



Brussels, 4.8.2017
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ANNEXES 1 to 2

ANNEXES

to the

REPORT FROM THE COMMISSION

**assessing the 2022 requirement to avoid highly global warming Hydrofluorocarbons in
some commercial refrigeration systems**

ANNEX I

Key definitions related to the 2022 requirement

- **Multipack centralized refrigeration systems**

'Multipack centralised refrigeration systems' means systems with two or more compressors operated in parallel, which are connected to one or more common condensers and to a number of cooling devices such as display cases, cabinets, freezers or to chilled store rooms¹.

This definition would also include chillers, condensing units and any other technology consisting of more² than one compressor fulfilling the other criteria of the definition.

- **Commercial use**

'Commercial use' means used for the storage, display or dispensing of products, for sale to end users, in retail and food services³.

This definition would therefore exclude storage facilities without a sale to end users.

- **40 kW refrigeration capacity threshold**

40 kW in point 13 of Annex III refers to the rated capacity of a single refrigeration circuit at evaporation temperatures of -10°C for medium temperature (MT) applications and -35°C for low temperature (LT) applications at an ambient temperature of 32°C.⁴ In case two completely independent refrigeration circuits deliver MT and LT separately from each other in direct expansion systems, then the prohibition only applies to either independent circuit if it singly surpasses the capacity threshold. If one refrigeration circuit can deliver both MT and LT capacity at the same time, the sum of the capacities is relevant for calculating the capacity of the system. Otherwise, the higher of the two capacities is used to see if the 40kW threshold is exceeded. For multifunctional equipment only the refrigeration capacities apply and not the capacities for air conditioning or heating.

- **Primary circuit of a cascade system**

'Primary refrigerant circuit of cascade systems' means the primary circuit in indirect medium temperature systems where a combination of two or more separate refrigeration circuits are connected in series such that the primary circuit absorbs the condenser heat from a secondary circuit for the medium temperature⁵.

This definition is understood to include systems in which the heat from the low temperature circuit is absorbed by an indirect medium temperature circuit before being absorbed by the primary circuit, as well as systems where the primary circuit receives the condenser heat from the low temperature circuit directly as well as from a second medium temperature circuit (in other words reference systems E and F below in Annex II). The definition requires that the MT circuit is split in a primary and secondary circuit. On the other hand, a simple cascade with R134a in the primary circuit also serving the MT cooling requirements in direct expansion (DX system) and absorbing the heat from a CO₂ circuit for the LT is not covered by this definition.

¹ Article 2(37) Regulation (EU) No 517/2014.

² Including if only required for redundancy, i.e. to ensure reliable operation.

³ Article 2(32) Regulation (EU) No 517/2014.

⁴ This definition is based on a similar definition contained in EN 13215: Condensing units for refrigeration. Rating conditions, tolerances and presentation of manufacturer's performance data.

⁵ Article 2(38) Regulation (EU) No 517/2014.

ANNEX II

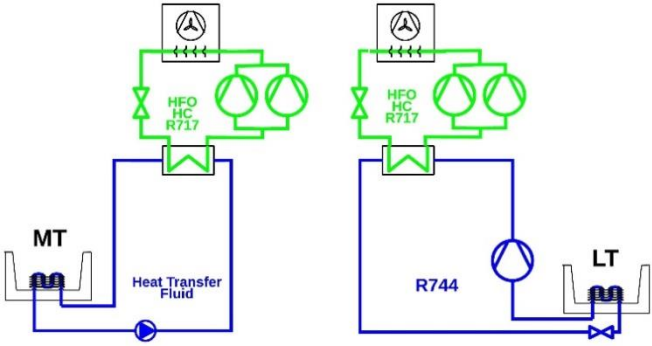
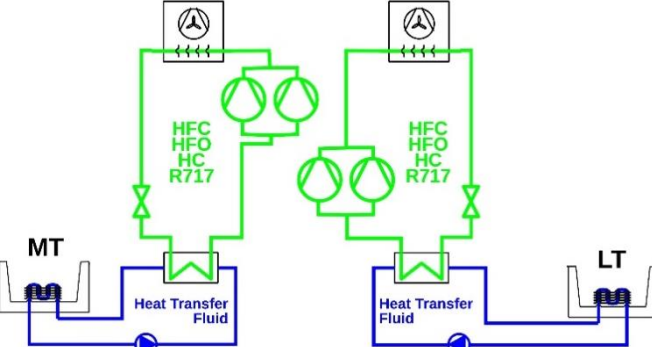
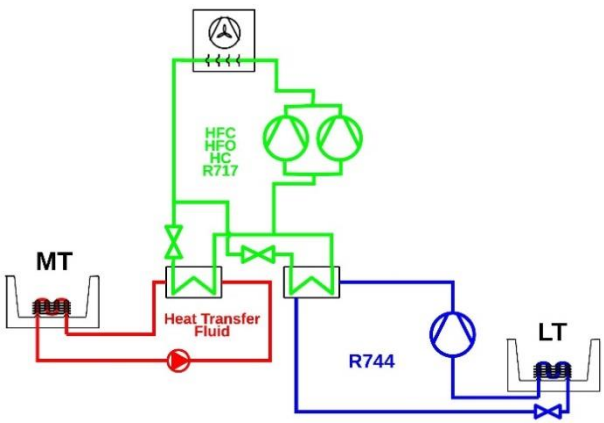
Supermarket refrigeration systems permitted after 2022

