



FIXED EXTINGUISHING INSTALLATIONS SECTION

**POSITION PAPER
ON THE USE OF CARBON DIOXIDE
FOR
FIRE PROTECTION APPLICATIONS**

Eurofeu Position paper on the use of carbon dioxide in fire protection applications

1 General

Carbon Dioxide is a colourless, odourless, dry inert gas that is normally present in the atmosphere with a concentration of 0.03 % by volume.

Carbon Dioxide, usually referred to as CO₂, is the oldest and a well known gaseous fire extinguishing agent. It has been used for approximately 80 years in the fire protection industry. It is cost effective and available worldwide.

Because of its physical properties CO₂ is suitable for total flooding of areas and for local application systems. If people can be present in the protected area, safety aspects must be considered. These are included in Clause 4 of this Position Paper.

2 Extinguishing mechanism

To extinguish a fire the oxygen concentration, which is normally 21 % by volume in the atmosphere, is reduced to 13.8 % by volume or lower, depending on the material to be extinguished.

A cooling effect, resulting from the expansion of the discharged liquid CO₂ converting into dry ice and then vaporising into a gas, assists the fire extinguishing process for particular applications e.g. cooling down hot oils below their flash point.

3 Environmental aspects

CO₂ is a natural gas and is an important part within the organic life cycle. CO₂ in general contributes to the global warming process of the stratospheric atmosphere and is included within the "Kyoto Protocol".

CO₂ used in fire protection systems does not really contribute to the global warming as the CO₂ is extracted from existing sources e.g. from the atmospheric air or from natural underground sources. After a discharge to extinguish a fire the CO₂ is returned to nature. Compared to CO₂ producers such as combustion engines, the amount of CO₂ that is used for fire protection purposes is very small. For example: -

- The amount of CO₂ discharged into the atmosphere in Germany in 2002 was 1,016,000 tonnes
- The total CO₂ emission in the 15 Member States of the European Union in 2002 was 4,125,000 tonnes
- Whereas the amount of CO₂ installed in new fire protection systems in Germany in the same year was approximately 200 – 300 tonnes.

Fire extinguishing is a typical non-emissive application, where the extinguishant is only released to extinguish a fire.

4 Safety aspects

CO₂ has a dangerous physiological impact at normal extinguishing concentrations and can cause coma and death. During discharge the air temperature drops and a dense cloud prevents visibility. People that are inside a room when a fire occurs have to evacuate the room before the CO₂ discharge begins.

Reliable delay and alarm technologies (involving redundancy features) are required to ensure that people can leave before a CO₂ release is initiated. Typical delay times are between 20s and 45s, depending on the size of the protected area. Special safety measures based on strong national and/or international regulations for the system itself and for the user exist and have to be followed. (As an example, for Germany, it is BGR 134, Berufgenossenschaftliche Regel [safety and health at work])

5 Advantages of CO₂

Because CO₂ becomes gaseous and mixes with the air during discharge and then disappears after extinguishing without leaving a residue, there is no damage to the material inside the room or the protected application that is caused by the agent itself. CO₂ is suitable for a wide range of materials and to extinguish Class A, B and C fires. For open, local applications (Protection of risks without a surrounding enclosure) CO₂ is particularly well suited for Class B and C fires.

Because CO₂ is stored in a liquid phase the CO₂ supply needs only a small space. Special low-pressure CO₂ tanks to contain greater volumes of the gas are available for the protection of large enclosures.

6 Applications

Rolling mills, printing machines, machine tools (e.g. spark erosion machines), cable floors, cable tunnels, normally unoccupied switchgear and electrical rooms, as well as stores for dangerous goods and flammable liquids like paints.

7 Conclusion

CO₂ and CO₂ systems are a part of the fire protection scene as well as other gases. They fill a gap for special applications due to the unique physical characteristics of CO₂. Due to the virtually zero amount added to the atmosphere, there is no environmental impact from the use of CO₂ for fire protection purposes.

A CO₂ installation must always be designed, installed, commissioned and maintained by an expert following national/international regulations. Safety precautions such as pre-warning alarms, service or lock off valves etc. must be incorporated whenever used in occupied and occupiable areas. Systems and system components must be approved by a recognised European test laboratory and shall meet EN Standards. Under these circumstances a CO₂ system is a safe and environmental friendly fire protection solution.