

COPELAND
RAC event

Regulatory overview

- F-Gas review
- PFAS under REACH
- Ecodesign
- EN60335-2-89

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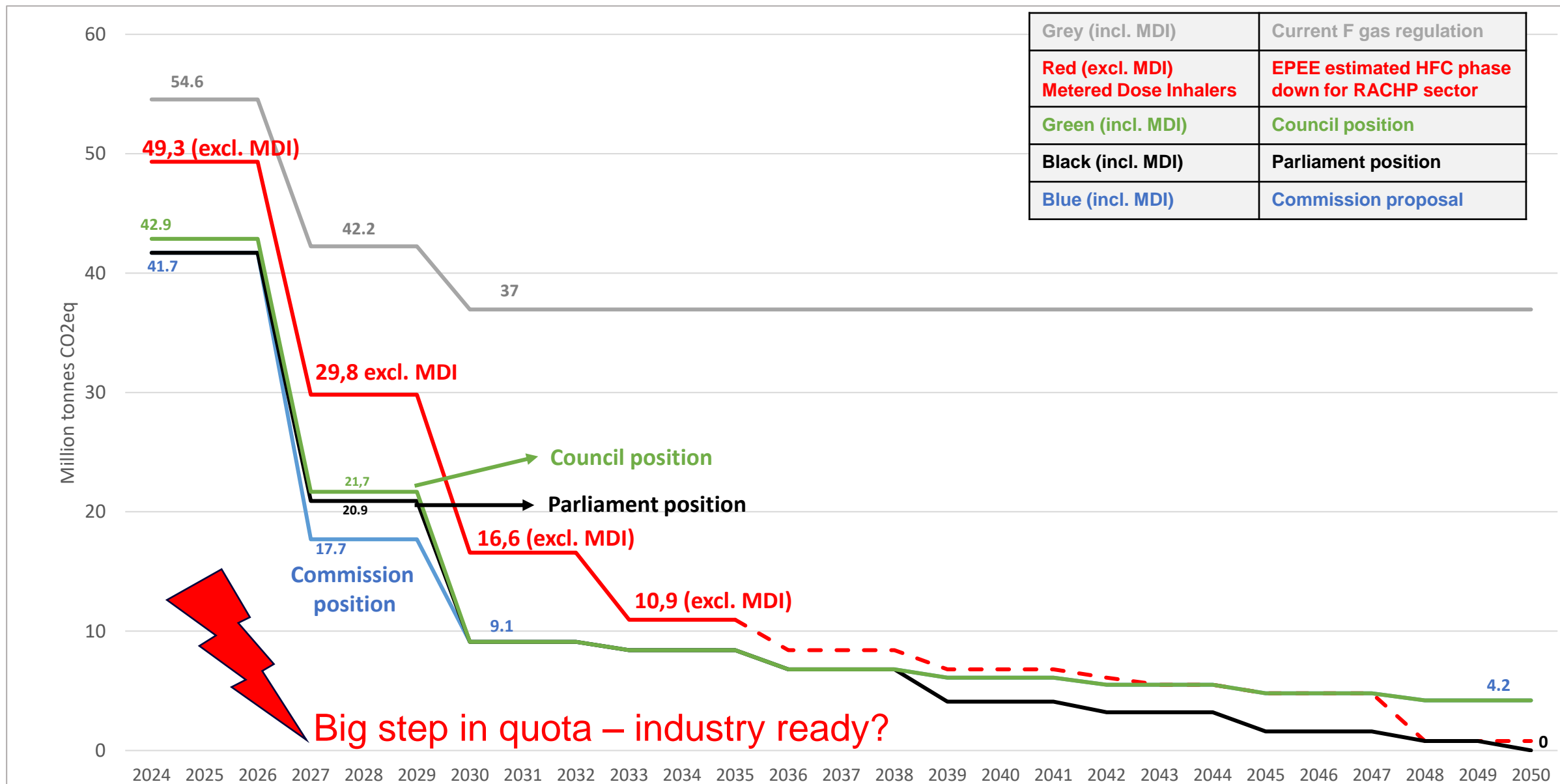


