UNIT COOLERS

COMMERCIAL UNIT COOLERS

Under-counter unit coolers	**EVB**
Ceiling unit coolers	**XR - MF/MFE - MR/MRE - MH/MHE**
Unit cooler cassettes	**KRS/KRS-W**
Dual-discharge unit coolers	**TA**
Cubic unit coolers	**3C-A**

INDUSTRIAL UNIT COOLERS

Dual-discharge unit coolers	**GTI/GTA**
Cubic unit coolers	**NK**
Tunnel unit coolers	**NW - NF**
Centrifugal fan unit coolers	**NC**

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HK® REFRIGERATION

Unit coolers - Overview

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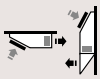
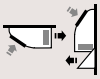
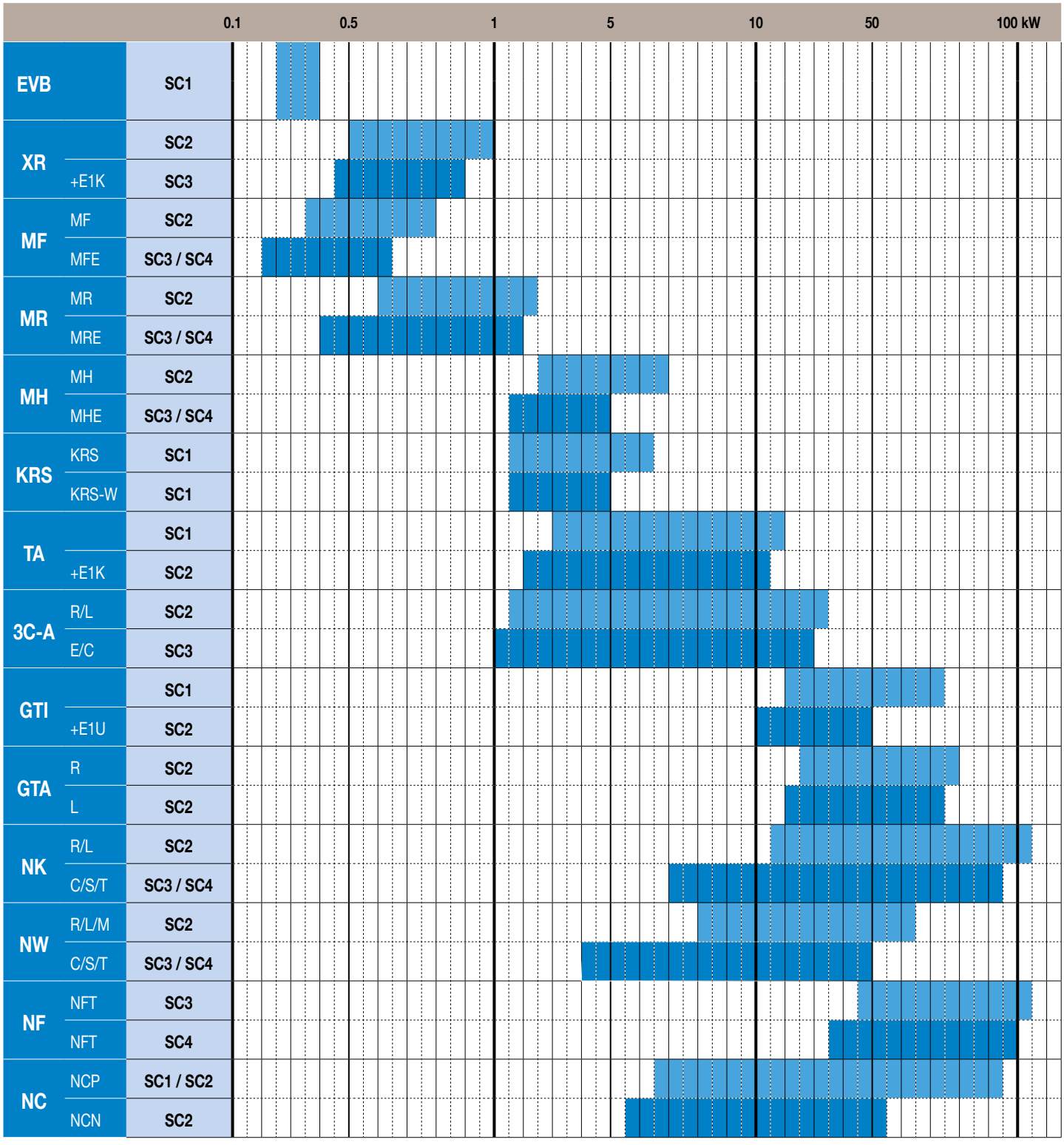
	CAPACITY	VENTILATION				COIL / CASING			EUROVENT	APPLICATIONS						MARKETS		
	Mini / Maxi R404A kW	Axial - Centrifugal Num.	EC motor	Factory wired	Position and blowing	Coil protection	Fin spacing mm	Casing - Pre-painted	EUROVENT certification	Refrigerated units / cells / small cold rooms	Cold rooms	Kitchens / work areas / laboratories	Warehouses / storage	Food processing	Rapid cooling / deep-freezing	Food Service	Supermarket	Process / Industry
EVB 	0,2 / 0,4	1 > 2	-	●		●*	2,10	●	X	●	-	-	-	-	-	●	-	-
XR 	0,4 / 1	1	-	●		●*	2,10	●	X	●	-	-	-	-	-	●	-	-
MF 	0,2 / 0,8	1 > 2	-	●		●*	4,23 6,35	ABS	X	●	●	-	-	-	-	●	-	-
MR 	0,4 / 2,6	1 > 4	-	●		●*	4,23 6,35	ABS	●	-	●	-	-	-	-	●	●	-
MH 	1,4 / 7	2 > 4	○	●		○	4,23 6,35	●	●	-	●	-	-	-	-	●	●	-
KRS 	1,5 / 9	1 > 2	-	●		●	2,81	ABS	X	-	-	●	-	-	-	●	●	●
TA 	2 / 22	1 > 4	-	●		○	3,63 6,35	ABS	●	-	●	●	-	-	-	●	●	-
3C-A 	1 / 35	1 > 4	○	●		○	4,00 6,00	●	●	-	●	-	●	●	-	●	●	●
GTI 	11 / 74	3 > 5	-	●		○	4,23 6,35	●	●	-	-	●	●	-	-	-	●	●
GTA 	20 / 82	2 > 4	-	○		○	4,23 6,35	●	●	-	-	●	●	-	-	-	●	●
NK 	7 / 130	1 > 4	-	○		○	4,23 6,35 9,00 12,00	●	●	-	-	-	●	●	●	-	-	●
NW 	4 / 63	1 > 4	-	○		-	6,35 9,00 12,00	●	●	-	-	-	-	●	●	-	-	●
NF 	35 / 130	2 > 6	-	○		-	9,00	●	●	-	-	-	-	●	●	-	-	●
NC 	5 / 95	1 > 4	-	○		○	4,23 6,35	●	X	-	-	●	●	-	-	-	●	●

