

Working on Air Conditioning Systems / Building Services

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Risk Assessments in Building Services



		Potential Severity Rating			
		Minor	Moderate	Significant	Catastrophic
Probability of severity occurs	Very Likely	Moderate	High	Extreme	Extreme
	Likely	Low	Moderate	High	Extreme
	Unlikely	Very Low	Low	Moderate	High
	Rare	Very Low	Very Low	Low	Moderate

BS EN378 – the Safety Standard

BS EN 378-4:2016



Refrigerating systems and heat pumps — Safety and environmental requirements

Part 4: Operation, maintenance, repair and
recovery

EN378 covers the safety implications
needing to be considered for anything
relating to the refrigerants, the
systems, and the locations where the
systems are found

BS EN378 – the Safety Standard

BS EN 378-3:2016



Refrigerating systems and heat pumps — Safety and environmental requirements

Part 3: Installation site and personal
protection

EN378 covers the safety implications
needing to be considered for anything
relating to the refrigerants, the
systems, and the locations where the
systems are found

BS EN378 – the Safety Standard

BS EN 378-2:2016



Refrigerating systems and heat pumps — Safety and environmental requirements

Part 2: Design, construction, testing,
marking and documentation

EN378 covers the safety implications
needing to be considered for anything
relating to the refrigerants, the
systems, and the locations where the
systems are found