F-Gas Regulation: Co-decision procedure

Right of legislative initiative: The European Commission

1. The EU Commission submits a proposal to the EC Council (EC) and the European Parliament (EP)
 2. EC and EP adopt a legislative proposal either at the first reading or at the second reading
 3. If the two institutions do not reach an agreement after the second reading a conciliation committee is convened => Trialogue
 4. If the text agreed by the conciliation committee is acceptable to both at the third reading, the legislative act is adopted
 5. If a legislative proposal is rejected at any stage of the procedure, or the EP and EC cannot reach a compromise, the proposal is not adopted and the procedure ends
- Target of DG Clima and Council Presidency: applicability 1.1.2024 => Need to conclude the file by end of September 2023, but change of presidency (SE → ES) did not increase the speed of discussions!
 - On 20th July, there was an all-day Technical Trialogue which apparently was critical to be able to move the negotiations forward
 - Negotiators resumed after the summer recess in the week of the 21st of August 2023 when EP/EC came back to work
 - The F-gas issue was on the agenda of the 29th August EP's ENVI Committee meeting with Bas Eickhout (EP rapporteur) providing a summary (not public) and there were EC "Working Party on the Environment" meetings in September
 - 4th Political Trialogue 5th October 2023 in Strasbourg– too late for applicability 1.1.2024 - New quota as of 2025, then 2027, ban dates stay
 - ?? Potential Blocking Minority of smaller Member States (35% min. needed)??

Phase Down – Latest Position



Annex IV: Product Bans and Industry Alliance analysis

NB Industry Position: All new product bans shall have the derogation clause related to safety requirements

| Application Bans | F-Gas Draft | Council mandate Swedish presidency | EU Parliament's proposal | Industry Alliance's draft analysis |
|--|--|---|---|---|
| 10: Domestic refr./freezers | | No additional ban | Full F-gas ban by 2024 | Not in our scope - Neutral |
| 11: Refr./freezers comm. use | GWP 150 by 2024 | GWP 150 by 2024 | Full F-gas ban by 2024 | EU Parl. proposal not acceptable |
| 12: Any self-contained refrigeration | GWP 150 stationary applications by 2025 | GWP 150 for stationary applications by 2025 | Full F-gas ban for stationary applications by 2025 | EU Parl. proposal not acceptable <6kW: GWP 150 by 2025 >6kW: GWP 150 by 2028 |
| 13/14: Stationary refrigeration | GWP 2.500 by 2024 | GWP 2.500 by 2024 | A) Full F-gas ban by 2025 except for below -50°C applications B) Full F-gas ban by 2027 | EU Parl. proposal not acceptable GWP 150 except for bans 12 and 15 and except process chillers by 2028 |
| 13/14(b): Chillers | | | Full F-gas ban on mini, displacement and centrifugal chillers by 2027 | EU Parl. proposal not acceptable <12 kW: GWP 150 by 2028 >12 kW: GWP 150 by 2030 |
| 15: Stationary Multipack centralized Rack >40kW | GWP 150 (GWP 1.500 in primary circuit) by 2022 | | | ASERCOM: GWP 150 (exc. process chillers) by 2028 |
| Light Comm. Vehicle, Trucks and Trailers, Ships' Refr. | | | Full F-gas ban by 2027 | EU Parl. proposal not acceptable |
| 17: Self-contained AC and HP | GWP 150 by 2025 | <50kW: GWP 150 by 2027 >50kW: GWP 150 by 2030 | Full F-gas ban by 2028 | EU Parl. proposal not acceptable <12 kW: GWP 150 by 2028 >12kW: GWP 750 by 2028 |
| 18: Split AC & HP | < 3kg GWP 750 2025 <12kW GWP 150 by 2027 >12kW GWP 750 by 2027 | <12kW: GWP 150 by 2027 for A/W and 2029 for A/A >12kW: GWP 750 by 2029 >12kW: GWP 150 by 2033 | B) <12kW: full F-gas ban by 2028 C) 12kW-200kW: GWP 750 by 2028 D) >200kW: full F-gas ban by 2028 | B + D - EU Parl. proposal not acceptable Industry's proposal: Single split A/A < 6kW: GWP 150 by 2030 Other split: GWP 750 by 2029 |

Why does the REACH initiative aim at PFAS?

