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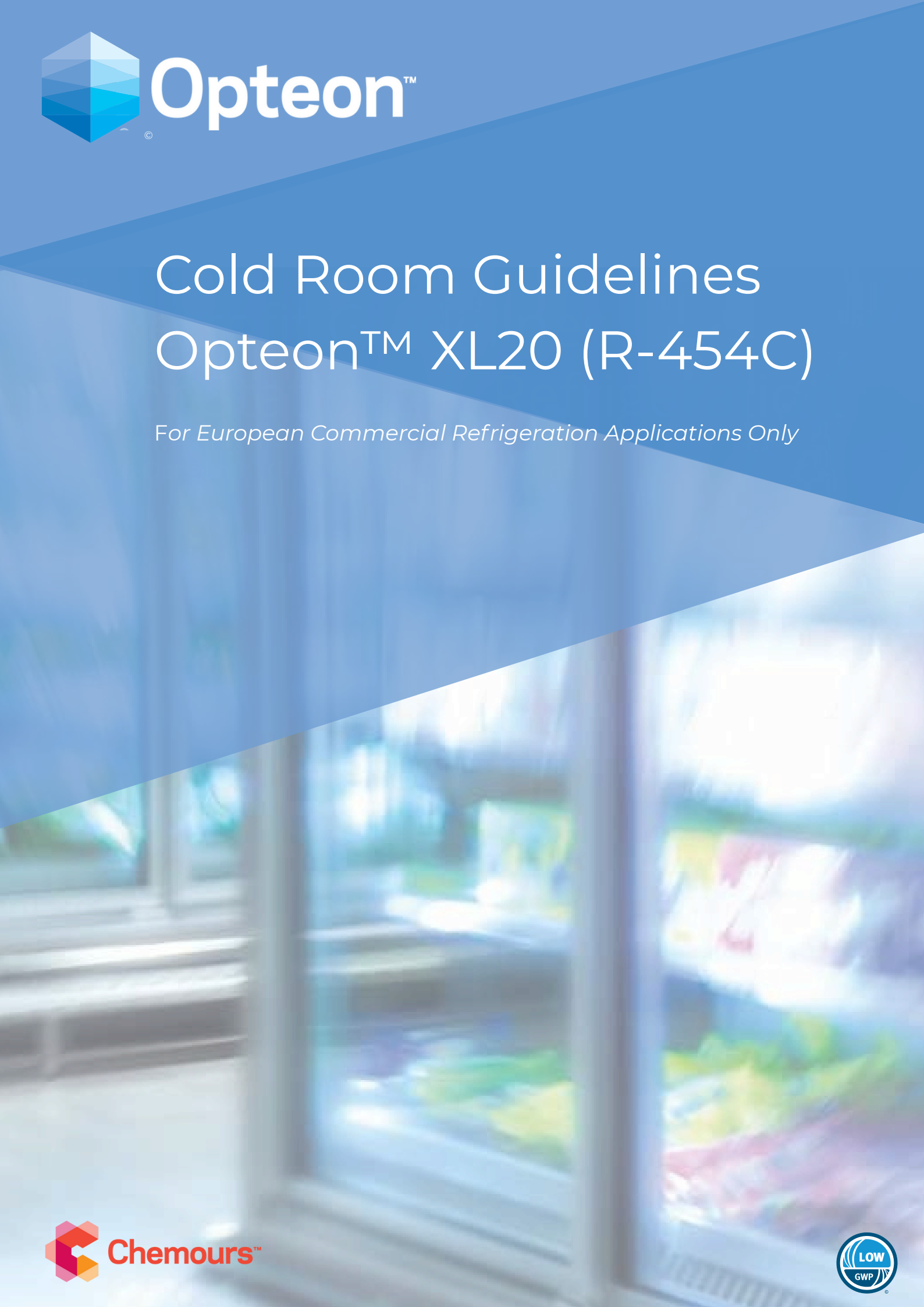
# Cold Room Guidelines Opteon™ XL20 (R-454C)

*For European Commercial Refrigeration Applications Only*



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# Introduction

Opteon™ XL20 (R-454C) is a hydrofluoroolefin (HFO)-based refrigerant designed to replace legacy refrigerants like R-404A and R-22. With a low global warming potential (GWP) of 146*, it offers a sustainable solution for a wide range of refrigeration applications, including cold rooms. As an ASHRAE A2L refrigerant and PED Group 1 classification, Opteon™ XL20 is mildly flammable, allowing for larger charge sizes compared to higher flammability refrigerants like A2 and A3.

