

# Safe transport of dry ice

Safety Pocket Guide No. 4



## Dear Gas Users,

Messer produces and supplies a wide range of gases.

The use of solid CO<sub>2</sub> (dry ice) as a coolant when transporting goods ensures maintenance of the cold chain and is particularly widespread in the transportation of perishable foodstuffs. To ensure safe transportation when using solid CO<sub>2</sub> as a coolant, it is necessary to take the potential hazards into account.

This leaflet contains safety guidelines for the use of solid CO<sub>2</sub> as a coolant when transporting perishable goods in refrigerated boxes.

Cooling goods with dry ice results in sublimation of CO<sub>2</sub>, potentially creating a dangerous atmosphere in the vehicle load compartment.

A load compartment, if not well ventilated, is considered an enclosed space, even while loading and unloading through the open door.

We strongly encourage you to be aware of the potential hazards when handling CO<sub>2</sub>, to be familiar with and comply with all safety measures, including ADR paragraph 5.5.3. Please also keep this leaflet within reach at all times.

Each product comes with a safety data sheet providing you with all the important safety information regarding gases. Please familiarise yourself with this information.

Your Messer Team





## Hazards of CO<sub>2</sub>

The potential hazards of CO<sub>2</sub> for humans are:

- **Intoxication and asphyxiation**

Solid CO<sub>2</sub> sublimates to gaseous CO<sub>2</sub>. Even at very low concentrations, gaseous CO<sub>2</sub> will interfere with the metabolic action of human respiration and blood chemistry. CO<sub>2</sub> concentrations as low as 1 % in breathed air may result in drowsiness. At concentrations of 3 % - 5 % symptoms equal to driving whilst under the influence of alcohol can appear. A concentration of over 10 % CO<sub>2</sub> in air can even cause death.

- **Cold burns**

Potential of harming skin and eyes on contact due to the extreme cold of dry ice (-78.5 °C).

- **Injuries due to over-pressurisation**

Solid CO<sub>2</sub> sublimates to a gaseous state with an expansion ratio of over 845:1, potentially causing over-pressurisation and therefore the risk of unintentional pressure release if stored inappropriately.

# Scenarios with accident potential

**The most critical activities which may lead to hazards due to a dangerous CO<sub>2</sub> atmosphere (increased CO<sub>2</sub> concentration and/or lack of oxygen) occurring in the supply chain are:**

1. Loading of the container into the confined space of the vehicle
2. Transport (driving)
3. Idling (not driving, but keeping the load compartment closed)
4. Unloading of the container from the confined space of the vehicle

**Humans can potentially be exposed to a dangerous CO<sub>2</sub> atmosphere in the following scenarios:**

- Entering the confined space of a vehicle between already loaded packages (e.g. adding or removing packages, checking the load).
- Closing of doors to the load compartment, intentionally or unintentionally, with a person inside.
- Opening and entering the load compartment by emergency services i.e. in case of a road accident.
- A person is trapped inside the vehicle during loading or unloading.
- Doors to the load compartment close, intentionally or unintentionally, with a person inside the compartment unable to re-open them (e.g. due to wind, FLT impact, human failure).

- When opening the compartment doors, gaseous CO<sub>2</sub> accumulated at the bottom of the compartment will flow out of the vehicle and surround nearby persons.
- When entering the load compartment immediately after opening the doors there can be a high concentration of CO<sub>2</sub> in the compartment.
- Load compartment and driver cabin are not separated (airtight).
- Confined space is created using a compartmentalised truck (e.g. equipped with a „rolling gate“).



## Risk levels

The level of risk of an unsafe atmosphere due to use of solid CO<sub>2</sub> as a cooling agent during transportation depends on:

- Quantity of solid CO<sub>2</sub> inside the vehicle
- Type of packaging and insulation
- Temperature of the load compartment
- Vehicle ventilation
- Duration of having solid CO<sub>2</sub> in an enclosed space



RISK OF FREEZING



ASPHYXIATION DANGER



Special transport boxes for dry ice are well insulated.

# Safety precautions

To make sure that no accidents happen, some precautionary measures should be taken:

- Always make sure that the load is secured.
- Always ensure adequate ventilation, either during transportation or before entering the load compartment.
- Do not enter the vehicle load compartment immediately after opening the doors.
- Make sure that nobody is inside the compartment before closing the load compartment doors.
- If possible avoid confined spaces inside the compartment.
- Unload from rear to front to avoid entering confined spaces.
- Load from front to rear to avoid trapping somebody in confined spaces.
- In the event of an accident inform the emergency services not to enter the truck load compartment immediately after opening the doors.
- When opening the doors, do not stand/stay directly in front of the opening.
- Secure the load compartment doors in the open position before entering.
- Preferably the doors should be capable of being opened from the inside.

- Preferably use vehicles with a separate, „airtight“ driver’s cab.
- Avoid transporting dry ice in the cab of a truck or the passenger compartment of a car. If it is unavoidable, the load shall be well insulated and secured, and adequate ventilation shall be maintained.



## Regulations according to ADR

The ADR (European Agreement Concerning the International Carriage of Dangerous Goods by Road) provides regulations for transportation with commercial transport vehicles involving the use of dry ice as a coolant.

If there is a risk of asphyxiation, meaning if the vehicle is not well ventilated according to ADR 5.5.3.3.3, this danger must be indicated by a warning notice at all access points until the vehicle has been well ventilated and the cooled or conditioned goods have been unloaded. It is recommended to always assume an asphyxiating atmosphere until a safe atmosphere has been proven with a suitable and tested analysis device.

### **When using solid CO<sub>2</sub> as a coolant or conditioner, the marking on vehicles and containers must comply with the following illustration\*:**

- The name of the coolant/conditioner must be indicated in one line using capital letters not less than 25 mm high. If the proper shipping name is too long to fit in the space available, its font may be reduced to the largest possible size that fits.
- In addition, the transport documents must include the following information: UN 1845 CARBON DIOXIDE, SOLID, AS COOLANT.
- Furthermore, the drivers require additional training appropriate to their area of responsibility and concerning the transport-related risks.

For an approved consignment that is not well ventilated, however, the basic requirement is that:

- gas exchange between the load compartment and the driver's cab is prevented or
- the load compartment is insulated, refrigerated or mechanically refrigerated, see ADR 5.5.3.3.3.

With entry into force of ADR 2017, these regulations (ADR 5.5.3) also apply to the commercial transportation of dry ice even if it is not being used as coolant. However, such consignments remain exempt from all other requirements of ADR.

*\* The marking and entry into the transport documentation shall be in an official language of the country of origin and also, if that language is not English, French or German, in English, French or German, unless agreements, if any, concluded between the countries concerned in the transport operation provide otherwise.*



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#### Disclaimer

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**MESSER**   
Gases for Life

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