* *Painted coil (chill applications)* ● *Standard* ○ *Option* X *Range not concerned by EUROVENT certification*

CONDITIONS STANDARD	t_{A1} - AIR INLET TEMP.	t_e - EVAPORATING TEMP.	DT1 STANDARD
SC1	+10 °C	0 °C	10
SC2	0 °C	-8 °C	8
SC3	-18 °C	-25 °C	7
SC4	-25 °C	-31 °C	6
SC5	-34 °C	-40 °C	6



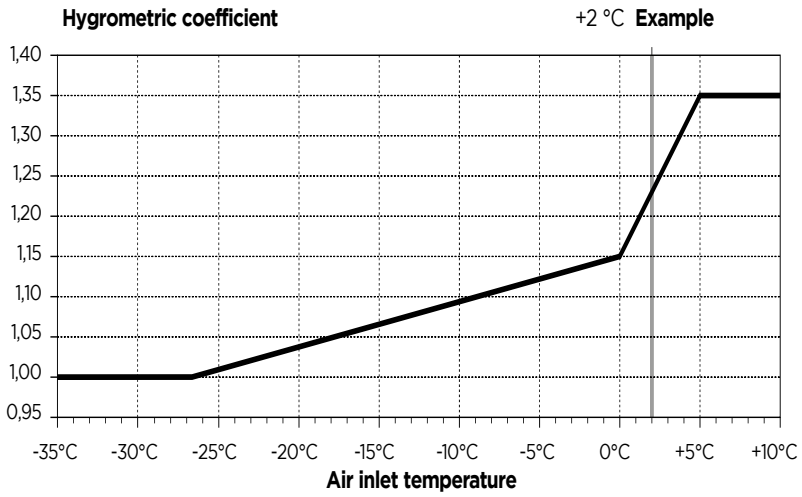
SELECTION COEFFICIENTS

Standard conditions

Standard conditions	t_{A1} Air inlet temp.	t_e Evaporating temp.	DT1 standard
SC 1	+10°C	0°C	10 K
SC 2	0°C	- 8°C	8 K
SC 3	-18°C	-25°C	7 K
SC 4	-25°C	-31°C	6 K
SC 5	-34°C	-40°C	6 K

