



# CO<sub>2</sub> Extinguishing agent



#N06451 R77101  
GAR MAX50KG CO2  
PP250KG/CM2 06/99



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## CO<sub>2</sub> physical characteristics

Chemical name:	Carbon dioxide
Chemical formula:	CO <sub>2</sub>
Molecular Weight:	44,01
Liquid density at a 20°C:	777Kg/m <sup>3</sup>
Critical temperature:	31°C
Critical pressure:	78.82 bar
Vapour pressure at 20°C:	57.2 bar
Maximum filling density:	0.67 Kg/L
Air relative density:	1.5
Ozone destructive power:	0
Greenhouse effect potential:	1

## What is the CO<sub>2</sub>?

CO<sub>2</sub> is a liquefied, colourless, inert, clean, non-corrosive and non-electricity conductor gas. Its density is 1.5 times higher than the air.

Used to extinguish flammable liquids, gases and in some cases for solid combustible fires.

The CO<sub>2</sub> effective concentration in fire extinguishing causes asphyxia on people and it is only used in areas which are usually unoccupied. It extinguishes through the reduction of oxygen in the air below the combustion limits (15%) and it also cools and absorbs the flame heat.



## Advantages



- ✓ Non-electricity conductor
- ✓ Low cost
- ✓ Clean extinguishing agent.
- ✓ Versatility of applications:
  - Total flood
  - Local application
- ✓ Friendly with the ozone layer.

## Application systems

### Total flood

Storage of the carbon dioxide in a bottle or array of bottles needed to reach the required extinguishing concentration through discharge in the area.

Connected to a network of distribution pipes and discharge diffusers distributing the CO<sub>2</sub> inside the area to be protected which will be provided with high tightness.

### Local application

Storage of the carbon dioxide needed in a bottle or array of bottles.

Connected to a network of distribution pipes and discharge diffusers on the equipment, to discharge the CO<sub>2</sub> in a fast discharge time, in state of carbon dioxide snow, on an equipment to be protected. In this case, tightness of the area where the equipment to be protected is, is not necessary.

## Types of systems

### Modular systems

Composed of one only bottle with a small network of pipes and a minimum number of diffusers where the extinguishing agent is discharged homogeneously inside the area to be protected.

### Centralised systems

Composed by a group of storage bottles with the same pressure and quantity of extinguishing agent, connected through a common collector to a piping distribution network and diffusers appropriately distributed and dimensioned for the extinguishing agent to be homogeneously distributed.

## Types of fires

### Superficial fires

Flammable liquid and vapour fires which are extinguished by total flood of the area with a CO<sub>2</sub> concentration depending on each material and the volume of the area.

### Deep fires

Flammable solid fires such as cotton, cardboard, paper, wood, electrical material... which need a longer cooling and maintenance time of the external environment.

# Sizing of discharge pipes

Generally, pipes and accessories to be used in the CO<sub>2</sub> system distribution network should be able to resist the pressure created in them.

Pipes recommended are without welding and type de ASTM, A 106B or similar. Accessories and pipe fittings recommended are high pressure forging typed ANSI 3000 Lb or similar.

Calculation of the pipe dimension is carried out through computer programs, however, the table on the left can be applied for pipe pre-sizing.

CO <sub>2</sub>	
Nominal diameter	Discharge flow Kg/Min
DN10 (3/8")	Up to 30
DN15 (1/2")	31-60
DN20 (3/4")	60-90
DN25 (1")	90-150
DN32 (1 1/4")	150-270
DN40 (1 1/2")	270-360
DN50 (2")	360-600
DN65 (2 1/2")	600-990
DN80 (3")	990-1380
DN100 (4")	1380-2400
DN115 (5")	2400-3800
DN150 (6")	> 3800

CO <sub>2</sub>	
Nominal diameter	Maximum support spacing
DN10 (3/8")	1,7 m.
DN15 (1/2")	1,8 m.
DN20 (3/4")	1,9 m.
DN25 (1")	2 m.
DN32 (1 1/4")	2,2 m.
DN40 (1 1/2")	2,3 m.
DN50 (2")	2,5 m.
DN65 (2 1/2")	2,8 m.
DN80 (3")	3,1 m.
DN100 (4")	3,5 m.

# Pipe supports

Supports for the distribution network should resist dynamic and static loads generated, as well as changes in the pipe due to thermal effects.

