A2L REFRIGERANT FLUID INSTALLATION GUIDE

CONTENT

Preamble

The Carrier Group products are developed in the respects of all European regulations. To respects those regulations, Carrier Group teams have followed a robust methodology based on a strong risk analysis.

Beyond regulatory mandatory products safety, potential risks must be analyzed and evaluated by the owner of the equipment to eventually set and apply all adequate necessary supplementary measures through its own risk analysis.

In case of use of this equipment in a place where employees can be present, following the requirement of European directive 2009/104/CE, the employer shall also take the measures necessary to ensure that the work equipment made available to workers in the undertaking or establishment is suitable for the work to be carried out or properly adapted for that purpose and may be used by workers without impairment to their safety or health.

The aim of the present document is to help the owner of the equipment to mitigate the risk generate by its installation by using equipment with low flammability refrigerant fluids, long term alternative to HFC

Warning

EN 378:2016 standard establishes safety requirements to manage every potential risk.

The present guide provides advices to better understand them and help to install our unit. However, it does not purport to cover all possible configurations.

Reminder

The standard EN 378 and particularly part 3:

- Is not mandatory to apply
- Shall not replace the applicable regulatory requirements

Therefore, the present guide shall not replace the risk analysis that must be done by customers who remain responsible for the safety and measures taken to ensure it.

The present guide could not in no case to engage the responsibility for Carrier SCS or any other Carrier group companies.

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Introduction

To reduce the refrigeration and air conditioning industry environmental impact, the F-Gas Regulation imposes a phase-down for the high GWP fluids.

In this context, alternative refrigerant fluids gradually replace the common HFC, such as R134a or R410A. These new refrigerants are chosen to strongly decrease the GWP and ensure a high efficiency level of the air conditioning systems.

Nevertheless, some of these new fluids, used in a pure chemical form, present some flammability characteristics. Their using requires assessing the risk introduced by their flammability properties. Those risks are the flammability risk and in some situation the explosion risk.

This document is related to the use of refrigerant belonging to the 2L class as per ISO 817, which are considered as mildly flammable.

This document provides a guidance in different types of installation sites to better consider the safety aspect linked to the flammability and/or explosion risk and so driving the risk assessment of the installations of the equipment which always remains under the responsibility of the customer.

General information on A2L fluids

From a safety perspective, refrigerant fluids are classified according to 2 parameters:

- Toxicity
- flammability

Classification is given by ISO 817 & EN 378 standards as shown in below table:

Safety categories of refrigerant fluids		
Flammability	Toxicity	
	Nontoxic	Toxic
Nonflammable	A1	B1
Slightly flammable	A2L	B2L
Flammable	A2	B2
Highly inflammable	A3	B3

This guide is especially dedicated to the installation of machines using R32 and R1234ze fluids, belonging to A2L category.

In addition to recommendations provided further in the document, all measures must be taken to prevent fluid entering inside buildings:

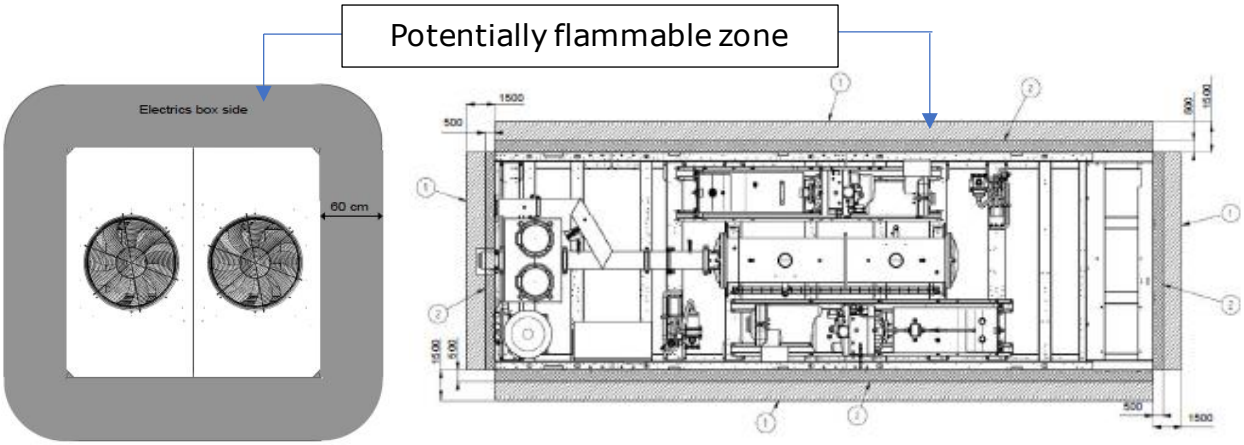
- distance with all openings (windows, doors)
- hydraulic circuit & external relief valve

General information on potentially flammable zone & ignition sources

The full unit, including all options & accessories that are delivered by the manufacturer, has been qualified for the use with A2L refrigerant.

