Climate Change Adaptation, Forest Science, Natural Resource Management, Molecular Genetics, and Decision Analysis.

# Tim Hammond, Sr. Director of Engineering / WaterFurnace



Tim A. Hammond

Tim Hammond is Vice President of Engineering for WaterFurnace International, Inc. Tim has spent most of his 20 years at WaterFurnace learning about commercial HVAC/geothermal applications to innovate and expand commercial product solutions. He started his career in geothermal while working for a family - owned residential HVAC contractor and earning a mechanical journeyman's license. He earned his Mechanical Engineering degree from Purdue Fort Wayne University and is a member of industry groups such as AHRI and ASHRAE.

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# US and NY Policy Update

See Climate Change Regulatory Revisions at:  
<https://dec.ny.gov/regulatory/regulations>

Suzanne Hagell, NYSDEC Office of Climate Change  
NY-GEO Conference April 9, 2024



# NYS Climate Leadership and Community Protection Act (2019)

New York State is required to reduce GHG emissions:

- 40% by 2030, from 1990 levels (40x30)
- 85% by 2050, from 1990 levels (85x50)

Uses different accounting, including a 20-year Global Warming Potential

To achieve a goal of:

- Net zero emissions by 2050

Reference: NYS Environmental Conservation Law Section 75



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# 30+ Years of Refrigerant Phase-downs

## 1987 Montreal Protocol – Ozone Depleting Substances

- 1990 US Clean Air Act directs EPA to lower ODS
- 1993-2024: EPA “SNAP” updated 26 times

## 2014 Kigali Amendment – Greenhouse Gas Substitutes (HFCs)

- ~~2014-2016 EPA updates SNAP States adopt SNAP rules~~
- 2020 US AIM Act directs EPA to lower HFCs 86% by 2036
- 2023 First EPA “Technology Transitions” rule

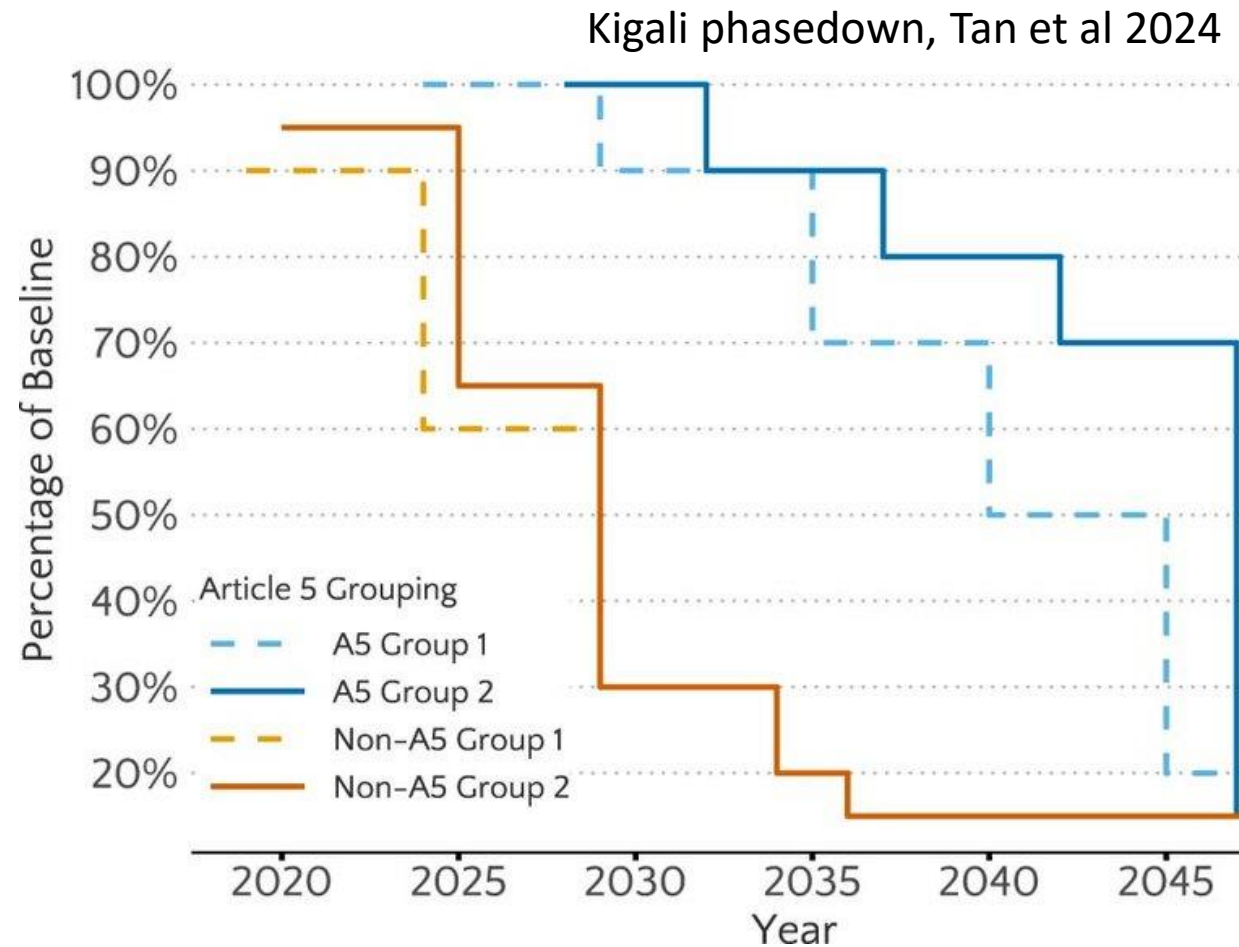


# The 2036 Kigali Phasedown and USEPA

EPA's stepwise approach to HFC demand:

- Set prohibition dates for NEW equipment based on GWP
- Make new substitutes available (A2Ls, A3, CO2, ammonia)
- Based on industry-wide, multi-year negotiations

At the same time, EPA reduces allocations and leaks.



# NY's HFC Regulation (Part 494)

Adopted Part 494 in 2020 to backstop EPA SNAP from 2014

- Joined by 16 other states. Prohibits the highest GWP HFCs in chillers, refrigeration, foam.

**Next step: Achieve the Climate Act and align with EPA, states**

- Expand Part 494 to align with Kigali 2036 timeline
- Also add refrigerant and leak reporting for largest sources
- Also looking at incentives, etc



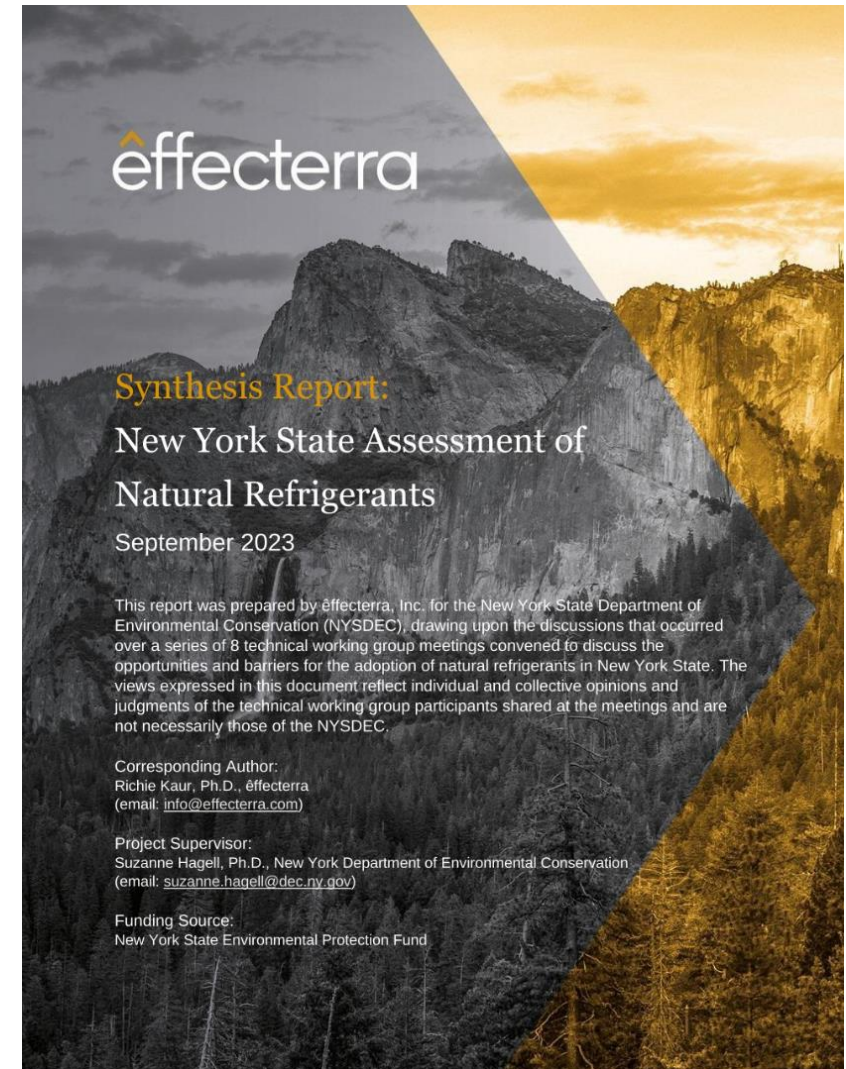
# Will NY be different from US?