1. PBT Chemicals

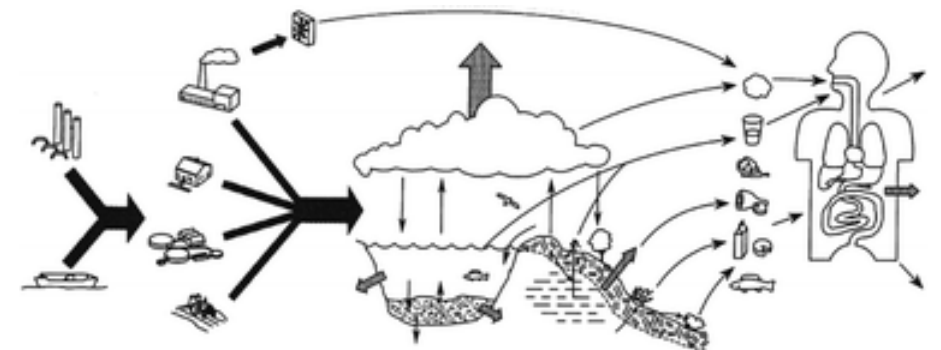
- Many PFAS (Per- and polyfluoroalkyl substances) are considered **PBT** chemicals.
- Carbon Fluorine (CF) bonds are very stable in the environment (**Persistent**). Certain chain lengths are biologically accessible, build up in fat tissue (**Bioaccumulative**) and have **Toxic** effects.
- PFAS compounds are detectable in the blood of the whole **US population**
- REACH accordingly evaluates to cover PFAS = **“Forever Chemicals”**
- The used PFAS definition is very wide and covers about **10,000 chemicals and includes all F-Gases** (ultrashort-chain -CF₂ and -CF₃)

2. Further Aspects: Decomposition of F-Gases are released into the atmosphere

- TFA (trifluoroacetic acid) is a breakdown product of some fluorocarbons, is naturally occurring in the environment and resistant to further degradation (breakdown) = **ultrashort-chain PFAS**
- A scientific model on Arctic Ice Core Records estimates that the replacement of R134a with R1234yf will result in an annual **TFA** wet deposition of 160–240 µg m² in continental North America which is **higher than the cumulative deposition during the last decade** of record for each ice core

→ Environment and Health

- PFAS cause an issue **if released into the environment**: land, air, water.
- Especially **through the drinking water** wildlife and humans are exposed to PFAS → PBT / Forever Chemicals have a long-term impact on health!
- **TFA** removal is very difficult
- **REACH applies the Pre-cautionary Principle!**



Fluoropolymers In HVACR Controls and Monitoring Equipment

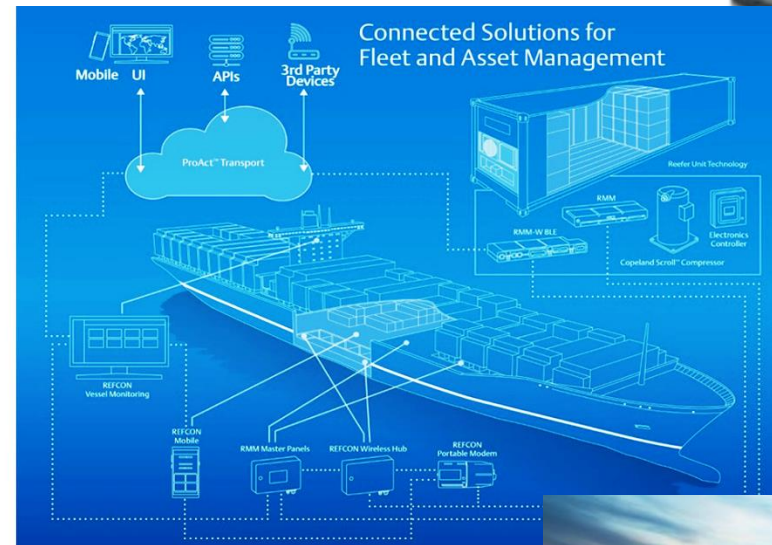
Note, These are only examples of parts containing PFAS. This is not meant to be a comprehensive list.

Electrical discrete and integrated components contained within these products

– PFAS fluoropolymer and fluoroelastomer use in electronics is driven by their unique and often combined properties:

- *High Temperature Resistance*
- *Excellent Chemical Resistance*
- *UV resistance*
- *High Dielectric Strength*
- *High Refractive Index*
- *Inherent Flame Retardance*
- *Moisture Barrier*
- *Non-Fouling Behavior in Water Systems*

• No adequate alternatives for HVACR equipment identified!



In-Transit Monitoring

Our core technologies and expertise help monitor products on the GO.