BS EN378 – the Safety Standard

BS EN 378-1:2016



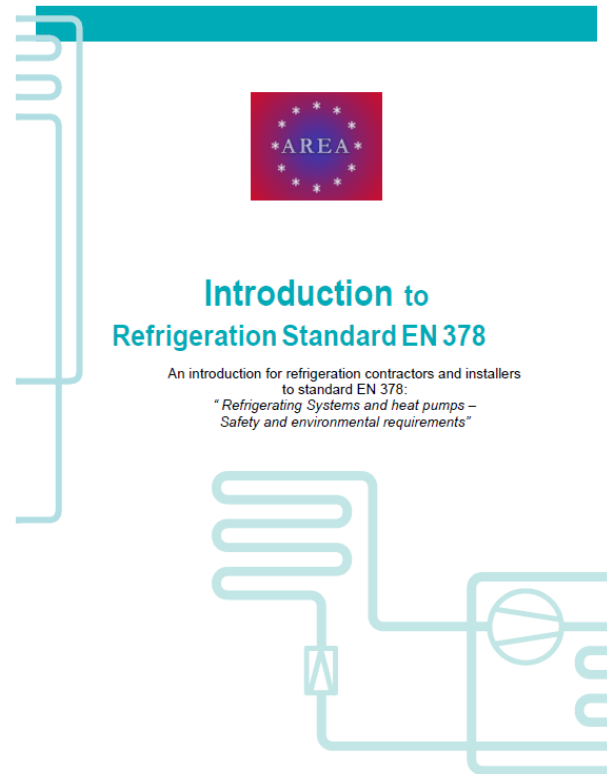
BSI Standards Publication

Refrigerating systems and heat pumps — Safety and environmental requirements

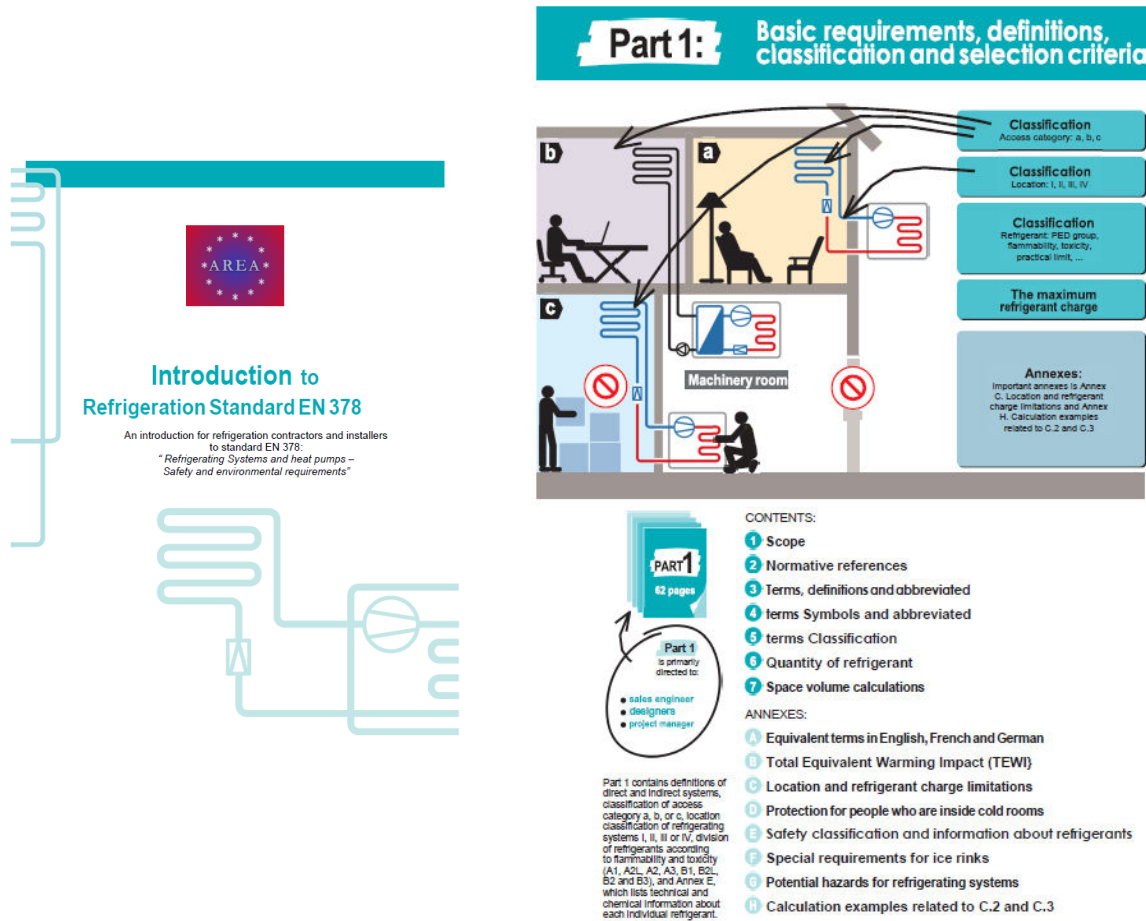
Part 1: Basic requirements, definitions,
classification and selection criteria

EN378 covers the safety implications
needing to be considered for anything
relating to the refrigerants, the
systems, and the locations where the
systems are found

BS EN378 – the Safety Standard



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BS EN378 – the Safety Standard

Introduction to Refrigeration Safety

Part 1: Basic requirements, classification and safety

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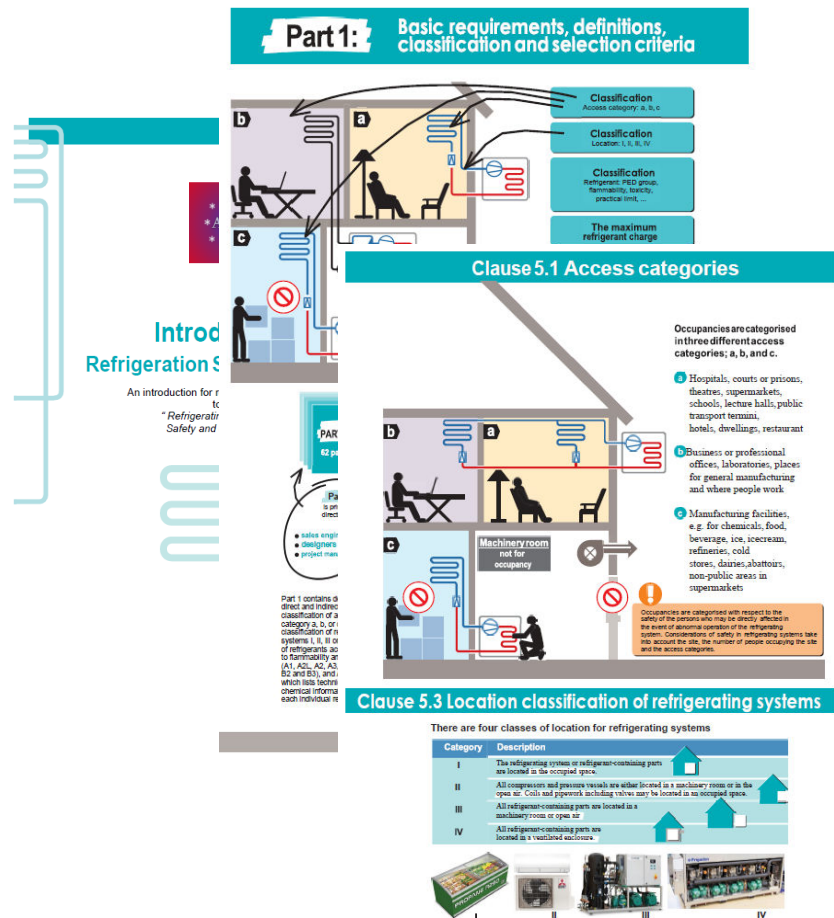
- 1 Scope
- 2 Normative references
- 3 Terms, definitions and abbreviated terms
- 4 Symbols and abbreviated terms
- 5 Classification
- 6 Quantity of refrigerant
- 7 Space volume calculations