The goal is to align, while still achieving the Climate Act

1. Backstop EPA and the AIM Act.
2. Make sure refrigerants are available ahead of 2036.

Key considerations: Where are we ready now (refrigeration) versus where reclaim is needed in the interim (HPs).

2023 NYS Natural Refrigerants



# Tim Hammond, Sr. Director of Engineering / WaterFurnace



Tim A. Hammond

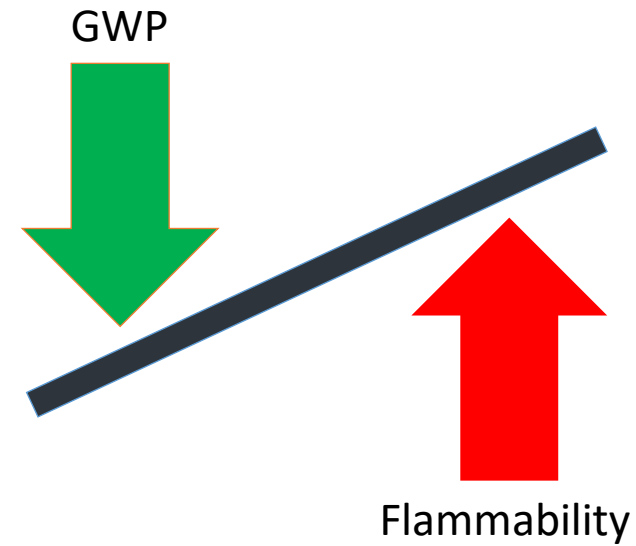
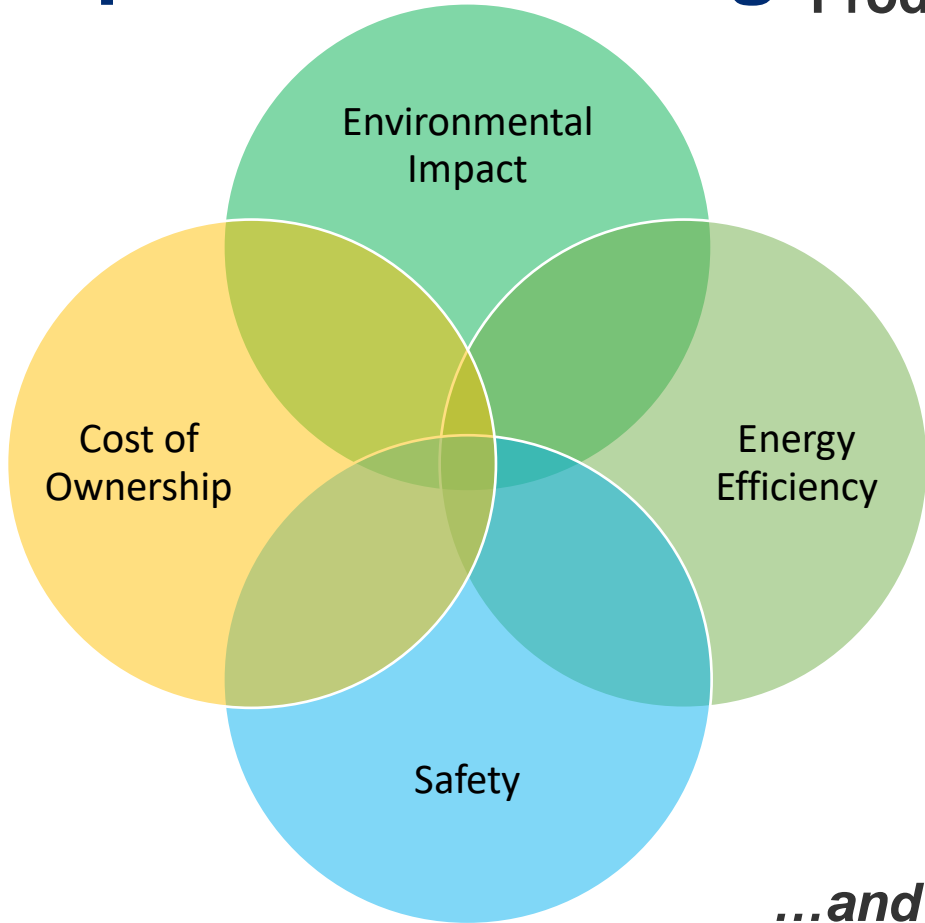
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# **Impact of A2L Refrigerant Change**

**Tim Hammond  
Vice President of Engineering  
WaterFurnace International**

# Impact of Lowering GWP

## Product Design Trade-offs







*...and still need to meet customer needs for comfort and reliability*



# aSHRAE 34 Classification

## What does flammability mean?

Increasing Flammability ↑	Higher Flammability	<b>A3</b>	<b>B3</b>	Higher Flammability (explosive) 	<b>Class 3 Requirements</b> 1. Exhibit flame propagation @ 60°C & 101.3 kPa 2. LFL ≤ 0.10 kg/m <sup>3</sup> or HOC ≥ 19,000 kJ/kg
	Flammable	<b>A2</b>	<b>B2</b>	Low Flammability 	<b>Class 2 Requirements</b> 1. Exhibit flame propagation @ 60°C & 101.3 kPa 2. LFL > 0.10 kg/m <sup>3</sup> 3. HOC < 19,000 kJ/kg
	Lower Flammability	<b>A2L</b>	<b>B2L</b>	Lower Flammability 	<b>Class 2L Requirements</b> 1. Exhibit flame propagation @ 60°C & 101.3 kPa 2. LFL > 0.10 kg/m <sup>3</sup> 3. HOC < 19,000 kJ/kg 4. S <sub>u</sub> ≤ 10 cm/s
	No Flame Propagation	<b>A1</b>	<b>B1</b>	No Flame Propagation 	<b>Class 1 Requirements</b> 1. No flame propagation @ 60°C & 101.3 kPa
		Lower Toxicity	Higher Toxicity		
		Increasing Toxicity →			

- Highly flammable concentration limits
- Low heat of combustion levels
- Low burn velocity
- Minimum ignition energy