Facility Temperature Monitoring

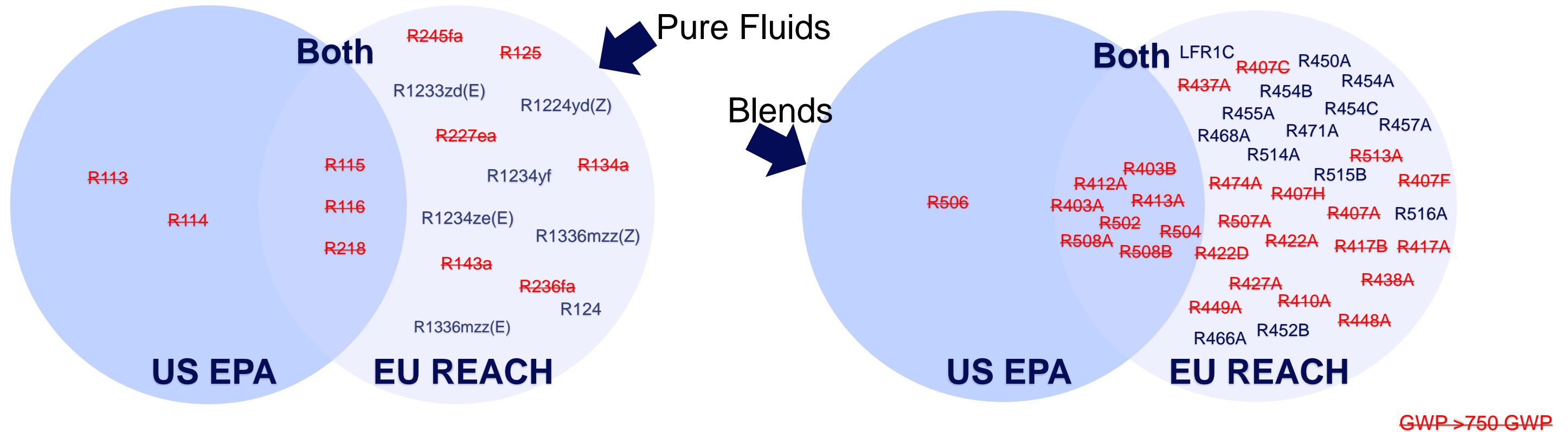
Easily installed, our systems monitor temperature and humidity in stationary areas.



Security

Mitigate cargo theft and financial loss with real-time alerts.

Fluorinated Refrigerants - Classification as a PFAS by the EU & EPA (US)



Pure Fluids not covered in PFAS

- All Naturals
- R-32 – A2L: 675 GWP
- R-13I1 – A1: <1 GWP
- R-152a – A2: 124 GWP
- R-1132a – A2: <1 GWP (AR6)
- R-1132(E) – (B2): <1 GWP (AR6)

Blends not covered in PFAS

- R-429A – 16 GWP – A3: R-E170/152a/600a (60±1/10±1/30±1)
- R-430A – 110 GWP – A3: R-152a/600a (76±1/24±1)
- R-431A – 44 GWP – A3: R-290/152a (71±1/29±1)
- R-435A – 30 GWP – A3: R-E170/152a (80±1/20±1)
- LFR3B – 140 GWP – A1

Refrigerant Derogations in the REACH Dossier

- Gives extra time to comply with regulation
 - Granted to application or industry sector
 - Two types: (1) Time Unlimited and (2) Time-Limited