For that purpose, the manufacturer complies with EN 378-2 §6.2.14 and defined potentially flammable zone using EN 60079-10-1 in order to identify where ignition sources must not be present. Then the manufacturer designed the machine in order that, if the unit is used the way it was designed for, there is no internal ignition source in the internal potentially flammable zone.

Thus, the only residual risk is to have an ignition source introduced in the potentially flammable zone by the user. For that purpose, the manufacturer decided to represent the external potentially flammable zone where the user must not introduce ignition source.



Above example are indicative only, please refer to each unit IOM for dedicated exact zoning.

This indication is only here to help our customer to identify the limits of the flammability risk.

But there is no risk of explosion linked to the used of A2L refrigerant due to the machine itself.

Note (the following information is provided by the manufacturer exclusively for informational purposes. The application of the following directives relies exclusively upon the user):

According to directives 2009/104/EC and 1999/92/EC, these zones might be qualified by the user as ATEX Zone based on the user's own risk analysis for which the user remains solely responsible. According to the definition of Annex I of directive 1999/92/EC, this zone might be classified Zone 2 because it might be a place in which an explosive atmosphere consisting of a mixture of air with flammable substances in

the form of gas is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

In case an additional equipment is necessary (motorized valve, pump, etc.…), it must be:

- installed out of defined potentially flammable zone
- qualified as a non-ignition source for the fluid used

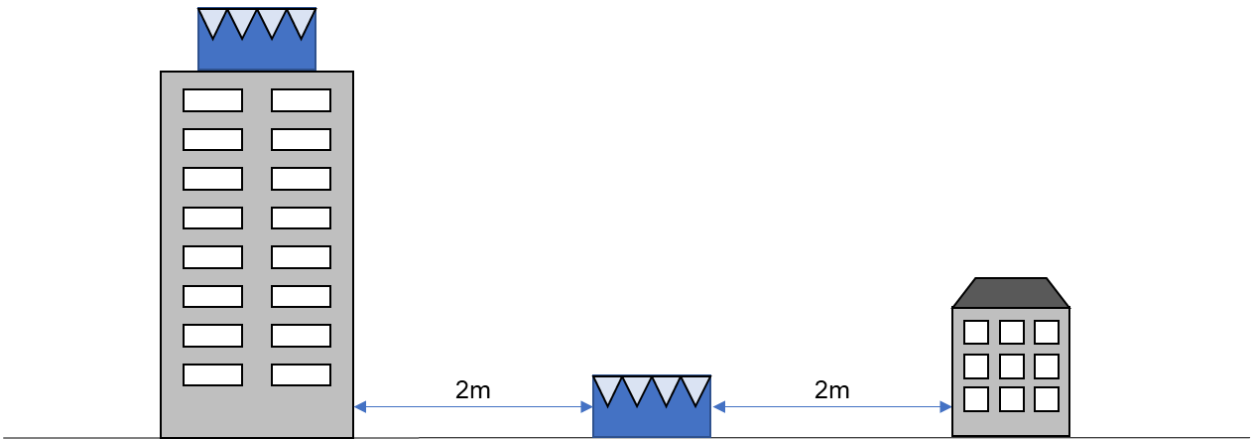
Installation cases

The installation cases are the basis of the risk analysis according the flammable risk. When the manufacturer does its risk analysis it takes in consideration the installation cases according the definition here below that the user can take in consideration for its own risk analysis.

Choice of used solution is under responsibility of customer, depending on site specificities.

Free field installation

Unit is installed without obstacles around, avoiding accumulation of refrigerant fluid in case of leak.