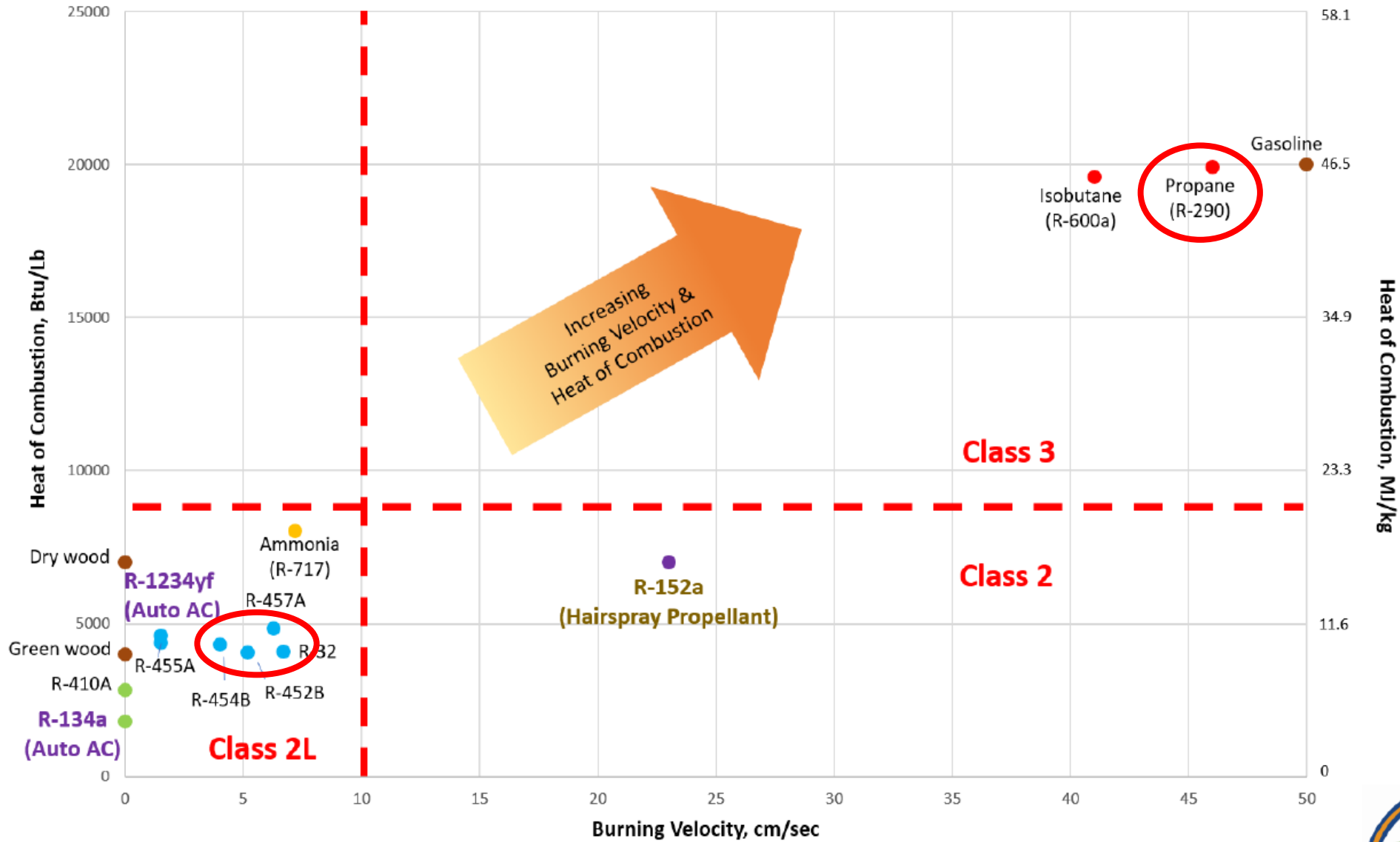
*Does not mean non-flammable.*

*...1000 times easier to ignite propane (R-290)*



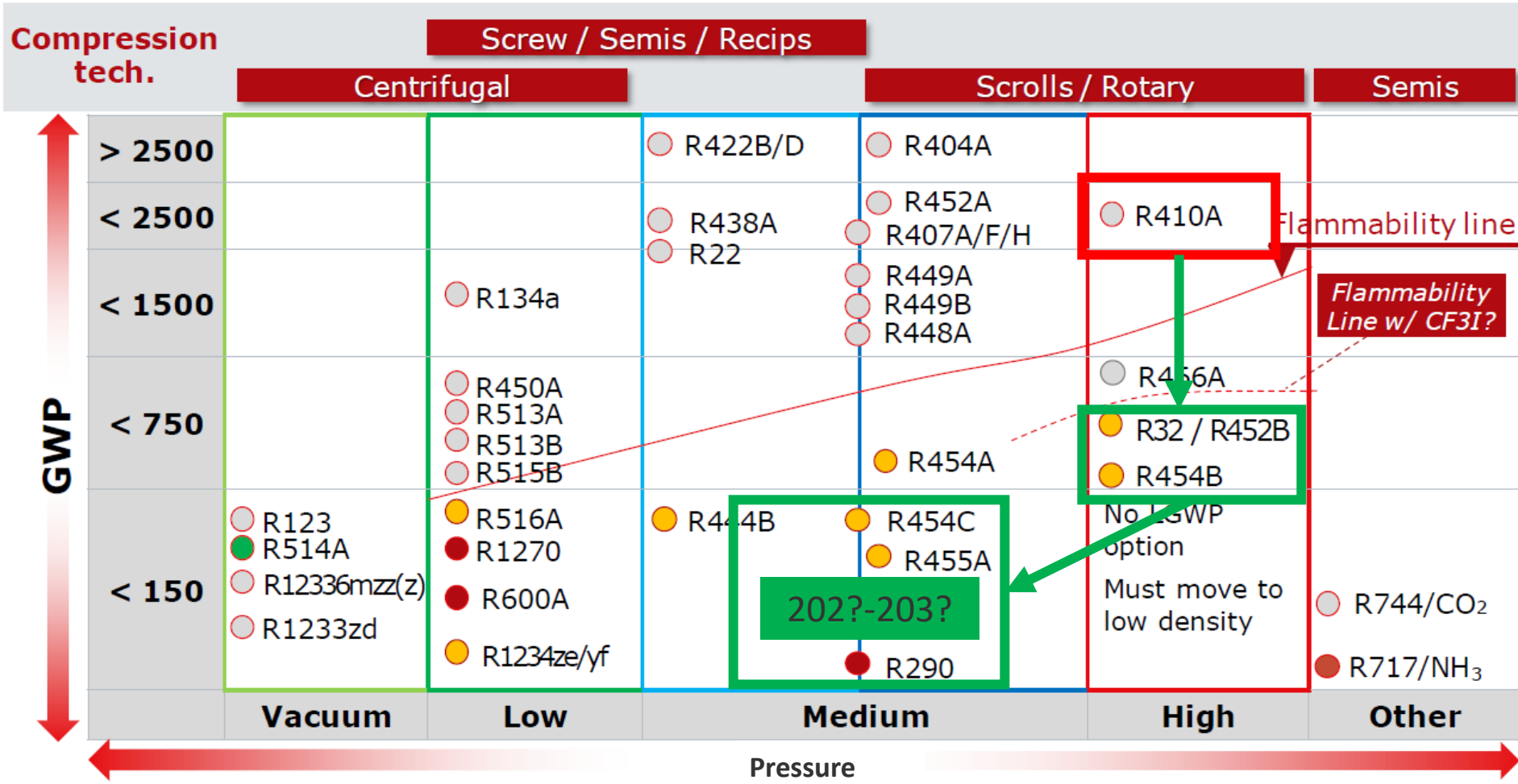
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# Flammability Properties



● A3 ● A2 ● B2L ● A2L ● A1 ● Fuels



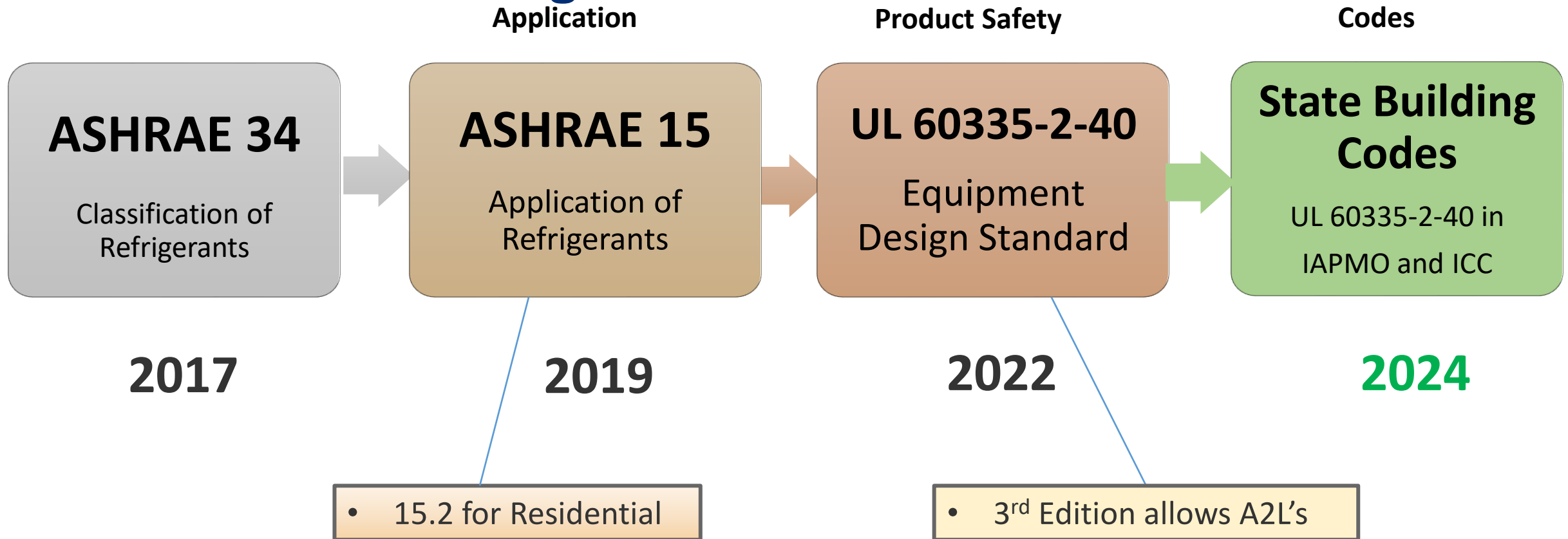


Source: Danfoss

- Legend**
- A1 - Non flammable
  - A2L - Mildly flammable
  - A3 - Highly flammable
  - B1 - Toxic Non flammable
  - B2L - Toxic less flammable
  - On the market
  - Not yet on the market