ANNEXES:

- 1 Equivalent terms in English, French and German
- 2 Total Equivalent Warming Impact (TEWI)
- 3 Location and refrigerant charge
- 4 Protection for people who are inside
- 5 Safety classification and information
- 6 Special requirements for ice rinks
- 7 Potential hazards for refrigerating systems
- 8 Calculation examples related to safety

Part 1 contains definitions of direct and indirect systems, classification of access category a, b, or c, location classification of refrigerating systems I, II, III or IV, division of refrigerants according to flammability and toxicity (A1, A2, A3, B1, B2, B3, B4, B5, B6, B7, B8, B9, B10, B11, B12, B13, B14, B15, B16, B17, B18, B19, B20, B21, B22, B23, B24, B25, B26, B27, B28, B29, B30, B31, B32, B33, B34, B35, B36, B37, B38, B39, B40, B41, B42, B43, B44, B45, B46, B47, B48, B49, B50, B51, B52, B53, B54, B55, B56, B57, B58, B59, B60, B61, B62, B63, B64, B65, B66, B67, B68, B69, B70, B71, B72, B73, B74, B75, B76, B77, B78, B79, B80, B81, B82, B83, B84, B85, B86, B87, B88, B89, B90, B91, B92, B93, B94, B95, B96, B97, B98, B99, B100, B101, B102, B103, B104, B105, B106, B107, B108, B109, B110, B111, B112, B113, B114, B115, B116, B117, B118, B119, B120, B121, B122, B123, B124, B125, B126, B127, B128, B129, B130, B131, B132, B133, B134, B135, B136, B137, B138, B139, B140, B141, B142, B143, 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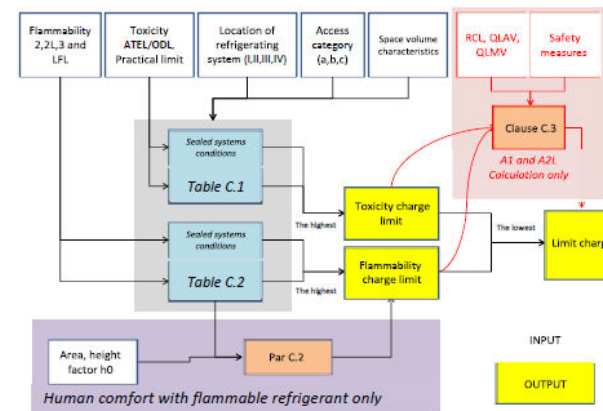
BS EN378 – the Safety Standard