5 Years + 18 Months
(6.5 Years) 2032/2033

OR

12 Years + 18 Months
(13.5 Years)
2039/2040

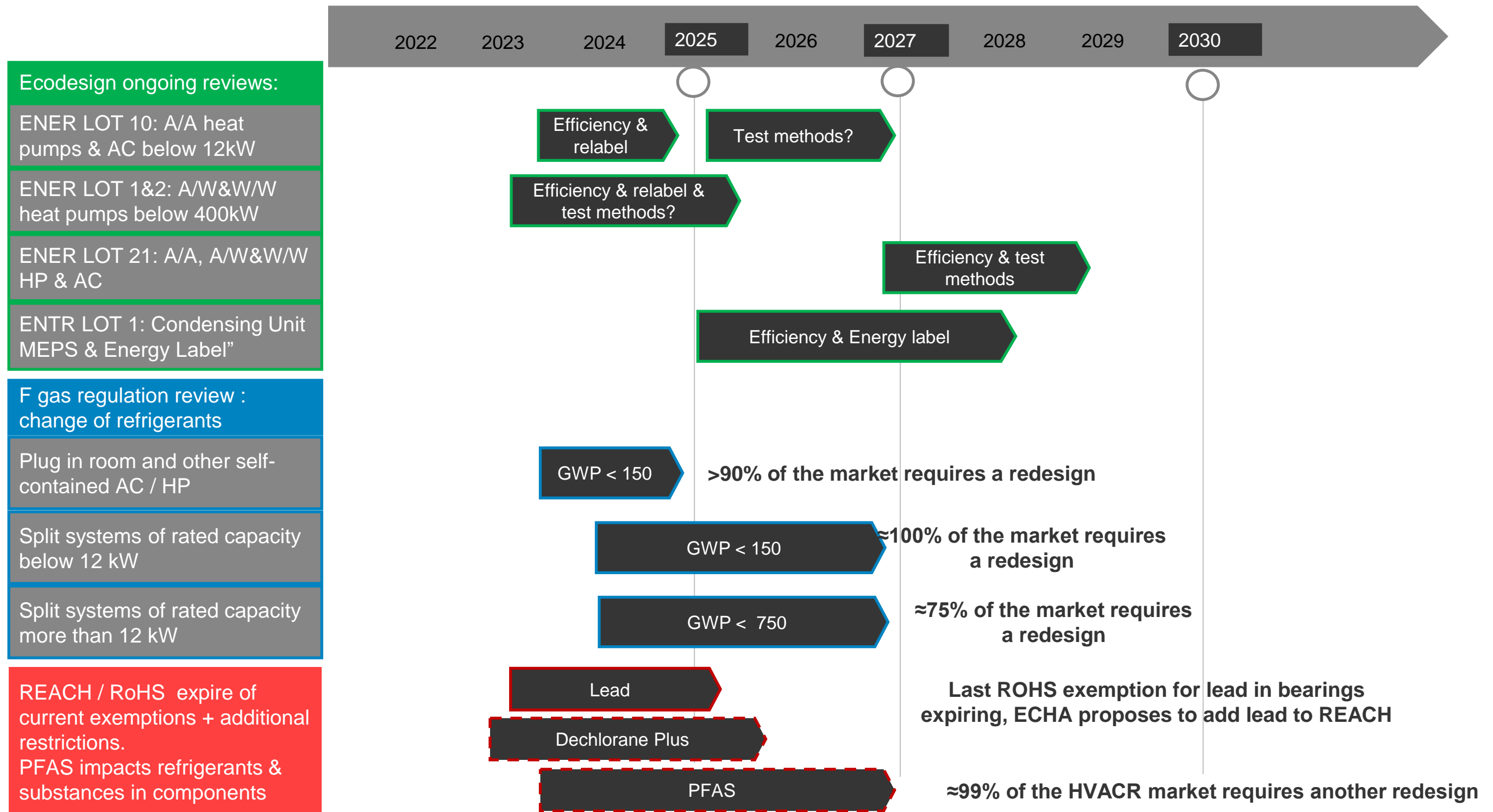
- Refrigerant Derogations already in the proposed dossier.

1. **Low temperature refrigeration** below -50°C, 6.5 years
2. **Laboratory test and measurement equipment**, 13.5 years
3. Refrigerated **centrifuges**, 13.5 years
4. Maintenance and refilling of **existing HVACR equipment** and for which no drop-in alternative exist, 13.5 years
5. **HVACR-equipment in buildings** where national safety standards and building codes prohibit the use of alternatives, TIME-UNLIMITED
6. **Mobile** air conditioning-systems in combustion engine vehicles with mechanical compressors, 6.5 years
7. **Transport refrigeration** other than in marine applications, 6.5 year

Executive Summary F-gas review and PFAS under REACH

| Regulation | Description / Authority | Timing | Potential Impact |
|------------------|---|---|--|
| F-gas Revision | <p>Ordinary legislative (Co-decision) procedure = legislative proposal by EU Commission.</p> <p>EU Parliament and EU Council (Member States) have deciding vote and amendment options</p> | <p>EU Parliament vote 29.3.2023, followed by Council vote – leading to Trialogue (all 3 legislative bodies negotiate together – fast track procedure)</p> <p>→ Entry into force late 2023, applicable 1.1.2024 (or 2025)</p> | <p>→ Phase down and product bans require move to as low GWP as possible (including natural refrigerants as much and as fast as possible)</p> <p>→ High price and low availability of synthetic refrigerants (even <150GWP) to be expected</p> |
| PFAS under REACH | <p>Delegated act of EU Commission - scrutiny only by EU Parliament and EU Council</p> | <p>Dossier proposed by 5 countries, public consultation and risk & socio-economic assessment 2024</p> <p>→ Entry into force 2025?</p> <p>→ Applicable 18 months thereafter</p> <p>→ Specific derogations up to + 5 or + 12 years)</p> | <p>Most synthetic refrigerants fall under the PFAS definition</p> <p>→ Complete ban possible</p> <p>→ Service and maintenance limited to 13,5 years</p> <p>→ Physical components severely impacted</p> |