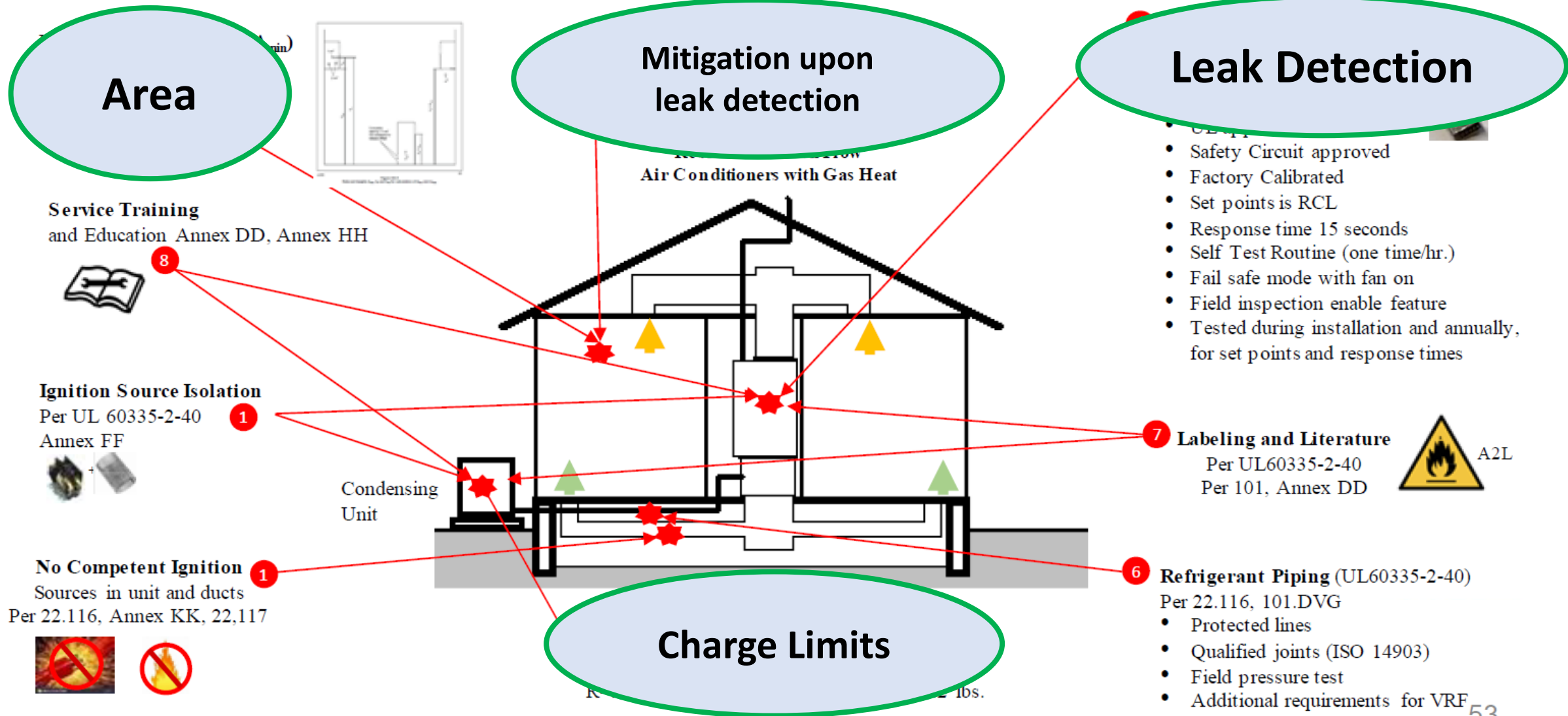
GWP versus Density (pressure) of the main refrigerant groups

# Standards to Building Code

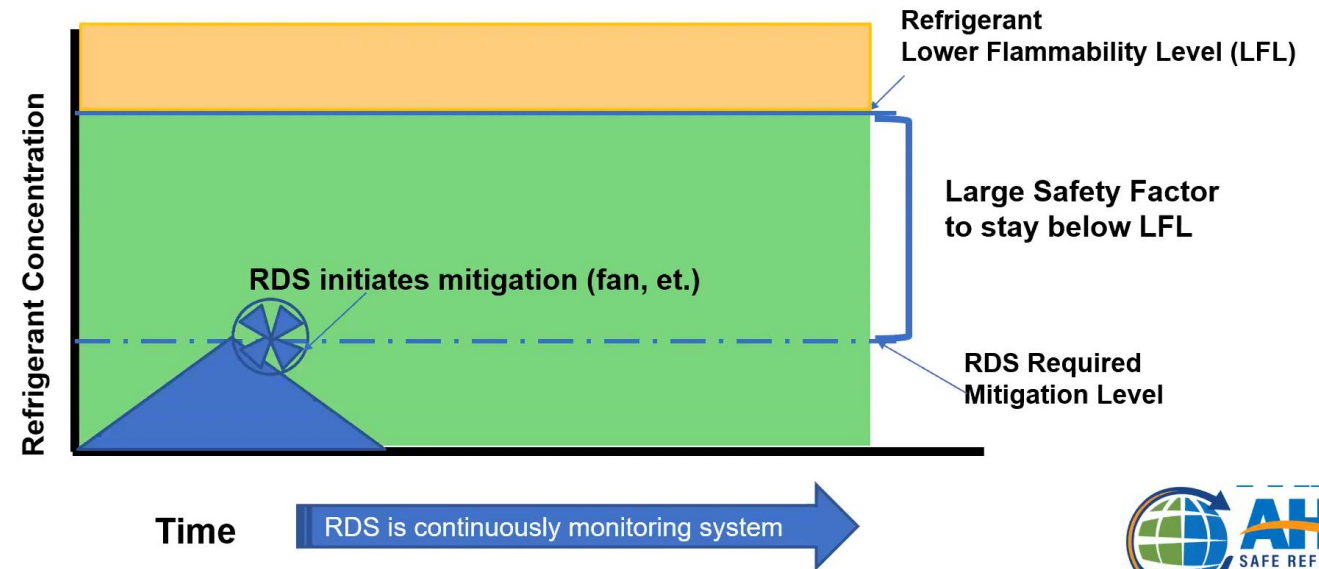
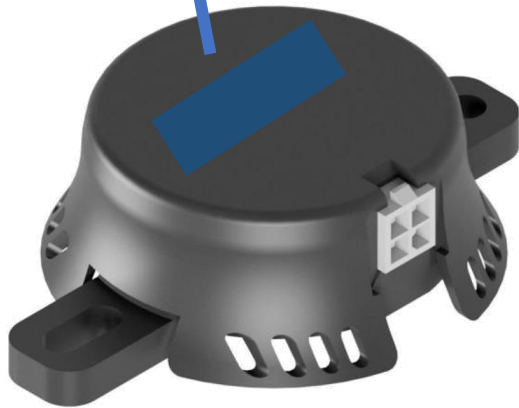
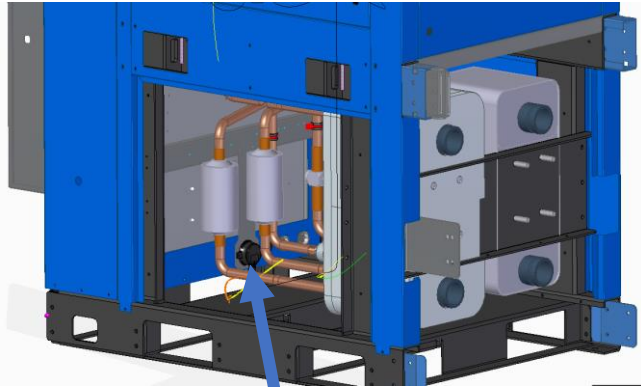


# Safe Application of A2L Refrigerants

UL60335-2-40 3<sup>rd</sup> Edition Summary for a Residential Ducted Unit (direct system) A2L Refrigerant Requirements



# Refrigerant Detection System (RDS)



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- Advanced RDS for reliable, long-life sensing
- RDS continuously monitors
- Fan active / compressor stopped upon detection of leak



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## Challenges and Opportunities for heat pump manufacturers





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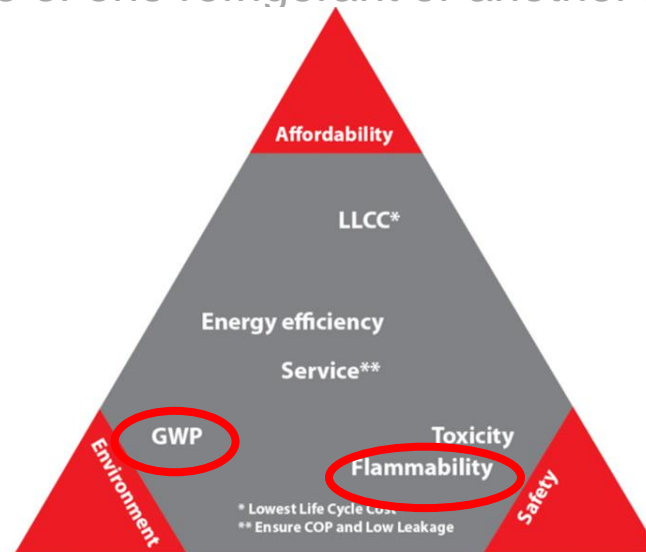
- I studied mining and energy engineering and I have been working in the heat pump industry at Ecoforest since 2017
- Ecoforest is a Spanish manufacturer of geothermal heat pumps with a presence in North America since 2018



# Strike a balance

## Challenges and Opportunities for heat pump manufacturers

- The new regulations on refrigerants lead us to find a balance between the environment, safety and profitability.
- Mainly two parameters limit the use of one refrigerant or another in a heat pump, GWP and Flammability.