EN378, Part 1, Annex C - Refrigerant charge limit requirements

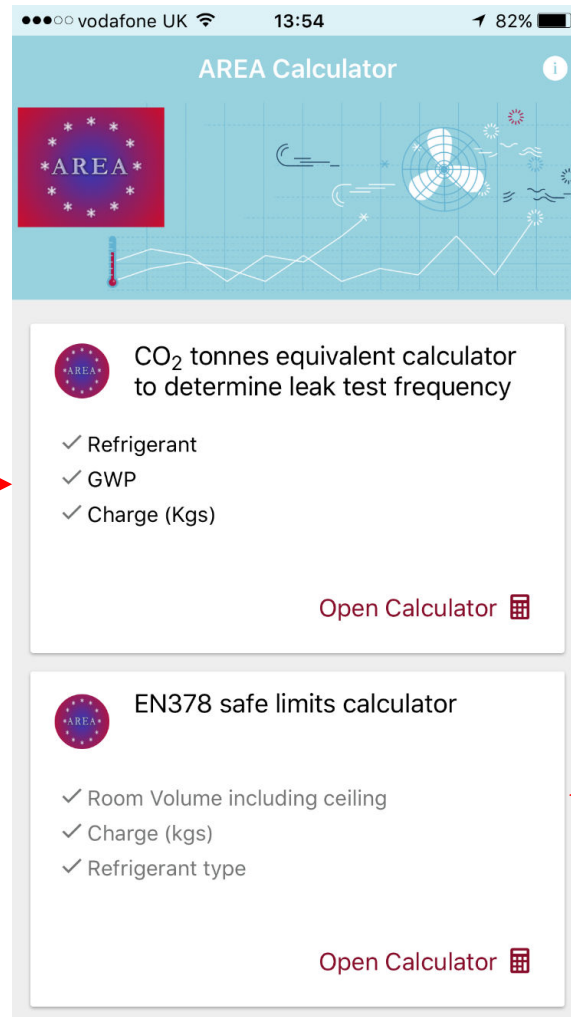
- The most important parameters for determining the maximum refrigerant charge are the flammability of the refrigerant and/or toxicity, location classification of refrigerating systems and access category.
- For A1 and A2L refrigerants, there is also a possibility to increase the maximum refrigerant charge if additional safety measures are implemented. See Clause C.3.

Maximum limit refrigerant charge calculation:



See page 13, Information about refrigerants, and page 14, examples of Table C.1 and Table C.2.

AREA F-Gas App – EN378 compliance checker



F-Gas CO₂eq calculator

“AREA F-Gas”
App available free
on iOS or Android
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EN378 compliance checker


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●●● Vodafone UK 13:54 82%

< Back EN378 safe limits calc... i

 Room Details

Length (m)

15

Width (m)

8

Ceiling Height (m)

3

Where a false ceiling is not vapour sealed this value shall include the area above the false ceiling.





Room Location

Ground Floor: Should be applied in all other where Upper and Below Ground locations do not apply ▼

Unit / Pipe Location

Ceiling ▼

Any cassette, ducted or under ceiling slung fan coil should be input as Ceiling. Other inputs dependent on installation requirements.

 Room  Occupancy  Refrigerant  Results


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Store

vodafone UK 13:54 82%

< Back EN378 safe limits calc... i

 Occupancy Details

Occupancy Category

a: General access: public areas where occupants have no knowledge of safety precautions required

Location Classification

Class II: Compressors or pressure vessels in machinery room or open air; pipework and valves may be in the room

Use of Room

Human Comfort

Most building services applications will be input as "Human Comfort" if the room is where the fan coil is situated, unless the room is sparsely or rarely occupied.

Density of Occupation

1 person or more per 10 (m3)

Is the room occupied by <1 person per 10 square metres?

Room Occupancy Refrigerant Results

AREA F-Gas App – EN378 compliance checker



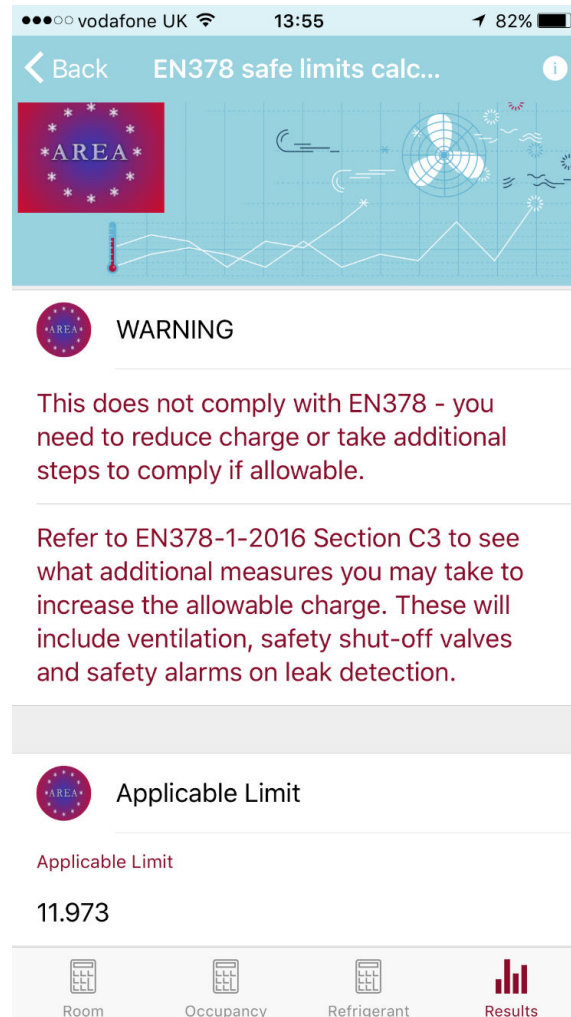
“AREA F-Gas”
App available free
on iOS or Android
from Apple iStore or
the Google Play
Store