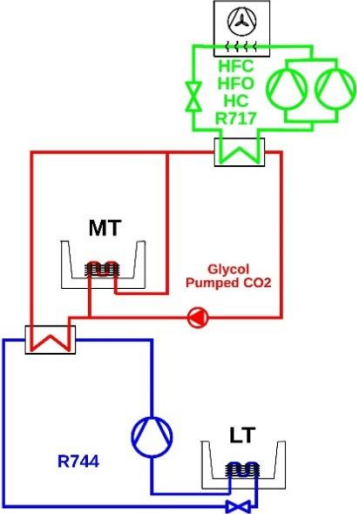
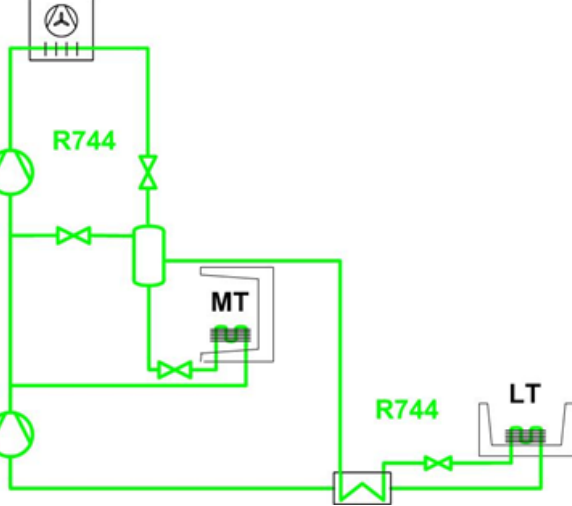
A number of technological alternatives for **centralised systems** are presented below in a schematic fashion to show possible systems designs allowed beyond 2022. Generally, any system that avoids using fluorinated greenhouse gases with a global warming potential (GWP) >150 would be allowed. End-users could also use **distributed systems**, such as e.g. systems using stand-alone units.

Table II.1 Exemplary designs for centralised systems compliant with the 2022 requirement⁶

Example System No.	Example system schematic	System description	Requirement for refrigerants to fulfill 2022 requirement
A		Multipack direct expansion (DX) system	< 150 GWP
B		Cascade CO ₂	< 150 GWP

⁶ GWP = global warming potential, HFO = hydrofluoroolefin or unsaturated HFC, R744 = CO₂, R717 = ammonia, HC = hydrocarbon, MT = medium temperature, LT = low temperature.

Example System No.	Example system schematic	System description	Requirement for refrigerants to fulfill 2022 requirement
C		Secondary medium temperature (MT) refrigeration circuit and low temperature (LT) CO ₂ cascade	< 150 GWP
D		Secondary MT/LT refrigeration circuit	< 150 GWP
E		Combined secondary MT refrigeration circuit and LT CO ₂ cascade	< 1,500 GWP in primary circuit and < 150 GWP in other direct or indirect circuits

Example System No.	Example system schematic	System description	Requirement for refrigerants to fulfill 2022 requirement
F	 <p>The diagram shows a combined refrigeration system. At the top, a green circuit represents a secondary medium temperature (MT) refrigeration circuit using HFC/HFO/HC R717. This circuit is connected to a red circuit representing a Glycol Pumped CO2 cascade. The red circuit includes a medium temperature (MT) evaporator and a low temperature (LT) evaporator. A blue circuit, labeled R744, represents the low temperature (LT) CO2 cascade, which is connected to the LT evaporator of the red circuit. The system includes various components like compressors, condensors, evaporators, and expansion valves, along with a pressure gauge and a pump.</p>	<p>Combined secondary MT refrigeration circuit (e.g. pumped CO₂) and LT CO₂ cascade</p>	<p>< 1,500 GWP in primary circuit and < 150 GWP in other direct or indirect circuits cascade</p>
G	 <p>The diagram illustrates a transcritical CO2 refrigeration system. It features a green circuit with a compressor at the top, followed by a condenser, an expansion valve, and an evaporator. The evaporator is connected to a medium temperature (MT) evaporator. The system also includes a low temperature (LT) evaporator, which is connected to the MT evaporator. The refrigerant R744 is used throughout the system. The diagram shows various components like compressors, condensors, evaporators, and expansion valves, along with a pressure gauge.</p>	<p>Transcritical CO₂</p>	