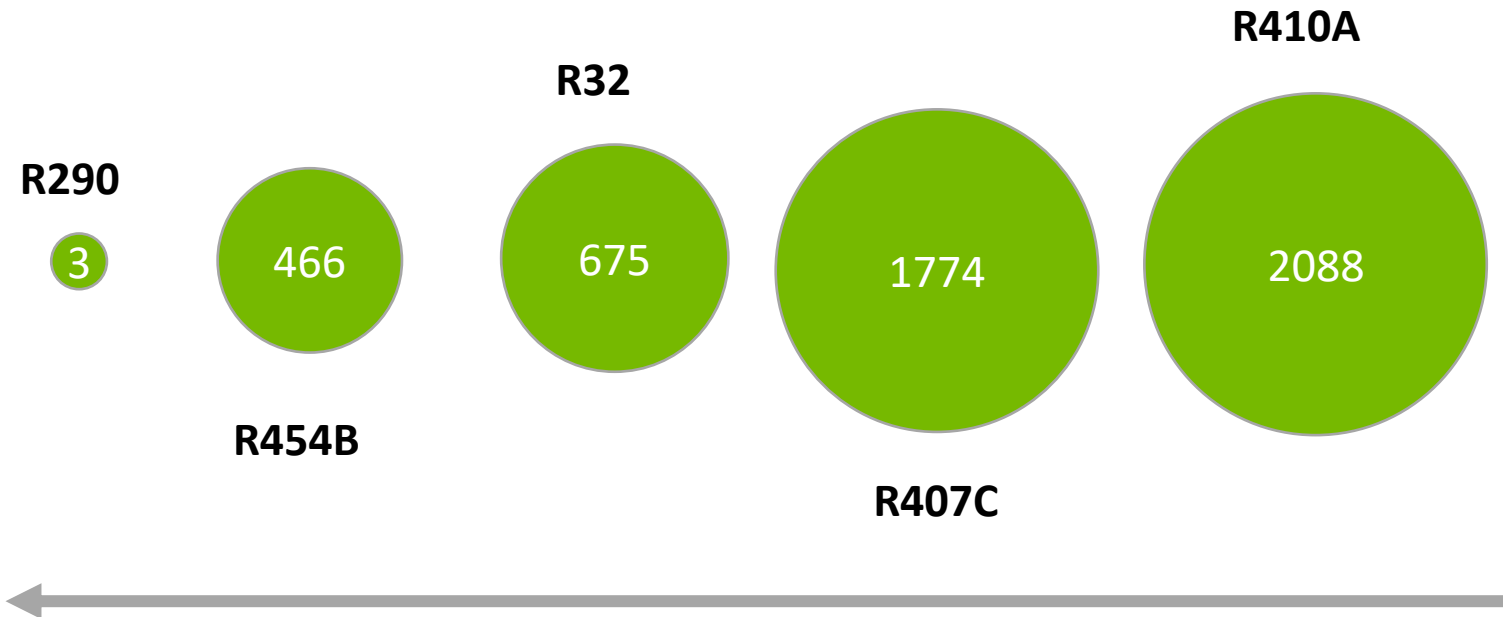


Source: Danfoss



## Challenges and Opportunities for heat pump manufacturers

- GWP (Global Warming Potential) is a term used to describe the relative potency of a greenhouse gas, taking account of how long it remains active in the atmosphere. The value, takes as reference the CO2



## Challenges and Opportunities for heat pump manufacturers

- Flammability of a refrigerant refers to its propensity to ignite and sustain combustion under specific conditions.



**A1: Non flammable**

**R410A R407C**

**A2L: Slightly flammable**

**R32 R452B**

**A3: Highly flammable**

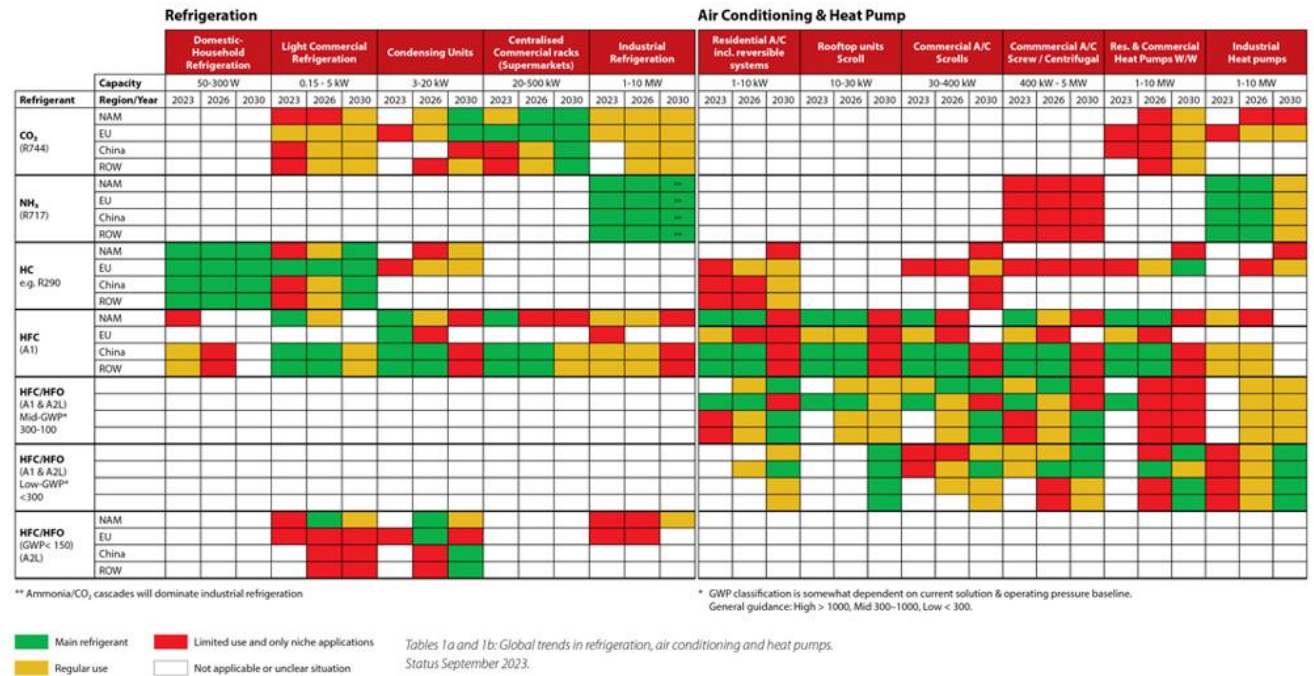
**R290**



# A complex situation

## Challenges and Opportunities for heat pump manufacturers

- The trend shows increasing acceptance of slightly flammable A2L refrigerants
- A3 refrigerants being used more and more, just in smaller systems as up to 500g of A3 refrigerant in hermetic systems
- A different regulation in each country and in each application.



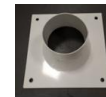
Source: Danfoss



# Comparison with Europe situation

## Challenges and Opportunities for heat pump manufacturers

- Europe is more flexible in the use of refrigerants such as A2, A2L and even A3.
- A2L refrigerants, mainly R32, have been used in A-A, A-W and geothermal heat pumps for many years.
- A3 refrigerants, especially R290, have been used in air-to-water heat pumps since 2021. R290 is used without restrictions in geothermal heat pumps with charges of 150 grams or less. For higher refrigerant charges, it is also allowed if mechanized ventilation is incorporated in the room.



Picture from the outlet duct system fitting 80mm



Duct Inlet

Duct outlet

This unit doesn't reflect inverter's refrigeration using brine circuit



Compressor will be insulated as the current range

All the space designed to contain the refrigerant circuit will be completely insulated

Certified sensor placed to detect R-290 leakage



## Challenges and Opportunities for heat pump manufacturers

### R&D:

- Increased difficulty of design to comply with safety regulations.
- Limited availability of components compatible with lower GWP refrigerants
- Different priorities depending on the country regulations

### Operations:

- Increase in the number of references, both of components and products to manufacture
- Stocks levels
- Number of suppliers

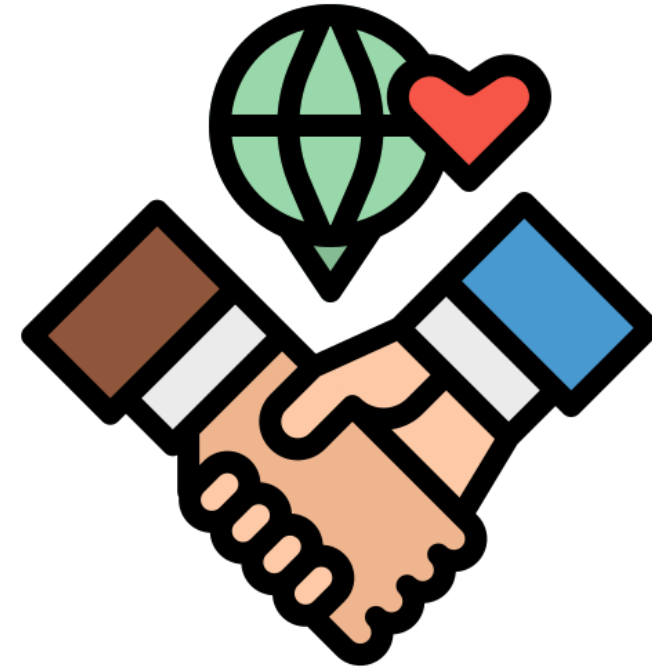
### Sales & Marketing:

- Uncertainty on the part of the final consumer



## Challenges and Opportunities for heat pump manufacturers

- Development of more efficient products and more environmentally friendly
- Product diversification
- Market expansion
- Collaboration with industry partners





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## Challenges and Opportunities for heat pump manufacturers



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# A2L Refrigerants

Jason Filler

ASHRAE Northeast-President  
Stark Tech-Sales Engineer

*Photo is ASHRAE Headquarters Building*

# COUNTDOWN



**8**

Months

**38**

Weeks

**40**

Hours

**New Refrigerants**

# Pay me Now or Pay me Later

- Lead Times
- What is the cost increase of equipment with A2L Refrigerant Vs. R-410A in 5-10 years?
- Lucrative Black Market.
- Environmental Considerations
- What are the service implications?