The screenshot shows the 'EN378 safe limits calc...' screen of the AREA F-Gas App. At the top, there's a status bar with 'vodafone UK', '13:54', and '82%' battery. Below the status bar is a navigation bar with a 'Back' button and an information icon. The main content area features a blue background with a white line graph and a fan icon. A red box with the 'AREA' logo is on the left. Below the graph, there's a section titled 'Refrigerant Details' with a red circular icon. Under this, there's a 'Refrigerant Name' dropdown menu set to '32'. Below the dropdown, there's a text box with the instruction: 'Select gas from the list. Any omissions should be reported to AREA as soon as possible if the APP is not needing updated.' Below this, there's a 'Total Charge Weight (kg)' field set to '60'. At the bottom, there's a navigation bar with four icons: 'Room', 'Occupancy', 'Refrigerant' (highlighted in red), and 'Results'.

AREA F-Gas App – EN378 compliance checker



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the Google Play
Store



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Store

●●○○ Vodafone UK 13:55 82%


< Back EN378 safe limits calc... ⓘ

Toxicity Charge Limit

108.000

Flammability Charge Limit

11.973

 Refrigerant

Refrigerant

32

Toxicity

A

Flammability

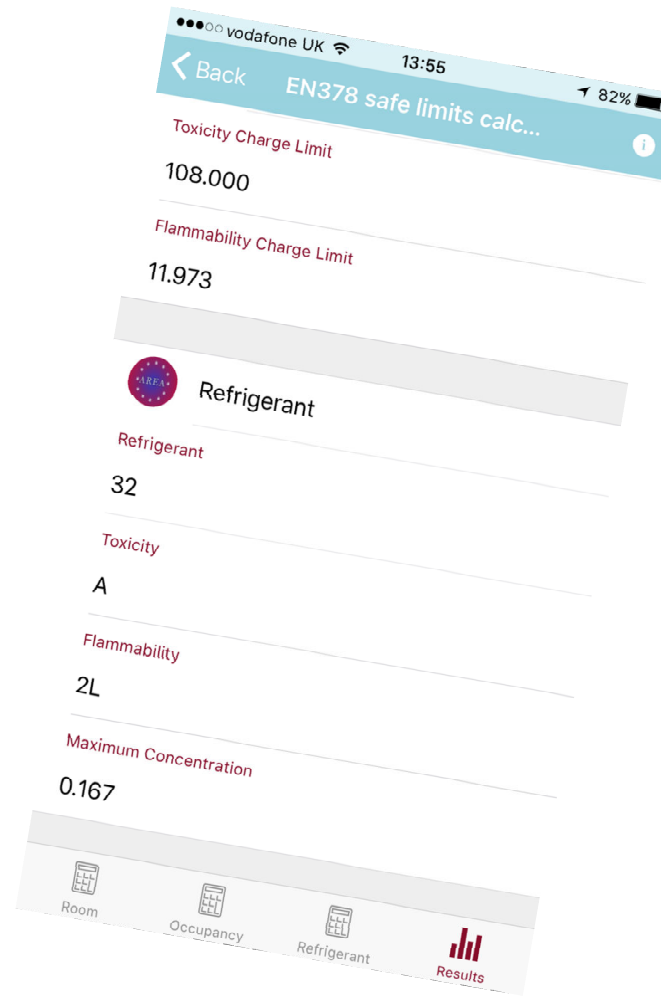
2L

Maximum Concentration

0.167

Room Occupancy Refrigerant Results

AREA Guidance: www.area-eur.be/publications



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**One table based on toxicity,
 one table based on flammability**

Refrigerant charge limits shall be calculated according to Table C.1 and Table C.2 depending on the toxicity and/or the flammability of the refrigerant.