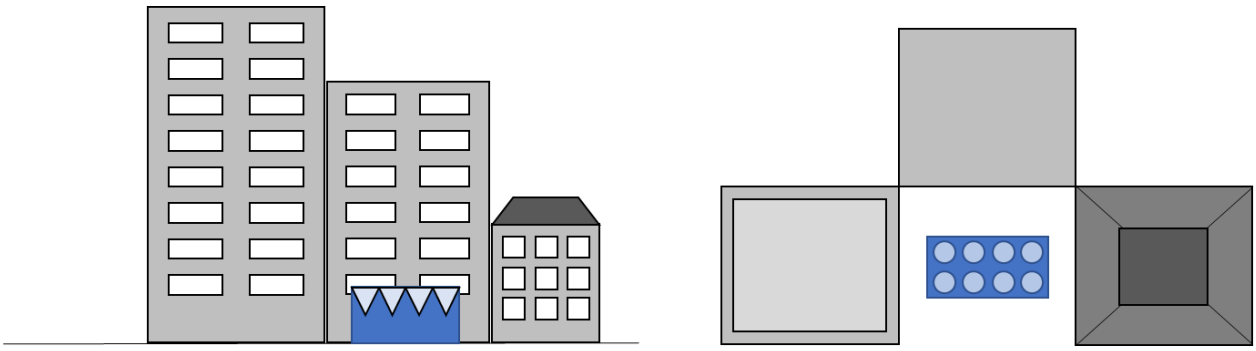


The minimum distance with building or walls is given to allow circulation of technician around the unit during maintenance.

You must always refer to the unit IOM to ensure minimum installation distance is respected for your unit.

Outdoor confined space installation

Small spaces



In that case, natural ventilation might be reduced, and refrigerant accumulated within the restricted space in case of leak event.

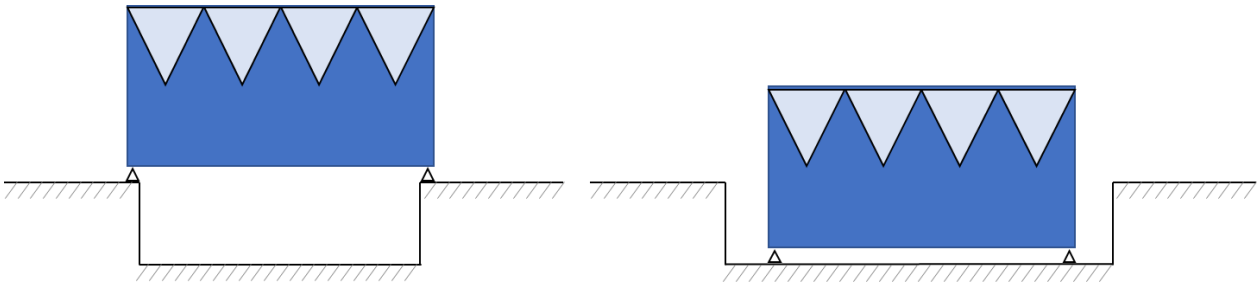
Customer must ensure no accumulation of refrigerant will be possible.

Commonly used solutions (non-exhaustive list) are:

- risk analysis demonstrating no accumulation risk
- additional ventilation system for identified accumulation areas + leak detector
- opening in wall at the position of the accumulation area

Choice of used solution is under responsibility of customer, depending on site specificities.

Installation over a pit



Slightly flammable fluids used by the manufacturer have a density higher than air. In case of leak, the main risk is the stagnation in the lowest point.

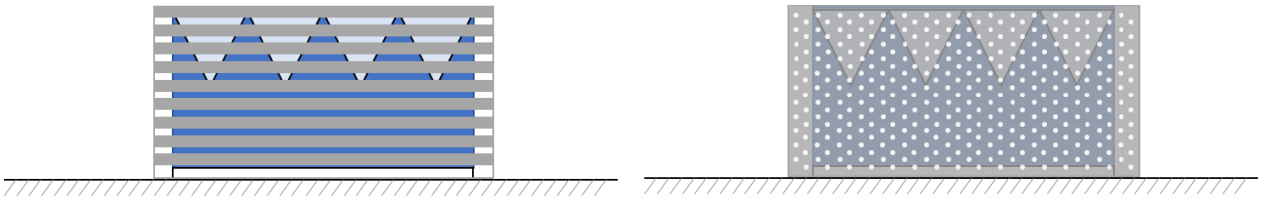
If unit is mounted in or over a pit, customer must ensure evacuation of gas is possible.

Commonly used solutions (non-exhaustive list) are:

- vent duct
- ventilation system + leak detector

Choice of used solution is under responsibility of customer, depending on site specificities.