# ASHRAE 15

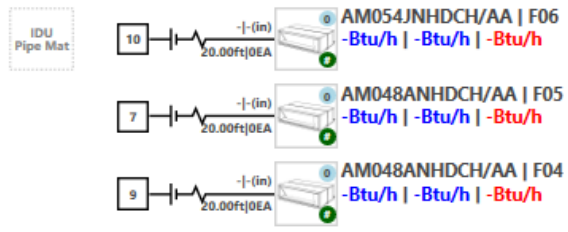
- Group A2L Safety Requirements Updated in 2022.
  - The releasable refrigerant charge cannot exceed the effective dispersal volume charge (EDVC) limit based on
    - ASHRAE Standard 34 classification
      - Class One: Volume Based on Occupied Spaces
      - Class Two: Volume Based on Occupied AND Unoccupied Spaces
  - Refrigerant Detection Systems.
  - Required Mitigation Actions
  - Mechanical Ventilation.
  - No Open Flame Producing Devices
  - Unclassified Electronic Devices.
  - Section 7.6 A2L in High-Probability System for Human Comfort



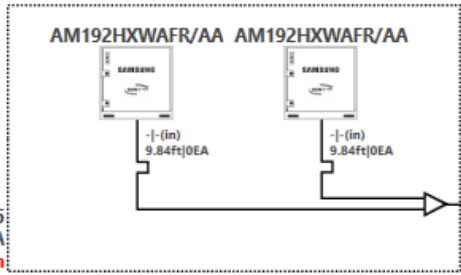
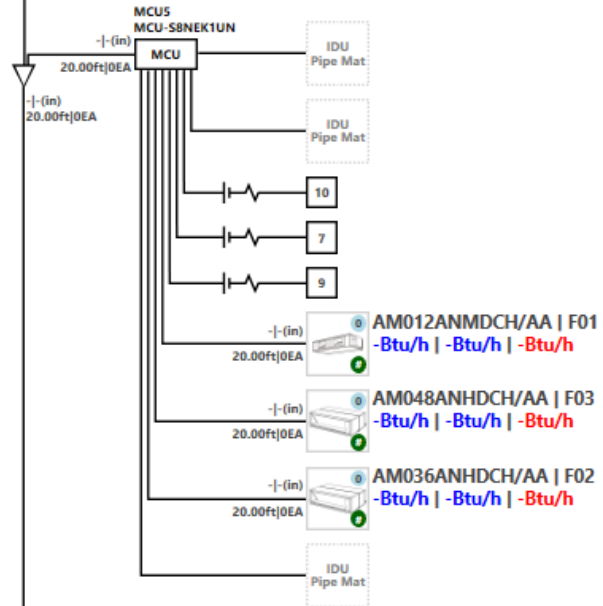
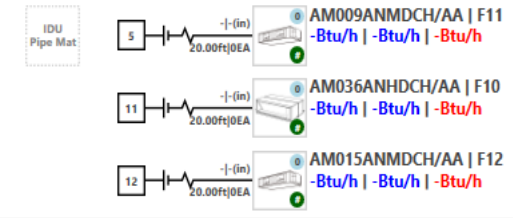
# ASHRAE 15 Section 7.6

- Refrigerant Quantity Limit-Maximum refrigerant of any independent circuit.
- Air Circulation must be initiated by a refrigerant monitor or continuous airflow.
- Refrigerant Detection Systems:
  - Must be integral and listed with the equipment
  - Ducted Systems with refrigerant charge greater than 4lbs
  - Refrigeration System in occupied spaces classified as institutional.
- If Activated:
  - Energized Air Circulation Fans, Open zone dampers, de-energize electric heat.
  - Activate Safety Shutoff Valves

1F  
118.00



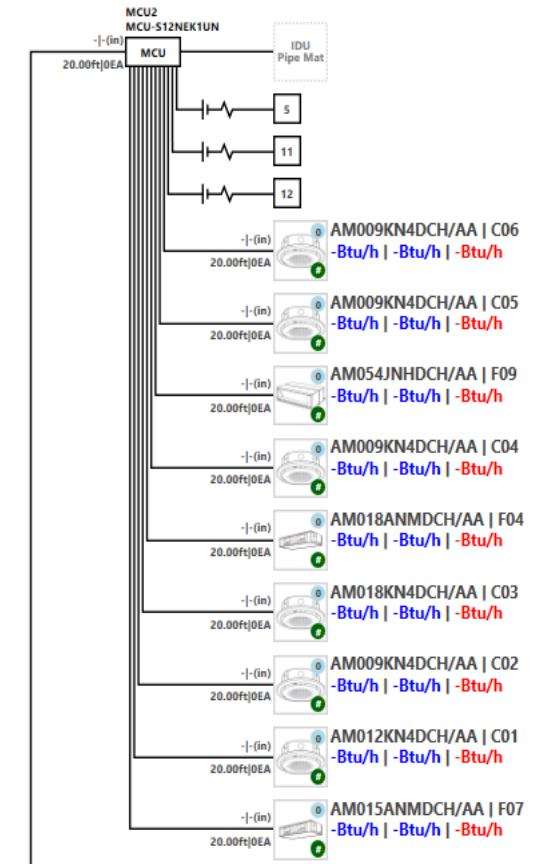
3F  
354.00



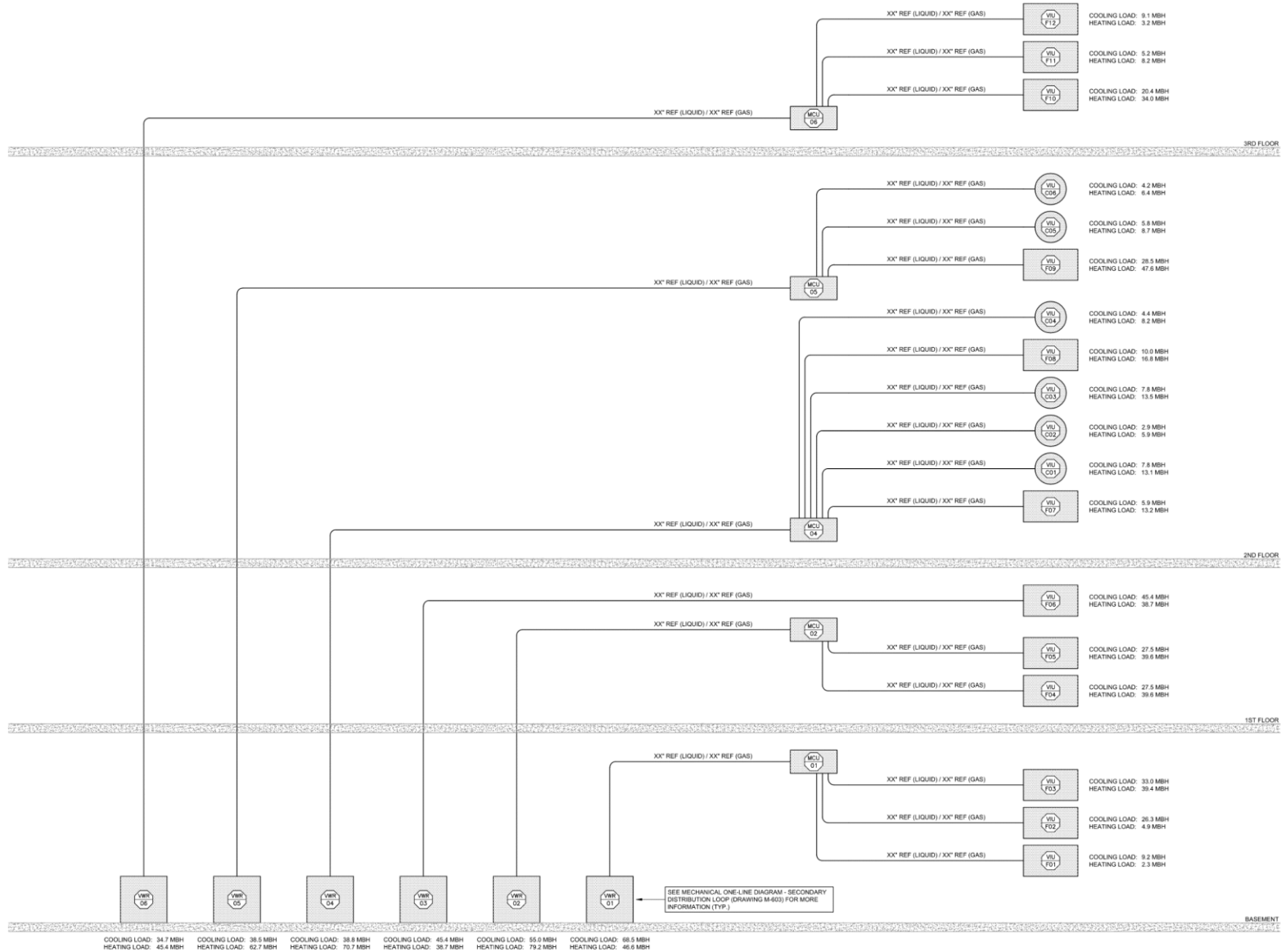
Water Source Condensers - Copy5  
AM384HXWAFR2AA  
-Btu/h | -Btu/h