Hygrometric coefficient

Standard conditions	Relative humidity	Nominal capacity / Standard capacity
SC 1	85%	1,35
SC 2	85%	1,15
SC 3	95%	1,05
SC 4	95%	1,01



Correction coefficient of DT1

For low glide fluids (less than 1K), or no glide, it is accepted that the capacity is directly proportional to the difference between the inlet air temperature and the evaporation temperature (DT1) i.e.:

$$\text{Required capacity} = \frac{\text{Nominal capacity x DT1 required}}{\text{DT1 standard}}$$

Refrigerant coefficient

Refrigerant	R404A	R134a	R507A	R407A	R407C	R407F
SC 1	1	0,93	0,97	1,19	1,21	1,19
SC 2	1	0,91	0,97	1,24	1,26	1,24
SC 3	1	0,85	0,97	1,28	1,31	1,29
SC 4	1	-	0,97	1,32	1,36	1,35

Fin material coefficient

Aluminium fin	Protected aluminium fin
1	0,97

Example

Whereby:

Capacity required	**Q = 6000 W**
Air inlet temperature	**t_{A1} = +2 °C**
Evaporation temperature	**t_e = -8 °C**
Refrigerant	**R 22**
Coil with protected fins	

In which case:
DT1 = tA1 - te = (+2)-(-8) = 10K

To select under standard conditions, the following correction coefficients must be applied:

- Relative humidity coefficient	**1,15/1,23 = 0,935**
- Correction coefficient for DT1	**8/10 = 0,8**
- Refrigerant coefficient	**1/0,95 = 1,05**
- Fin material coefficient	**1/0,97 = 1,03**

Expressed for given standard conditions, the required capacity of 6000 W becomes:

6000 x 0,935 x 0,8 x 1,05 x 1,03 = 4854 W

One therefore selects an **3C-A 3245 L**

On-board equipment

Our units are static. Included in a refrigeration system, they may be exited by motors, compressors, diesel engines, vehicles or others and suffer from vibration.
The person responsible for the system must ensure that the excitation frequency may not, under any circumstances, provoke the resonance of other components as this could result in irreparable damage (in particular in the case of on-board systems).

LENNOX
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F-Gas regulation

"PHASE DOWN"
Reduction of HFC
(79% by 2030)

NEW INSTALLATION
Ban on GWP ≥ 2500 in 2020
(depending on application)

F-Gas
EU No. 517/2014

PROCEDURES
Training & certification
Records – Labelling

INSTALLATION & MAINTENANCE
Containment measures: inspection for tightness and leaks

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The context

The chlorofluorocarbon (CF) and hydrofluorocarbon (HCFC) refrigerant fluids used in cooling systems today are considered to be powerful greenhouse gases.

To prevent climactic changes and global warming, the European Commission has adopted a roadmap for reducing global emissions by 2050.

This directive, which relates to **EU regulation No. 517/2014,** is called**F-Gas**:

- Defines rules regarding containment, use, recovery and destruction of fluorinated greenhouse gases and related measures.
- Defines the conditions for introduce on the market certain products and equipment containing HFCs.
- Imposes conditions on certain specific uses of fluorinated greenhouse gases.
- Sets quantitative limits (quotas) for sell on the market HFCs.

This decree is for all companies that install, maintain and sell equipment containing refrigerant fluids, as well as those that handle and distribute them.

Prevention & restrictions

Prevention of fluorinated greenhouse gas emissions.

All equipment must be designed to prevent accidental discharge of greenhouse gas.
Technical measures are taken upstream to reduce leaks to a minimum.
The equipment must have a leak protection system that alerts the owner or a maintenance provider company in the event of leaks (see (EU) regulation No. 517/2014 specifying the leak monitoring methods).
The F-Gas recommendation on fluorinated fluids imposes:

- Frequent inspections
- Qualification of companies and participants.