For any new or refurbished installation, a comprehensive risk assessment is essential to ensure safety across the design, installation, operation, and maintenance stages. This requirement applies regardless of whether the refrigerant is flammable or non-flammable.
When applying Opteon™ XL20 in cold room applications, users can adhere to the European Standard EN 378, which outlines safety and environmental requirements for refrigerating systems and heat pumps. EN 378 emphasizes the importance of charge limitations based on the flammability and toxicity of the refrigerant, the location classification of the refrigerating system, and the access category. This ensures safe operation and minimizes risks associated with refrigerant leaks.

By following these guidelines, users can achieve optimal performance and enhanced safety in their cold room applications while contributing to environmental sustainability. Additionally, advanced analysis can offer opportunities to exceed the thresholds outlined by EN 378, allowing for tailored solutions to meet specific project needs.

# System Architectures

## Sealed Systems:

Systems with permanent connections, as defined in EN378-1:3.1.7, can safely contain **up to 1.76 kg** of Opteon™ XL20 (R-454C) without requiring additional safety measures.

## Non-Sealed Systems:

Systems that do not meet the definition of sealed are categorized into three architectural types based on the location of system components, access levels, and occupancy, as outlined in EN378-1:5.1 and 5.3.

| System Architecture | Location | Access | Occupancy |
|---|---|---|---|
| **"Type 1"** | II | c | < less than 1 person per 10m$^2$ |
| **"Type 2"** | II | b or c | - |
| **"Type 3"** | I | b or c | - |

II: Compressors and pressure vessels are located in machinery rooms or open air, evaporators inside the occupied space
I : Refrigerating system located in the occupied space
c : Authorized access (manufacturing facilities: chemicals / food & beverage / cold storage / non-public areas of supermarkets)
b : Supervised access (business or professional offices, laboratories, general manufacturing facilities)

**GWP values based on EU Fgas Regulation 573/2024*

## System Architecture “Type 1”


Refrigerating system designed for Location II, Access c, occupancy less than 1 person per 10 $m^2$ have **NO CHARGE RESTRICTION.** Safety measures may still be applied, please refer to EN378-3 (For open air, 4.2 applies and, for machinery rooms, 4.3 applies).

## System Architecture “Type 2”


Allowable charge of Opteon™ XL20 (R-454C) in kilograms, calculated based on the level of protective measures implemented and the volume of the room.
According to EN378-1:C.3.2, the proper safety measures include gas detection equipment connected with safety shut-off valves, ventilation (mechanical or natural), and a safety alarm.

| NON Sealed System Location II Access b and c | | | |
|---|---|---|---|
| **Room Volume** | **Number of Safety Measures and Allowable Charge in kg** | | |
| **$m^3$** | **0** | **1** | **2** |
| 5 | 0 - 0.29 | 0.30 - 0.70 | 0.71 - 57.14 |
| 7.5 | 0 - 0.44 | 0.45 - 1.05 | 1.06 - 57.14 |
| 10 | 0 - 0.59 | 0.60 - 1.40 | 1.41 - 57.14 |
| 12.5 | 0 - 0.73 | 0.74 - 1.75 | 1.76 - 57.14 |
| 15 | 0 - 0.88 | 0.89 - 2.10 | 2.11 - 57.14 |

| NON Sealed System Location II Access b and c | | | |
|---|---|---|---|
| **Room Volume** | **Number of Safety Measures and Allowable Charge in kg** | | |
| **$m^3$** | **0** | **1** | **2** |
| 17.5 | 0 - 1.03 | 1.04 - 2.45 | 2.46 - 57.14 |
| 20 | 0 - 1.17 | 1.18 - 2.80 | 2.81 - 57.14 |
| 25 | 0 - 1.47 | 1.48 - 3.50 | 3.51 - 57.14 |
| 30 | 0 - 1.76 | 1.77 - 4.20 | 4.21 - 57.14 |
| 35 | 0 - 2.05 | 2.06 - 4.90 | 4.91 - 57.14 |
| 40 | 0 - 2.34 | 2.35 - 5.60 | 5.61 - 57.14 |