B1  
0.00

2F  
236.00







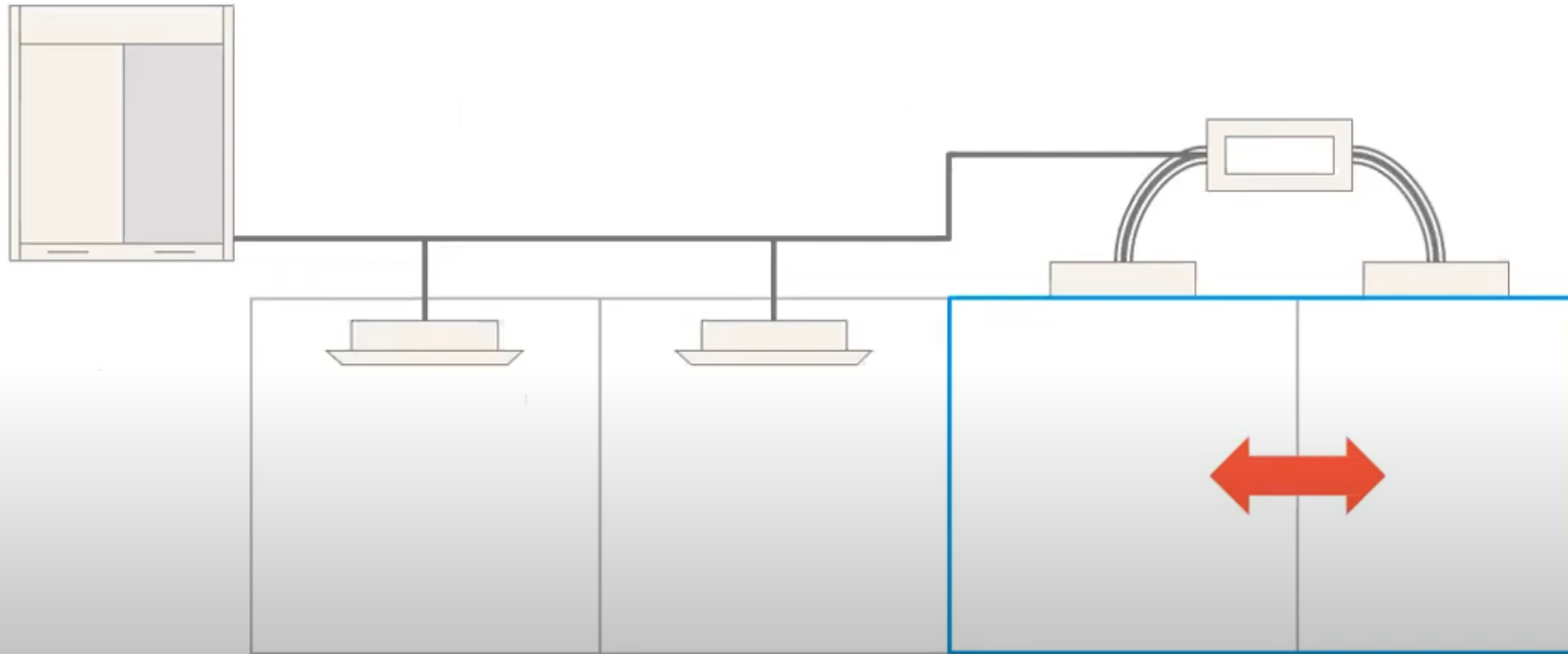
SEE MECHANICAL ONE-LINE DIAGRAM - SECONDARY DISTRIBUTION LOOP (DRAWING M-403) FOR MORE INFORMATION (TYP.)

VRF Unit	Cooling Load (MBH)	Heating Load (MBH)
VWR 06	34.7	45.4
VWR 05	38.8	62.7
VWR 04	38.8	70.7
VWR 03	65.4	38.7
VWR 02	65.6	79.2
VWR 01	68.5	46.6

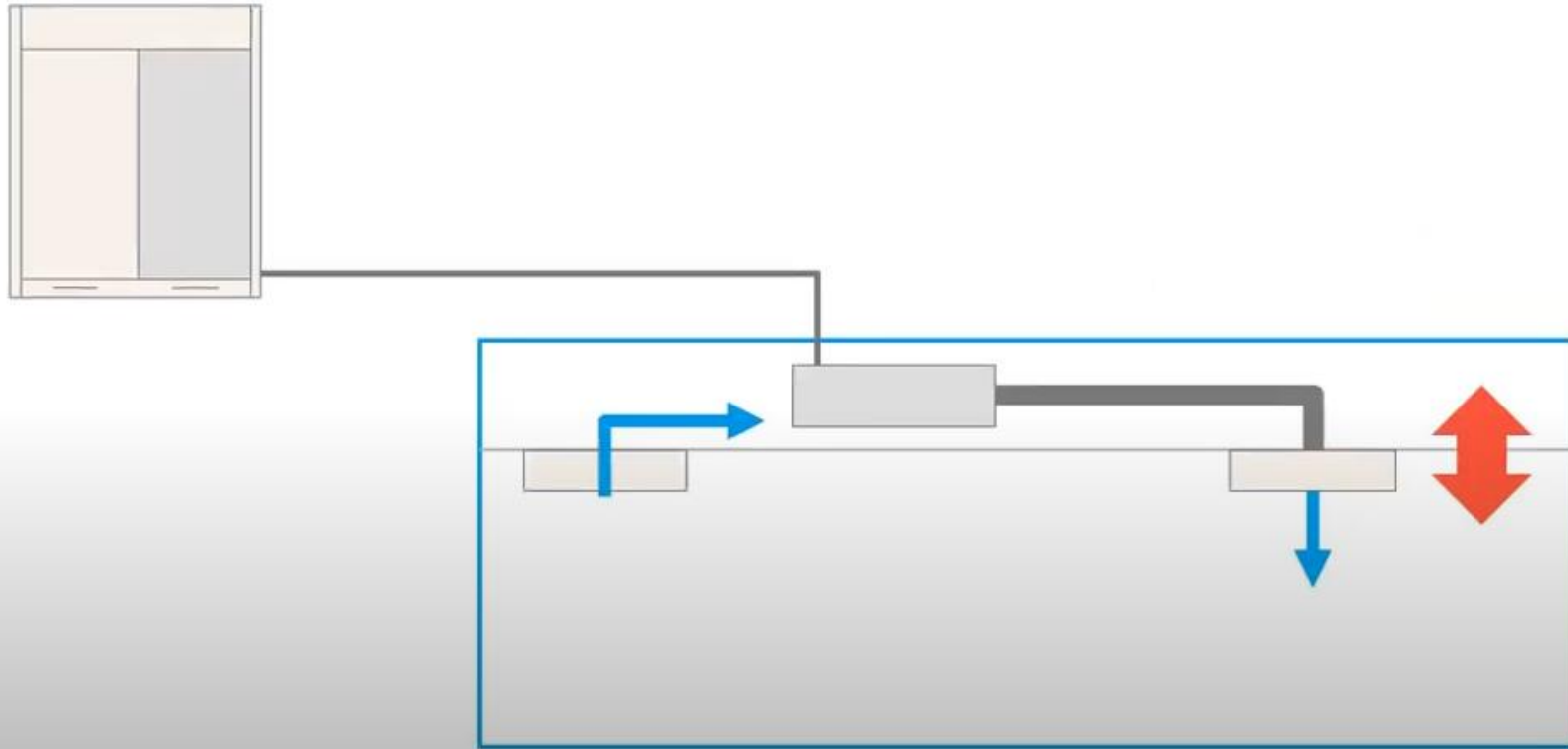
MECHANICAL ONE-LINE DIAGRAM - VRF RISER  
SCALE: N.T.S.



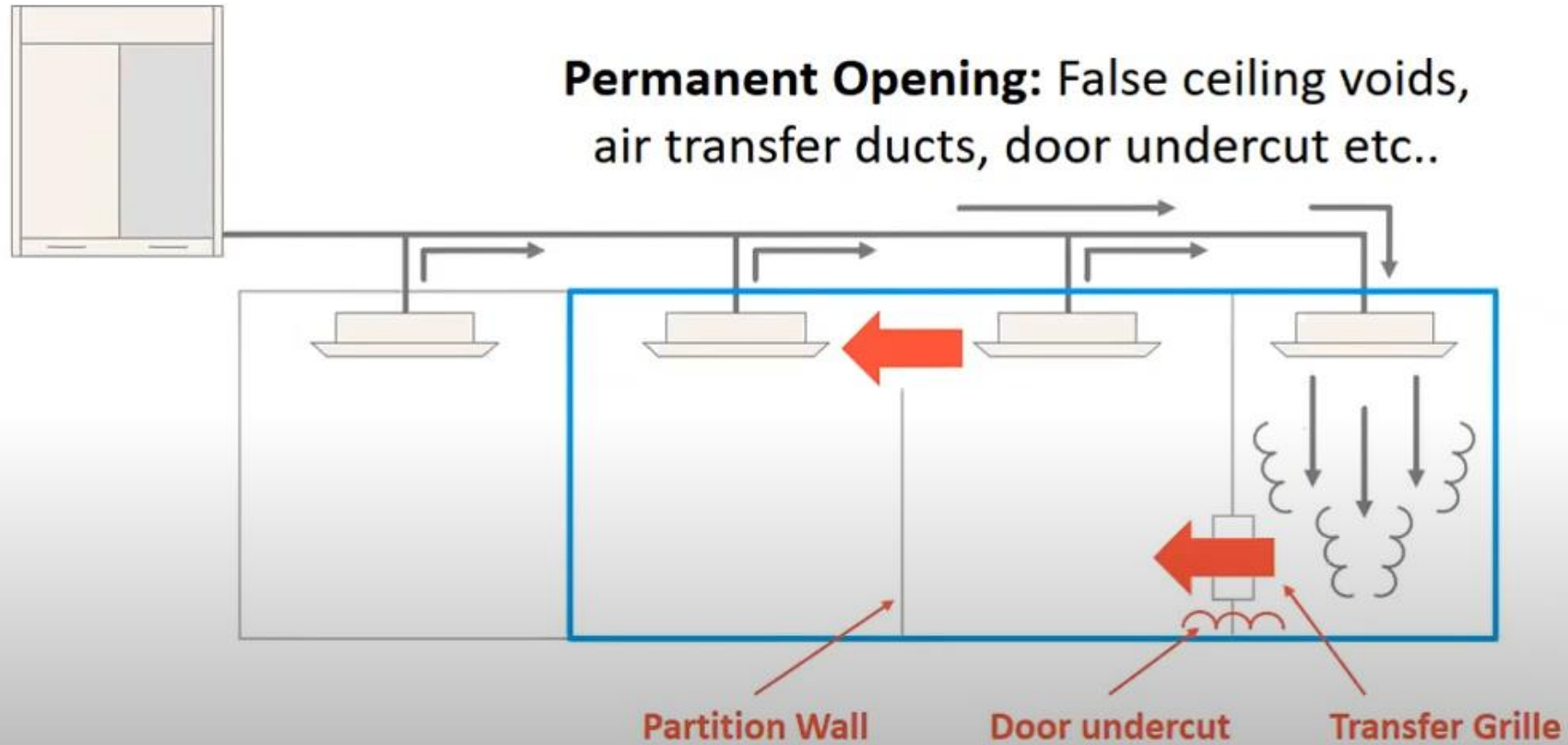
Use a ducted fan coil unit to serve multiple spaces