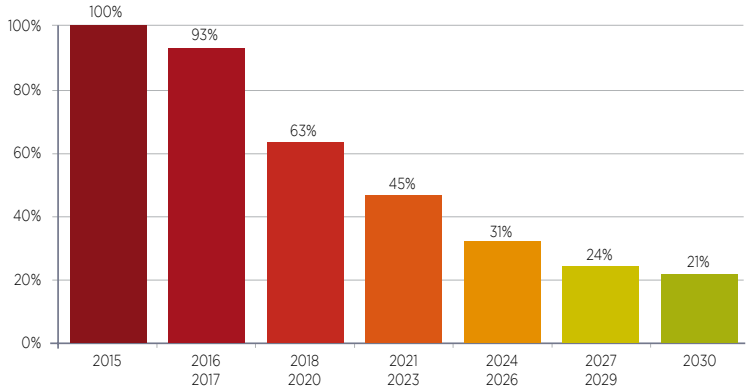
"Phase Down" quotas

The program calls for gradual reduction of the fluids available on the market from 2015 to 2030.

HFC quantities are reduced to 21% in 2030.

This restriction will require measures, such as regular leak inspection, along with certification and training of operators.

Calendar for introduction on the market (expressed as TEQ CO_2)

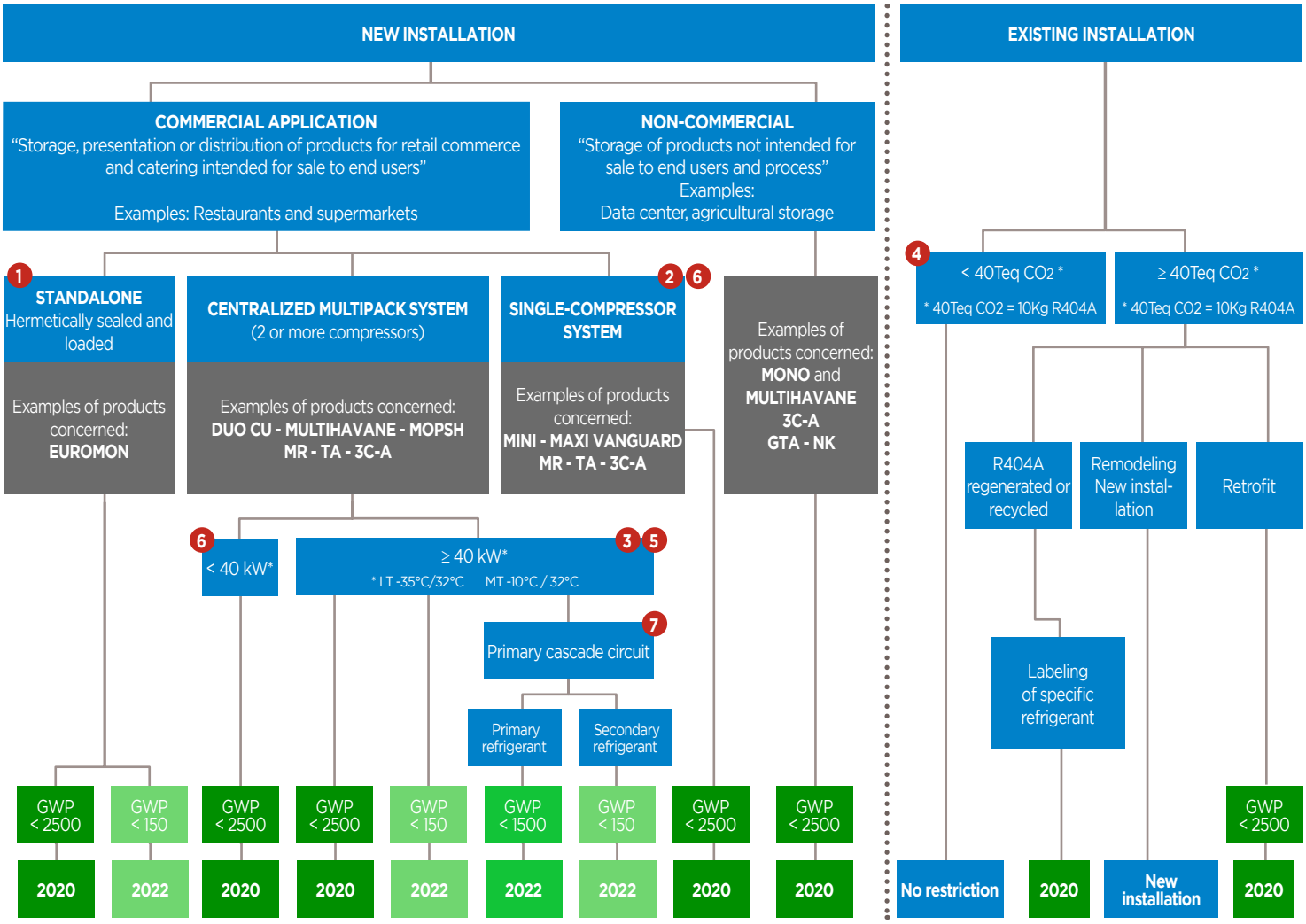


Usage restrictions for new equipment

New equipment is subject to application restrictions and HFC fluids to availability quotas.
All HFC fluids put on the market are classified according to Global Warming Potential (GWP).
The refrigeration and air conditioning products we are selling are affected by the following dates:

Fluids	R507A	R404A	R452A	R407A	R410A	R407F	R407C	R134a	R449A	R448A	R32	R513A	R450A	R454C	R455A	R152a	1234ze	1234yf	R290 (Propane)	R744 (CO_2)	R717 (NH_3)
GWP	2,500							1,500						150							
	3985	3922	2141	2107	2088	1825	1774	1430	1397	1273	675	631	600	148	145	124	6	4	3	1	0
Usage authorization	before **2020**		before/after **2020**					before/after **2022** (date for reexamining the F-Gas regulation)						before/after **2022** (date for reexamining the F-Gas regulation)							
Glide (K) to 40°C (Eurovent conditions)	0	0.3	3	4.5	0.1	4.5	5.1	0	4.5	4.8	0	0	0.6	6	11.4	0	0	0	0	0	0
Habitually used in positive refrigeration		X	X	X		X		X	X	X		X	X	X	X	X	X	X	X	X	X
Usually used in negative refrigeration		X	X	X		X			X	X				X	X			X	X	X	X

F-Gas regulation - EU No. 517/2014



1 2 3 cf. text : **Annex nr 1 of F-gas regulation (EU) N°517/2014**

1 Refrigerators and freezers for commercial use (hermetically sealed equipment)

2 Stationary refrigeration equipment, that contains, or whose functioning relies upon, HFCs with GWP of 2 500 or more except equipment intended for application designed to cool products to temperatures below – 50 °C

3 Multipack centralised refrigeration systems for commercial use with a rated capacity of 40 kW or more that contain, or whose functioning relies upon, fluorinated greenhouse gases with GWP of 150 or more, except in the primary refrigerant circuit of cascade systems where fluorinated greenhouse gases with a GWP of less than 1 500 may be used

4 cf. text : **F-gas regulation (EU) N°517/2014 Article 13 §3**

5 6 7 cf. text : **C (2017) 5230 Final 4.08.2017 + Annexes 1 & 2**

5 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 40 kW threshold is exceeded. For multifunctional equipment only the refrigeration capacities apply and not the capacities for air conditioning or heating.

6 Centralised systems refer to systems where the refrigeration capacity for the whole store is produced centrally in one location, often in a separate machine room. The majority of refrigeration systems that are currently installed in larger supermarkets and hypermarkets are so-called "multipack centralised refrigeration systems.

Other, more decentralised, ways of providing refrigeration are also commonly used today, particularly in smaller supermarkets and convenience stores. These include the use of several distributed condensing units and/or stand-alone units, both of which will not be affected by the 2022 requirement.

Condensing units may be affected if they fall under the definition of a multipack centralised systems pursuant to Article 2(37) of Regulation (EU) No 517/2014, e.g. in case they have 2 or more compressor operated in parallel; and provide more than 40kW of cooling capacity.

7 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.

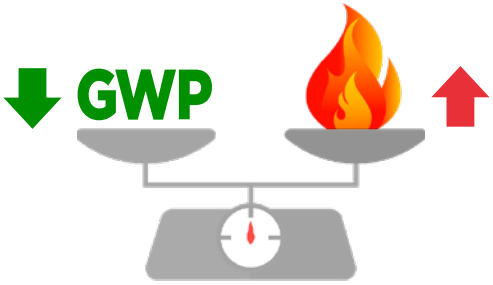
It is important to point out that the 2022 requirement does not allow a simple cascade with e.g. HFC R134a (global warming potential of 1430 times higher than that of CO2) in the primary circuit that also serves the whole medium-temperature cooling requirements while absorbing the heat from a CO2 circuit for the low temperature. The requirement demands instead that the medium-temperature itself is split into two circuits, where only the primary circuit would be allowed to use HFCs < 1500, such as R134a..

Safety group: Flammability/toxicity of fluids versus GWP

The F-Gas regulation reveals the reduction of strong GWP fluids, which orients us toward flammable or high-pressure fluids (CO_2).

In the future, it will be necessary to prepare for handling flammable or toxic fluids with low GWP.