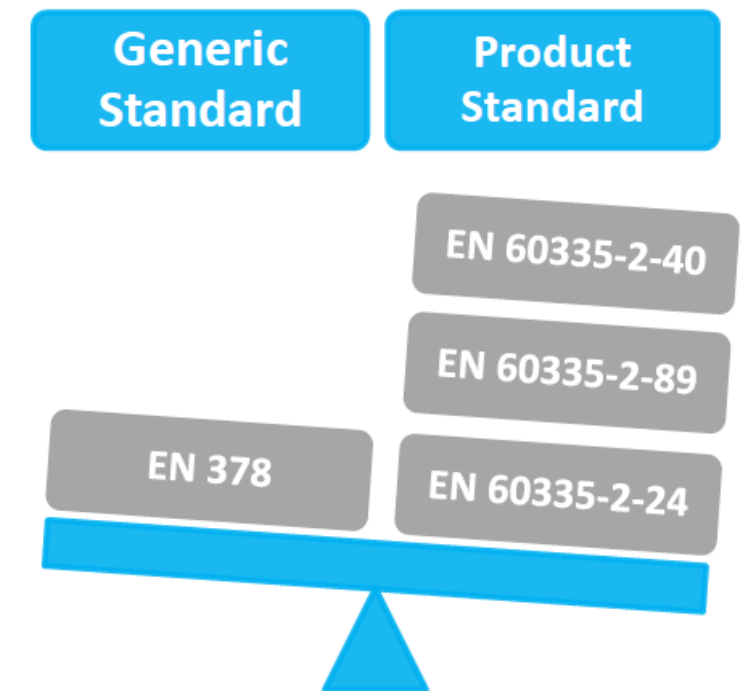
Energy Efficiency First – vs refrigerants choice – vs. fluoropolymers in components → long transition time needed!



Scope of International & European Safety Standards for HVACR

| | IEC 60335-1 | IEC 60335-2-24 | IEC 60335-2-40 | IEC 60335-2-89 | ISO 20854 | ISO 5149 |
|--------------------------|-------------|--------------------------------------|----------------|----------------|-----------|------------------|
| Domestic Refrigeration | X | X | | | | X |
| Commercial Refrigeration | X | | | X | | X |
| Industrial Refrigeration | | | | | | X |
| Transport Refrigeration | | | | | | X |
| AC & air HP | X | | X | | | X |
| Water Heating HP | X | | X | | | X |
| Refrigerated Containers | | | | | X | X |
| | EN60335-1 | EN60335-2-24 | EN60335-2-40 | EN60335-2-89 | ISO20854? | EN378 |
| | | Product or Equipment Standard | | | | General Standard |