Where more restrictive national or regional regulations exist, they take precedence over the charge limit requirements of EN 378.

Toxicity class	Access category	Leakage classification			IV
		I	II	III	
A	a	Upper flammable limit (UFL) + Room volume or not C.3	20% + UFL + Room volume or not C.3	20% + UFL + Room volume or not C.3	No charge restriction *
	b	Upper flammable limit (UFL) + Room volume or not C.3	20% + UFL + Room volume or not C.3	20% + UFL + Room volume or not C.3	
	c	Upper flammable limit (UFL) + Room volume or not C.3	20% + UFL + Room volume or not C.3	20% + UFL + Room volume or not C.3	
	d	Upper flammable limit (UFL) + Room volume or not C.3	20% + UFL + Room volume or not C.3	20% + UFL + Room volume or not C.3	
B	a	Upper flammable limit (UFL) + Room volume or not C.3	20% + UFL + Room volume or not C.3	20% + UFL + Room volume or not C.3	No charge restriction *
	b	Upper flammable limit (UFL) + Room volume or not C.3	20% + UFL + Room volume or not C.3	20% + UFL + Room volume or not C.3	
	c	Upper flammable limit (UFL) + Room volume or not C.3	20% + UFL + Room volume or not C.3	20% + UFL + Room volume or not C.3	
	d	Upper flammable limit (UFL) + Room volume or not C.3	20% + UFL + Room volume or not C.3	20% + UFL + Room volume or not C.3	

Example of charge limit requirements for refrigerating systems based on toxicity (From Table C.1)

Flammability class	Access category	Leakage classification			IV
		I	II	III	
1	a	According to C.2 and not more than the greater of 1 or 1.5 kg	20% + UFL + Room volume and not more than 1 kg	20% + UFL + Room volume and not more than 1 kg	Refrigerant charge not more than this
	b	According to C.2 and not more than the greater of 1 or 1.5 kg	20% + UFL + Room volume and not more than 1 kg	20% + UFL + Room volume and not more than 1 kg	
	c	According to C.2 and not more than the greater of 1 or 1.5 kg	20% + UFL + Room volume and not more than 1 kg	20% + UFL + Room volume and not more than 1 kg	
	d	According to C.2 and not more than the greater of 1 or 1.5 kg	20% + UFL + Room volume and not more than 1 kg	20% + UFL + Room volume and not more than 1 kg	
2	a	According to C.2 and not more than the greater of 1 or 1.5 kg	20% + UFL + Room volume and not more than 1 kg	20% + UFL + Room volume and not more than 1 kg	Refrigerant charge not more than this
	b	According to C.2 and not more than the greater of 1 or 1.5 kg	20% + UFL + Room volume and not more than 1 kg	20% + UFL + Room volume and not more than 1 kg	
	c	According to C.2 and not more than the greater of 1 or 1.5 kg	20% + UFL + Room volume and not more than 1 kg	20% + UFL + Room volume and not more than 1 kg	
	d	According to C.2 and not more than the greater of 1 or 1.5 kg	20% + UFL + Room volume and not more than 1 kg	20% + UFL + Room volume and not more than 1 kg	

Example of charge limit requirements for refrigerating systems based on flammability (From Table C.2)

13

Back EN378 safe limits calc... 13:55 82%

Toxicity Charge Limit
 108.000

Flammability Charge Limit
 11.973

Refrigerant
 32

Toxicity
 A

Flammability
 2L

Maximum Concentration
 0.167

Room Occupancy Refrigerant Results

AREA Guidance: www.area-eur.be/publications

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**One table based on toxicity,
one table based on flammability**

Refrigerant charge limits shall be calculated according to Table C.1 and Table C.2 depending on the toxicity and/or the flammability of the refrigerant.

Where more restrictive national or regional regulations exist, they take precedence over the charge limit requirements of EN 378.