A distinction is made between four fluid flammability groups and two toxicity groups:



	Nonflammable	Midly flammable	Flammable	Highly flammable
Low toxicity	A1	A2L*	A2	A3
High toxicity	B1	B2L	B2	B3

Refrigerants	R507A	R404A	R452A	R407A	R410A	R407F	R407C	R134a	R449A	R448A	R32	R513A	R450A	R454C	R455A	R152a	1234ze	1234yf	R290 (Propane)	R744 (CO_2)	R717 (NH_3)
GWP	3985	3922	2141	2107	2088	1825	1774	1430	1397	1273	675	631	600	148	145	124	6	4	3	1	0
Safety group	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A2L*	A1	A1	A2L*	A2L	A2	A2L*	A2L*	A3	A1	B2

** The profession's trade unions are working with the various ministries concerned, to update the the standard (EN 378-2016) with A2L Refrigerants and local governments to take into account regulation for establishments open to the public.*

Our commitment

We are committed to anticipating technological changes that will be necessary to bring our products into compliance with F-Gas:

R744 (CO_2), a natural alternative to HFC!

- Natural R744 fluid with a **minimal impact** on global warming (**GWP = 1**),
- Natural R744 fluid is **nonflammable**,
- Natural R744 fluid is **nontoxic** (but poses a risk of anoxia).

Despite the high technical level this natural refrigerant requires, its advantages are causing it to be used more and more.

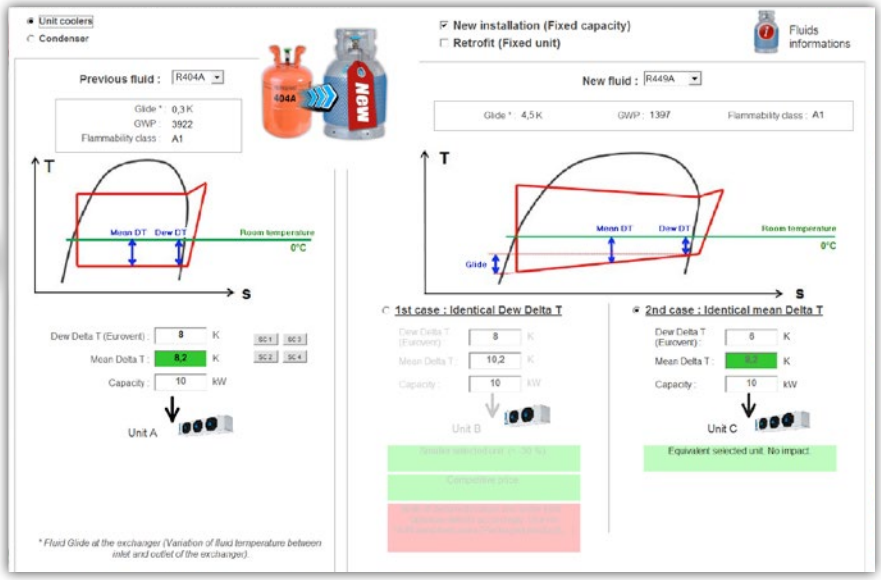
Our unit coolers

Installation type	Product name	Strengths **R404A**	Strengths **R744 (CO_2)**	Availability of refrigerant today
Ceiling installation	**MR**	**0.6 > 2.6 kW**	**0.6 > 2.6 kW**	HFC & HFO mixtures*
	MH	**1.5 > 7.7 kW**	**0.2 > 7.3 kW**	HFC & HFO mixtures*
Dual discharge	**TA**	**2 > 22 kW**	**2.1 > 13.3 kW**	HFC & HFO mixtures*
	GTI/GTA	**12.5 > 125 kW**	**20 > 98.4 kW**	HFC & HFO mixtures*
Cubic	**3C-A**	**1 > 35 kW**	**1.3 > 30.5 kW**	HFC & HFO mixtures*
	NK	**7 > 130 kW**	**8.6 > 155.2 kW**	HFC & HFO mixtures*

** R507A - R407A - R410A - R407F - R407C - R449A - R448A - R450A - R717 - R744 - R134a - Commonly available in 2017: R452A - R513A - R450A*

Refrigerant tool

Understanding the impact of the glide on the unit coolers selections.