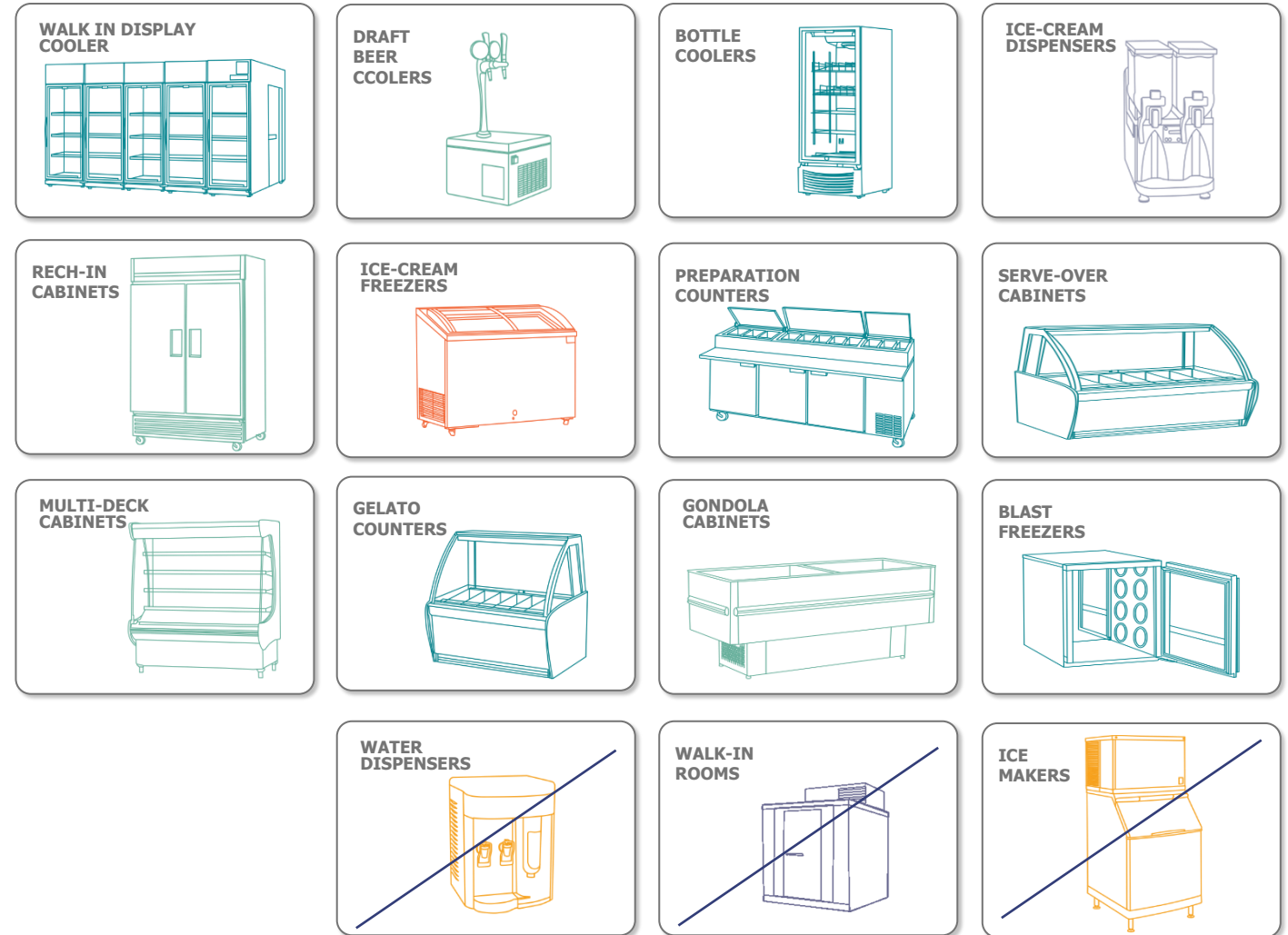
- Generally Harmonised EN 60335 Standards are adopted from the IEC standard with minor changes to comply with EU regulation (LVD, MD,...)
- EN are often revised later than IEC releases (IEC 60335-2-89 approved for 500g R290)
- EN 378:2016 and ISO 5149:2014 have been aligned recently



Requirements in product standards prevail over requirements in generic standards

Scope covered by IEC 60335-2-89 - Equipment

- Specifies safety requirements for commercial appliances and ice-makers with incorporated motor-compressor or supplied in two units for assembly as a single
- Deals with the common hazards including those that use flammable refrigerants and appliances employing R 744
- Not applicable to appliances with a mass of flammable refrigerant exceeding 13xLFL or to appliances with that use toxic refrigerants (class B – i.e NH3)
- This standard does **not** apply to:
 - split systems with flammable refrigerant exceeding 150g charge size
 - commercial ice-cream appliances
 - cold temperature rooms with a remote motor-compressor



IEC 60335-2-89 : The risk with more than 150 g flammable refrigerant must be the same as we have with the current limit of 150 g

- Maximum charge limit for flammable refrigerant $3 \text{ [m}^3\text{]} \times \text{LFL [kg/m}^3\text{]}$
 - Max. 1200g for A2L: R 454C / R 1234yf / R 1234ze and
 - 500g for R 290
- Requirement for appliances with more than 150 g flammable refrigerant
- Determination of gas concentration – Annex CC
- Between 151 g and $13 \times \text{LFL}$ (1200g max) :
 - Minimum room volume required and minimum air flow for appliances could be necessary ($A_{\text{lim}} = 1.81 \times M / \text{LFL}$)
- Refrigerant-containing parts should be protected clause 21.103
- Electrical components should be non-sparking electrical apparatus where leaked concentration $> 50\% \text{ LFL}$
- Low temperature solder alloys will be not accepted for pipe connections
- Should have a tested tightness control level of less than 3 grams per year (ISO14903)