Acoustic package



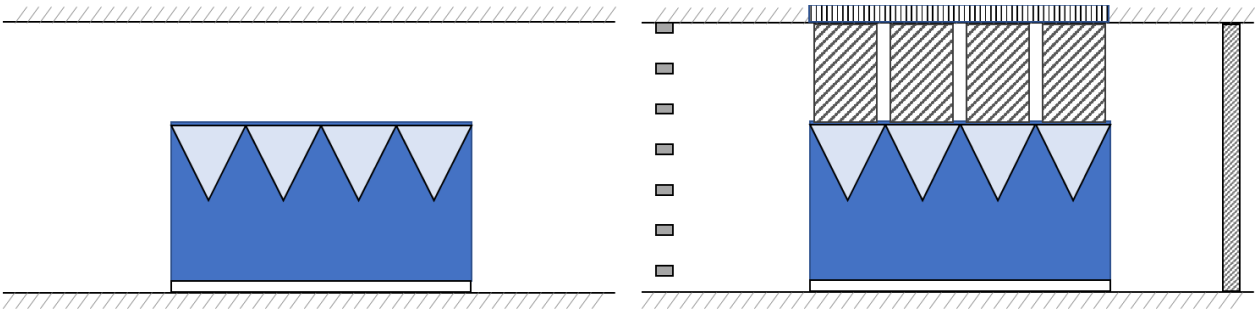
Some noise reduction systems have an impact on air circulation (packages, louvered panels, etc.).

The customer must ensure that the acoustic system in place doesn't allow refrigerant fluid accumulation, especially in low part.

An alternative solution is to equip the system with a leak detector that ensures cutting the power and stopping unit operations.

Choice of used solution is under responsibility of customer, depending on site specificities.

Under shelter or covered area



Is considered under shelter an area or local that has at least one wall with opening rate > 75% with outdoor. This type of installation can be considered as an outdoor installation.

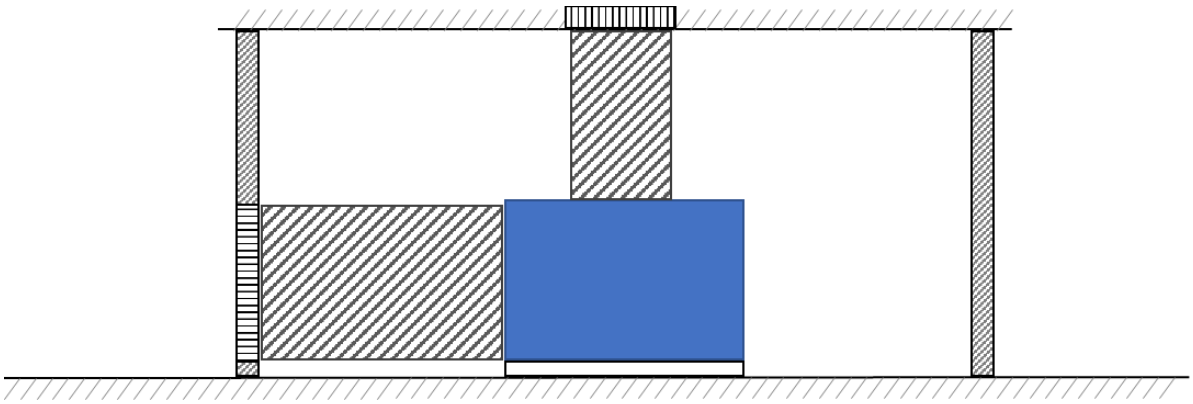
Customer must ensure accumulation of refrigerant is not possible.

Commonly used solutions (non-exhaustive list) are:

- risk analysis demonstrating no accumulation risk
- Permanent ventilation system avoiding gas accumulation
- additional ventilation system for identified accumulation areas + leak detector
- opening in wall at the position of the accumulation area

Choice of used solution is under responsibility of customer, depending on site specificities.