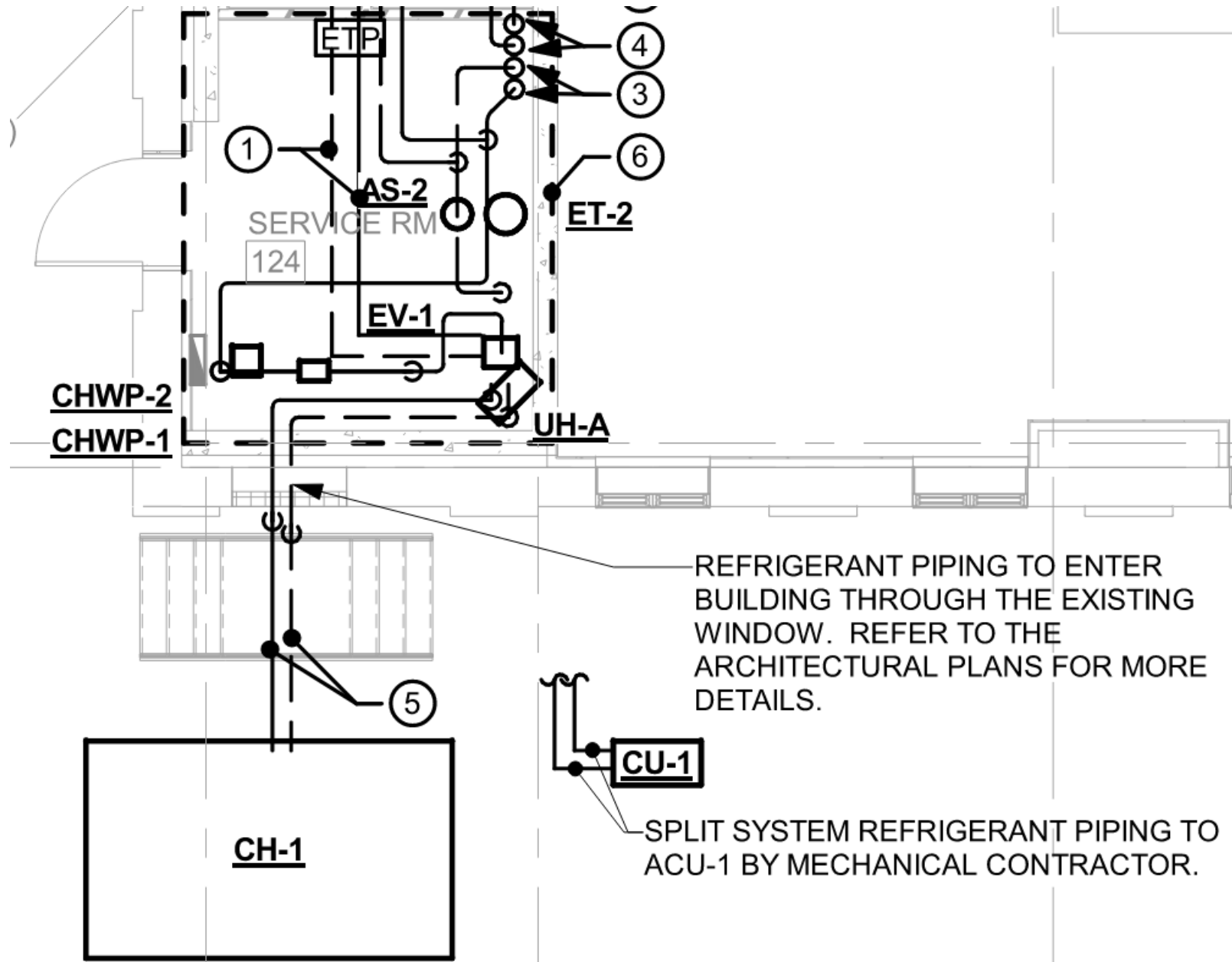


## Using the void space as a plenum chamber



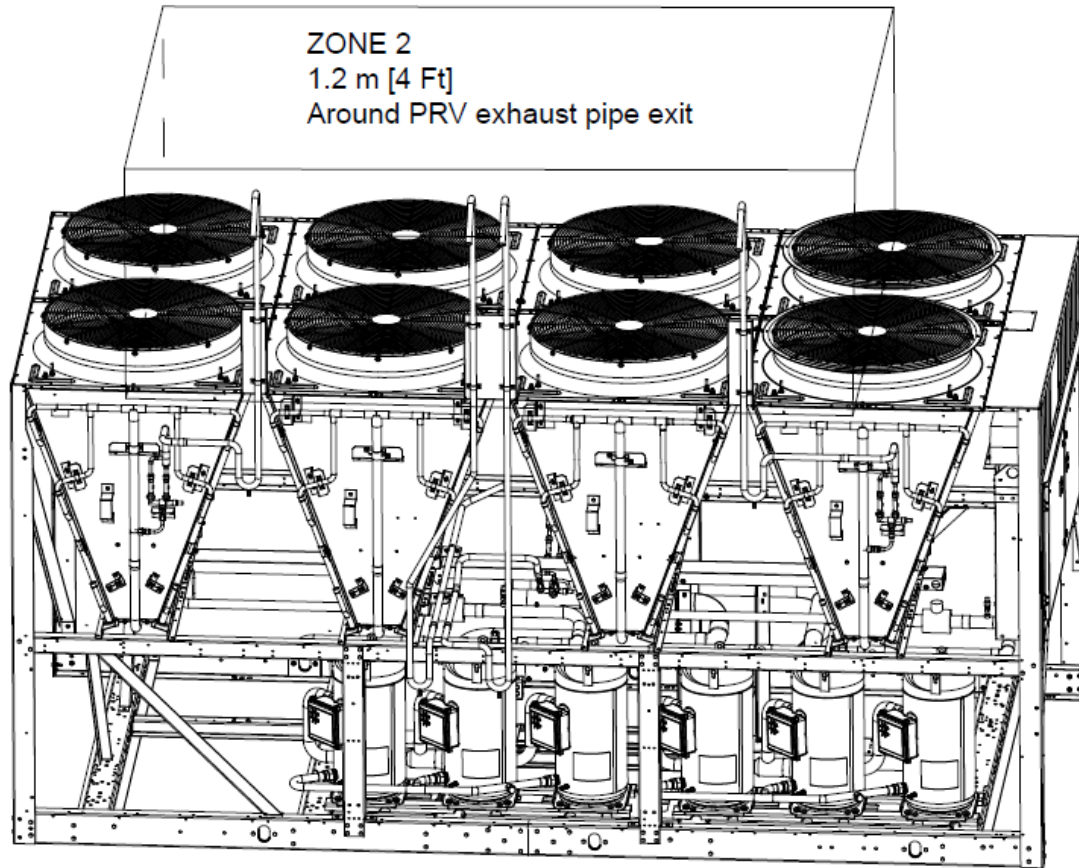
Increase the dilution volume





REFRIGERANT PIPING TO ENTER BUILDING THROUGH THE EXISTING WINDOW. REFER TO THE ARCHITECTURAL PLANS FOR MORE DETAILS.

SPLIT SYSTEM REFRIGERANT PIPING TO ACU-1 BY MECHANICAL CONTRACTOR.



\*Zone 2 – an area in which an explosive gas atmosphere is not likely to occur during normal operation, and if it does occur, it will exist for a short period of time only.

- Emergency Outlet (relief valve piping exhaust) is zone 2\* (EN 60079-10)
- There needs to be sufficient clearance around the relief valve piping exhaust
- There should be no potential ignition sources within 1.2 meters in all directions from the outlet of the relief piping





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POLICY & PROGRAMS – 4:00 PM