LENNOX
EMEA

UNIT COOLERS
CONDENSERS AND DRY COOLERS
COMMERCIAL AND INDUSTRIAL RANGES

ANTI-CORROSION TREATMENTS

- **Epoxy treatment** on the whole coil
- **Blygold treatment** on the whole coil
- **Heresite treatment** on the whole coil
- **Lacquered aluminium protection**, only on the fins

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Recommendations for our exchangers

FRIGA-BOHN HK REFRIGERATION

	COILS					CASING			
	Standard	Optional coil treatments				Standard	Casing option		
		BAE 1*	BAE 2*	BXT *	BHE*		PEI*	CIN*	RAL*
COMMERCIAL UNIT COOLERS									
EVB	BAE 1	●				White pre-lacquered galvanised steel			
XR	BAE 1	●				White pre-lacquered galvanised steel & ABS (drain pan)			
MF MFE	BAE 1 Not treated	●				ABS*			
MR MRE	BAE 1 Not treated	●				ABS*			
MH	Not treated	○				White pre-lacquered galvanised steel			
KRS	BAE 2		●			Magnesium zinc			
TA	Not treated	○		○		ABS*			
3C-A	Not treated	○	On specific request	○	○	White pre-lacquered galvanised steel	○	○	
INDUSTRIAL UNIT COOLERS									
GTA	Not treated		○	○	○	White pre-lacquered galvanised steel		○	○
GTI	Not treated		○	○		White pre-lacquered galvanised steel			○
NK	Not treated		○	○	○	White pre-lacquered galvanised steel		○	○
NW	Not treated					White pre-lacquered galvanised steel			
NF	Not treated					White pre-lacquered galvanised steel			
NC	Not treated		○			White pre-lacquered galvanised steel			
CONDENSERS									
MA	BAE 1	●				White pre-lacquered galvanised steel			
WA	Not treated			○		White pre-lacquered galvanised steel			
NEOSTAR	Not treated		○	○		White pre-lacquered galvanised steel			○
MXW	Not treated			○		White pre-lacquered galvanised steel			
CCT	Not treated	○		○		Magnesium zinc	○		
CCV	Not treated	○		○		Magnesium zinc	○		
DRY COOLERS									
FC NEOSTAR	Not treated		○	○		White pre-lacquered galvanised steel			○
AEV	Non traité			○		White pre-lacquered galvanised steel			

● Standard
○ Optional

* **BAE 1** Epoxy treatment (on the whole coil)
* **BAE 2** Lacquered aluminium foil (only on fins)
* **BXT** Blygold treatment (on the whole coil)
* **BHE** Heresite treatment (on the whole coil)

* **PEI** White paint
* **CIN** 316L stainless steel body
* **RAL** Polyester paint in special colour (choice of colour)
* **ABS** Acrylonitrile butadiene styrene

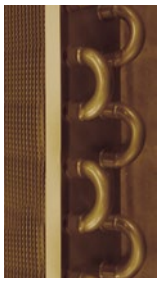
Recommendations in aggressive environments

FRIGA-BOHN HK REFRIGERATION

Recommended for this application
Can be used for this application
Not recommended for this application

Applications	Aggressive substances/particles	Type of anti-corrosion protection on our coils (copper tubes, aluminium fins)		
		BAE	BXT	BHE
Pastries				
Confectionery manufacturers	Bakery additives: - colourants E 100 to E 199 - preservatives E 200 to E 299 - antioxidants E 300 to E 399 - emulsifiers, thickeners E 400 to E 499 - baking powder (lactic acid)	😐	🙂	🙂
Cold rooms (bakery)				
Ready-to-eat marinades/salads				
Display cases	Acidifying air: Salts, acids, vinegar, preservative	😐	🙂	🙂
Fruits/vegetables				
Tropical fruits	Fruits with high acid content	😐	🙂	🙂
Bananas	Corrosive vapours			
Citrus fruits/lemons	Fruits with high acid content			
Vegetables				
Cheeses				
Storage (cellar)	Low NH3 emission and low relative humidity	😐	😐	🙂
Ripening room (for maturing soft cheeses)	High NH3 emission and high air humidity		☹	
Prepared products				
Frozen products storage		😐	🙂	🙂
Rapid cooling process			😐	
Dairies				
Milk	Acid vapours from milk and acidity of butter	😐	🙂	🙂
Meat/sausages				
Frozen products storage (packaged/unpackaged goods)		😐	😐	🙂
Refrigerated storage area for raw/fresh meat				
Rapid cooling of carcasses	Organic, amino acids			
Smoked meat/sausages	Organic, amino acids			
Salt store	Organic acids, salts			
Cold room for salted products	Organic acids, salts			
Salting rooms	Organic acids, salts			
Drying				
Waste	Organic acids			
Fish/seafood				
Fresh fish		😐	😐	🙂
Salting preparation rooms	Amines, salts			
Smoked fish drying				
Storage rooms				
Beverages				
Fermentation cellar	High sulphur, chlorine, C02	😐	😐	🙂
Wine cellar cooling			🙂	
Fruit juice bottling lines	Citric or sulphuric acid			
Mineral water bottling line	Aerosols		😐	
Malthouses (production of malt from cereals)	Organic acids, aggressive dusts, high protein levels			
Coffee shop				
Bars		😐	🙂	🙂
Roasting (cooking the coffee beans to bring out all the flavours).	Organic acids		😐	
Restaurant				
Kitchens	Spices, salts	😐	😐	🙂
Sea air (no direct contact with seawater)				
Evaporator not in close proximity to the sea	Air with low salt content	😐	🙂	🙂
Evaporator in close proximity to the sea	Air with high salt content			
Industrial equipment				
Crane cab in steelworks/foundries	Aggressive gas (chlorine), sulphur dioxide, metal dusts	😐	🙂	🙂
Regular cleaning and disinfection				
Type of cleaning	e.g.: foam, liquid, manual	☹	🙂	😐
Components and concentration to know	Chlorine, acids, alkali			
Wood dryers				
Hardwood (oak, tropical woods)	High evaporation	😐	😐	🙂
Softwoods (fir, pine)	Low evaporation		🙂	
Intensive farming stables/farms				
Abattoirs	Organic acids	😐	😐	🙂
Abattoir waste			🙂	
Leather and hides			😐	