Indoor installation



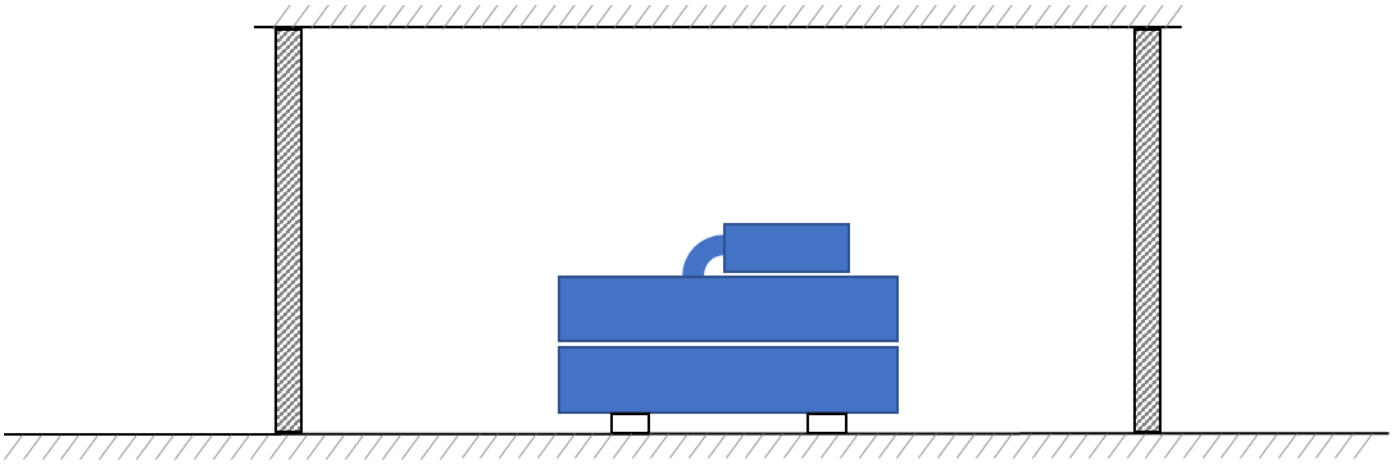
In case unit is installed in an indoor space, installation requirements provided by EN378-3 standard must be applied.

In that case, the potentially flammable zone generated by the unit is enlarged vs standard potentially flammable zone that is defined for outdoor use.

All necessary protection required must be employed (detection and ventilation).

Choice of used solution is under responsibility of customer, depending on site specificities.

Indoor unit



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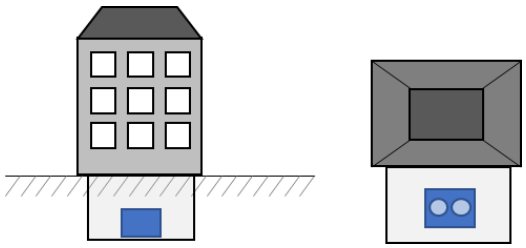
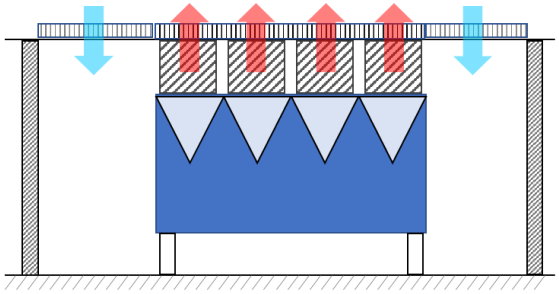
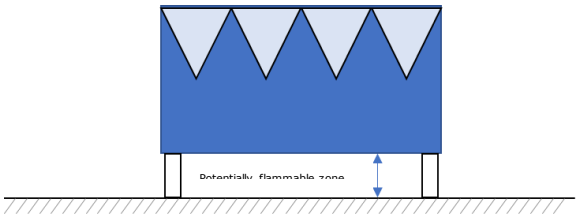
Variants and corresponding installation

You may not be in the exact same cases as presented previously.

Here is a list of existing cases and the corresponding installation types to report in this document.

Variant	Installation case to report to
Sunken courtyard 	Depending on the courtyard dimensions and clearance around the unit: • Free field installation or • Installation over/in a pit
Room with inlet/outlet from the ceiling 	Should be considered as: • Indoor unit
Unit mounted on platform 	Flammable risk area below the unit depends on ventilation: • Good ventilation: can be considered as free field installation a potentially flammable zone dimension is the same than on unit side • Lack of ventilation: should be considered as installation over/in a pit a Flammable risk area extends down to the floor

Leak detector additional information

Position recommendation

It is recommended to position leak detector(s) at the lowest point of the identified accumulation area.

Leak detector option

The option "Input contact for refrigerant leak detection" is only an information available through the unit controller.

The unit won't have any alarm logic linked to the signal.

The unit won't stop if signal corresponds to a leak detected.

It is customer responsibility to use that signal through site building management system or any other way if he wants to use is for safety.