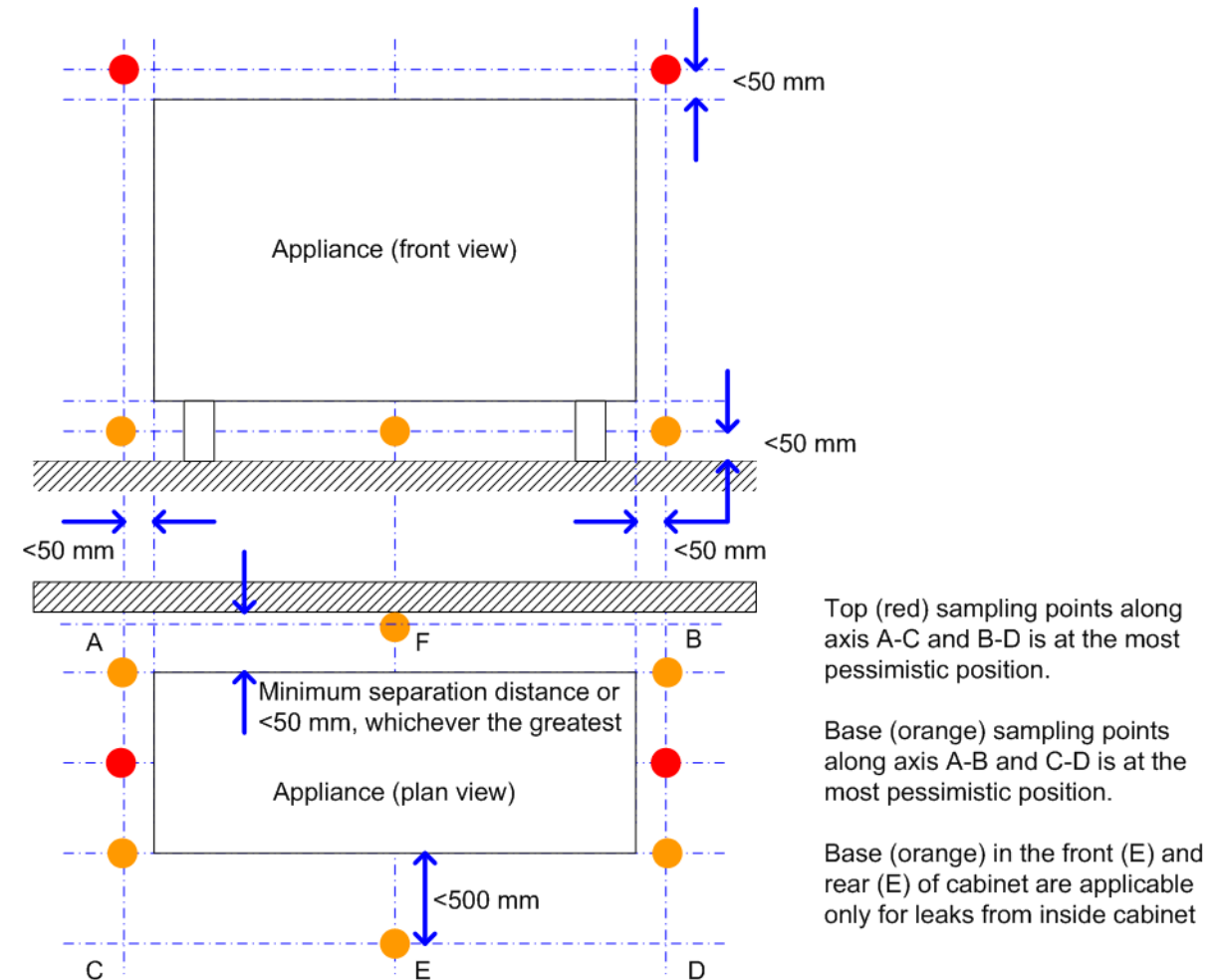
Annex CC – “ Risk Assessment for charge over 150 g “

Determine Flammable Concentration Surrounding the Appliance

- **Leak shall not result in a flammable concentration surrounding the appliance**
- Compliance checked by inspection and by tests specified in annex CC

Type test Approval (Annex CC)

- Appliances that contain more than 150g of flammable refrigerant in each separate refrigerant circuit shall be constructed such that a leak of refrigerant shall not result in a flammable concentration surrounding the appliance.
- If airflow is necessary to comply with this requirement the airflow shall be guaranteed when the appliance is energized.
- **The concentration at any of the sampling points shall not exceed 50% of LFL of the refrigerant used**



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