Description of the different protection options

	Different types of anti-corrosion treatments			
	BAE 1 Epoxy paint treatment	**BAE 2** Lacquered aluminium protection	**BXT** Blygold treatment	**BHE** Heresite treatment
Definition	**Epoxy** treatment *on the fins + end plates*	**Lacquered aluminium** foil, *only on the fins*	**Blygold** treatment *on the whole coil*	**Heresite** treatment *on the whole coil* *and on all the elements fitted before treatment*
Description	Very good flexibility, allows the coils to withstand thermal shocks without damage. Treatment thickness: 60-80µm.	Very good finish, high thermal conductivity, good drawing and low density.	Treatment thickness: 25-30µm. Composed of polyurethane, which allows the coil to have good thermal conductivity. No anti-bacterial treatment.	Low flexibility. High sensitivity to shocks. Treatment thickness: 75µm.
Method of application	**STAGES:** 1. Cleaning and degreasing the coil 2. **Spraying powder paint by hand using a spray gun and by robot** 3. Oven drying at 190°C 4. Visual inspection	Ready to use rolls of **lacquered aluminium**	**STAGES:** 1. Cleaning and degreasing the coil 2. **An operator sprays 4 criss-cross layers of polyurethane by hand** 3. Drying at 20°C in the open air if the coil is > 80cm or in the oven at 80°C if the coil is between 50 and 80 cm 4. Visual and endoscopic inspection	**STAGES:** 1. Cleaning and degreasing 2. **Several layers of resin applied by soaking** 3. Oven drying at approx. 120-142°C 4. Finished using a spray gun and dried in the oven at 180°C. 5. Visual inspection
Resistance to neutral salt spray *(tests carried out in accordance with the ASTM B117 and NF EN ISO 92/27 standards)*	**1500 hours**	**1000 hours**	**2500 hours**	**3500 hours**
Estimation of corrosivity category of environments. *(ISO 12944, see below)*	**C4**	**C3**	**C5 - I** **C5 - M**	**C5 - I** **C5 - M**
Durability class *(limit, medium, high)*	High	High	High	High
Colour	White	Gold	Champagne	Brown
Operating temperature range	Higher than +180°C	Higher than +180°C to -16°C	+180°C to - 80°C.	+180°C to -75°C
Photos				

ISO 12944 standard - Classification of environments

The **ISO 12944 standard** is a guide for choosing paint for steel structures that will ensure a certain level of durability in a given atmospheric environment.
The atmospheres are classified into 6 categories from C1 to C5-M.
In-situ or artificial laboratory tests make it possible to choose the most suitable coating.
This standard does not therefore apply directly to our products. However, we have used the classification of the different atmospheric environments and our neutral salt spray test results in order to provide you with an estimated classification for them.
The notion of durability does not constitute a warranty period.
It is an indication established according to the results obtained in salt spray tests.
A maintenance plan must be established to keep the heat exchangers in their original condition.
Not leaving deposits on their surfaces will in many cases avoid corrosive attack.