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| NON Sealed System Location II Access b and c | | | |
|---|---|---|---|
| **Room Volume** | **Number of Safety Measures and Allowable Charge in kg** | | |
| **$m^3$** | **0** | **1** | **2** |
| 45 | 0 - 2.64 | 2.65 - 6.30 | 6.31 - 57.14 |
| 50 | 0 - 2.93 | 2.94 - 7.00 | 7.01 - 57.14 |
| 60 | 0 - 3.52 | 3.53 - 8.40 | 8.41 - 57.14 |
| 70 | 0 - 4.10 | 4.11 - 9.80 | 9.81 - 57.14 |
| 80 | 0 - 4.69 | 4.70 - 11.20 | 11.21 - 57.14 |
| 90 | 0 - 5.27 | 5.28 - 12.60 | 12.61 -57.14 |
| 100 | 0 - 5.86 | 5.87 - 14.00 | 14.01 - 57.14 |
| 110 | 0 - 6.45 | 6.46 - 15.40 | 15.41 - 57.14 |
| 120 | 0 - 7.03 | 7.04 - 16.80 | 16.81 - 57.14 |
| 130 | 0 - 7.62 | 7.63 - 18.20 | 18.21 - 57.14 |
| 140 | 0 - 8.20 | 8.21 - 19.60 | 19.61 - 57.14 |
| 150 | 0 - 8.79 | 8.8 - 21.00 | 21.01 - 57.14 |
| 160 | 0 - 9.38 | 9.39 - 22.40 | 22.41 - 57.14 |
| 170 | 0 - 9.96 | 9.97 - 23.80 | 23.81 - 57.14 |
| 180 | 0 - 10.55 | 10.56 - 25.20 | 25.21 - 57.14 |
| 190 | 0 - 11.13 | 11.14 - 26.60 | 26.61 - 57.14 |
| 195 | 0 - 11.43 | 11.44 - 27.30 | 27.31 - 57.14 |

*When the refrigerant charge is greater than 25kg - please follow requirements in Table C.2 according to EN378-1:2020 + A1*

# System Architecture “Type 3”


Allowable charge of Opteon™ XL20 (R-454C) in kilograms, calculated based on room's volume.
According to EN378-1:2020 +A1, for Class I installations, the C3 provisions are not applicable. As a result, the implementation of additional safety measures does not permit an increase in the allowable charge size.

| NON Sealed System Location I Access b or c | |
|---|---|
| **Room Volume** | **Charge** |
| **m3** | **kg** |
| 5 | 0 - 0.29 |
| 7.5 | 0 - 0.44 |
| 10 | 0 - 0.59 |
| 12.5 | 0 - 0.73 |
| 15 | 0 - 0.88 |
| 17.5 | 0 - 1.03 |
| 20 | 0 - 1.17 |
| 25 | 0 - 1.47 |
| 30 | 0 - 1.76 |
| 35 | 0 - 2.05 |
| 40 | 0 - 2.34 |
| 45 | 0 - 2.64 |
| 50 | 0 - 2.93 |
| 60 | 0 - 3.52 |

| NON Sealed System Location I Access b or c | |
|---|---|
| **Room Volume** | **Charge** |
| **m3** | **kg** |
| 70 | 0 - 4.10 |
| 80 | 0 - 4.69 |
| 90 | 0 - 5.27 |
| 100 | 0 - 5.86 |
| 110 | 0 - 6.45 |
| 120 | 0 - 7.03 |
| 130 | 0 - 7.62 |
| 140 | 0 - 8.20 |
| 150 | 0 - 8.79 |
| 160 | 0 - 9.38 |
| 170 | 0 - 9.96 |
| 180 | 0 - 10.55 |
| 190 | 0 - 11.13 |
| 195 | 0 - 11.43 |



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# Requirements for Alternatives Provisions

**QLMV and QLAV charge values may only be used for location Class II in accordance with 5.3 where:**

- The refrigerant is classified as A1 or A2L
- The system charge for A2L refrigerants does not exceed 1,5 x m3 ( 57,14kg for R-454C)
- All connector (e.g Headers, Tees, reducers, etc.) of refrigerant containing piping in occupied spaces are manufactured from factory made fittings or manifolds.
- Site made joints and equipment of split systems installed in occupied spaces are in accordance with the instructions of the manufacturers of the factory made units.
- Only valves and service ports can be installed in occupied spaces which are part of the factory made units.
- The heat exchanger in the indoor unit and the control of the system are edsigned to prevent damage due to ice formation.
- The indoor unit is protected against fan breakage
- Only permanent joints are used in the occupied space except for site-made joints directly connecting the indoor unit to the piping.
- The refrigerant-containing pipes in the occupied space are installed in such way that it is protected against accidental damage in accordance with EN378-2:2026,6.2.3.3.4. and EN378-3:2016+A1:2020,6.2.
- Alternative provisions to ensure safety are provided in accordance with C.3.2.2 and C.3.2.3:- appropriate measures include ventilation (natural or mechanical) safety shut-off valves and safety alarm, in conjunction with a gas detection device, see in EN 378-3:2016+A1:2020, Clauses 6,8,9 and 10. A safety alarm alone is not considered as an appropriate measure where oppants are restricted in their movement (see EN 378-3:2016+A1:2020 8.1).
- Doors at the occupied space are not tight-fitting: and the effect of flow down is mitigated in accordance with EN378:2016 +A1:2020, C.3.2.4.
- For occupied spaces exceeding 250m2, the charge limites calculation shall use 250m2 as the room floor area for determination of the room volume.

For more information on the Opteon™ family of refrigerants or other Chemours products visit **opteon.com**