Toxicity class	Access category	Leakage classification			
		I	II	III	IV
A	a	Upper limits without emergency exits or before ground floor level	20% of LFL + Room volume or not C.3	No charge restriction	The charge requirements based on toxicity shall be assessed according to Table C.1, depending on the location of the installation
	b	Other	No charge restriction	No charge restriction	
	c	Upper limits without emergency exits or before ground floor level	20% of LFL + Room volume or not C.3	No charge restriction	
	d	Other	No charge restriction	No charge restriction	

Example of charge limit requirements for refrigerating systems based on toxicity (From Table C.1)

Flammability class	Access category	Leakage classification			
		I	II	III	IV
1	a	According to C.2 and not more than the greater of 1 or 1.5 kg	20% of LFL + Room volume and not more than 1 kg	20% of LFL + Room volume and not more than 1 kg	20% of LFL + Room volume and not more than 1 kg
	b	Other	20% of LFL + Room volume and not more than 1 kg	20% of LFL + Room volume and not more than 1 kg	20% of LFL + Room volume and not more than 1 kg
	c	Other	20% of LFL + Room volume and not more than 1 kg	20% of LFL + Room volume and not more than 1 kg	20% of LFL + Room volume and not more than 1 kg
	d	Other	20% of LFL + Room volume and not more than 1 kg	20% of LFL + Room volume and not more than 1 kg	20% of LFL + Room volume and not more than 1 kg

Example of charge limit requirements for refrigerating systems based on flammability (From Table C.2)

Clause 5.1 Access categories

Occupancies are categorised in three different access categories; a, b, and c.

- a** Hospitals, courts or prisons, theatres, supermarkets, schools, lecture halls, public transport termini, hotels, dwellings, restaurant
- b** Business or professional offices, laboratories, places for general manufacturing and where people work
- c** Manufacturing facilities, e.g. for chemicals, food, beverage, ice, icecream, refineries, cold stores, dairies, abattoirs, non-public areas in supermarkets

Occupancies are categorised with respect to the safety of the persons who may be directly affected in the event of abnormal operation of the refrigerating system. Considerations of safety in refrigerating systems take into account the site, the number of people occupying the site and the access categories.

Clause 5.3 Location classification of refrigerating systems

There are four classes of location for refrigerating systems

Category	Description
I	The refrigerating system or refrigerant-containing parts are located in the occupied space.
II	All compressors and pressure vessels are either located in a machinery room or in the open air. Coils and pipework including valves may be located in an occupied space.
III	All refrigerant-containing parts are located in a machinery room or open air.
IV	All refrigerant-containing parts are located in a ventilated enclosure.

EN378 safe limits calc...

13:55 82%

Room

Occupancy

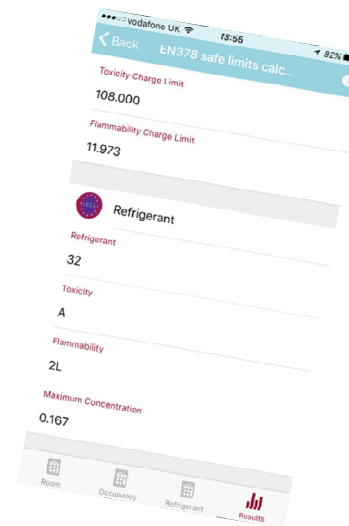
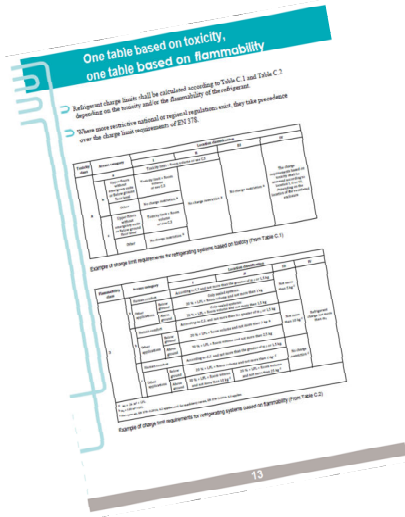
Refrigerant

Results

G.Fox@REFCOM.org.uk



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the Google Play
Store



		Potential Severity Rating			
		Minor	Moderate	Significant	Catastrophic
Likelihood severity occurs	Very Likely	Moderate	High	Extreme	Extreme
	Likely	Low	Moderate	High	Extreme
	Unlikely	Very Low	Low	Moderate	High
	Rare	Very Low	Very Low	Low	Moderate