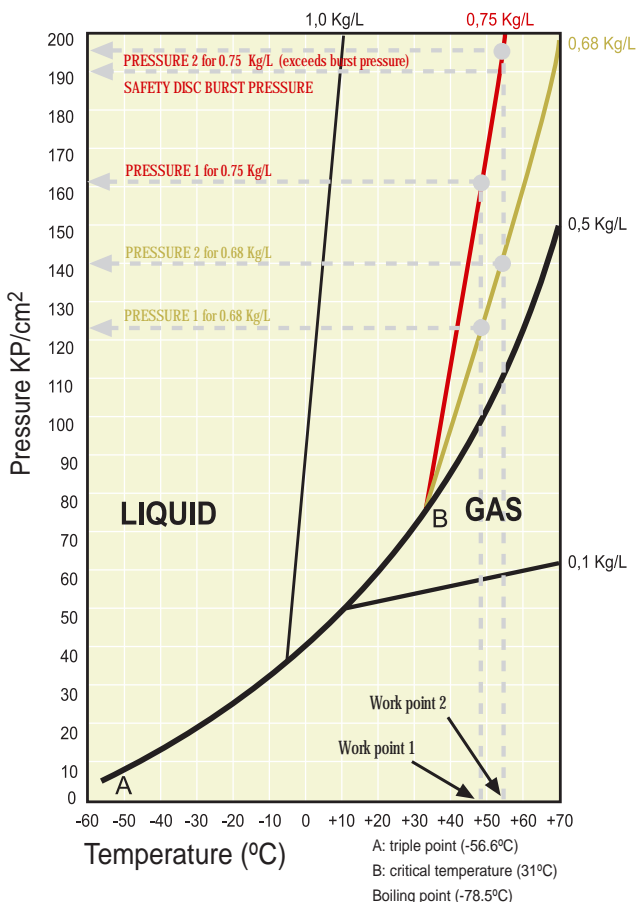
In the following graphic, maximum spacing for pipe supports according to the pipe diameter is shown.

# Temperature-Pressure Diagram

Generally, storage room temperature should not exceed the limits shown:

- In Local Application Systems: not higher than 49°C or lower than 0°C (see Work Point 1 in diagram T-P).
- In Total Flow Systems: not higher than 54°C or lower than -18°C (see Work Point 2 in diagram T-P).
- Based on the Temperature-Pressure diagram, shown on the left, it is observed that the filling factor recommended is 0.68 Kg/L as the maximum, to avoid overpressures and trigger by safety disc opening of the discharge valve.

## Pressure - Temperature Diagram



# Filling density

The bottle filling density does not have to generate pressures exceeding the specifications of the containers at the maximum design temperature. Exceeding the maximum filling density may result in an extremely high increase in the pressure due to a small temperature increase.

Property	Units	Value
Maximum filling density	Kg/L	0,68
Container working pressure at 54°C	Bar	140





## Modular bottles

High pressure bottles made of thermally-treated alloy steel without welding, (according to European Directive 84/525/CEE). Working pressure 60 bar, test pressure 250 bar, service temperature from -10°C to +60°C. Engraved and painted according to the regulations.

Equipped with

- 1" main valve AEX/VCO100 made of forged brass with stainless steel piston and shaft. Provided with safety disc and relief valve to avoid triggering if leaks.
- Syphon tube.
- Trigger solenoid (feeding 24V and 500mA of consumption).
- Attachment fitting.
- Flange.
- Protection cap.



## Centralised systems

High pressure arrays composed of 67 and 80 L-capacity bottles. Made of thermally-treated steel, without welding (according to European Directive 84/525/CEE). Working pressure 60 bar, test pressure 250 bar, service temperatures from -10°C to +60°C. Engraved and painted according to the regulations.

Equipped with 1" main valves AEX/VCO100 with pneumatic opening through the head, non-return valves, hoses for the trigger pneumatic drive and discharge hoses. Assembled in a metal frame with double attachment fittings and discharge collector with thread coupling to the installation. Frames can be made through bottles mounted on a single row or special frame for being mounted on a double row.



## Continuous weighing system

The continuous weighing system has been developed and patented by the R&D department of Aguilera Electrónica. It is based on traction and electronic circuit extensometric load cell technology with a microprocessor and display.

The display shows the weight of the cylinder (tare + load). The device has lights and alarms that draw attention to any weight loss greater than 200 grams, faults in the equipment and signals from another connected weight control device.

# at a glance

## Modular bottles with continuous weighing

High pressure bottles made of thermally-treated alloy steel without welding, (according to European Directive 84/525/CEE). Working pressure 60 bar, test pressure 250 bar, service temperature from -10°C to +60°C. Engraved and painted according to the regulations.

Equipped with: 1" main valve AEX/VCO100 made of forged brass with stainless steel piston and shaft. Provided with safety disc and relief valve to avoid triggering if leaks. Syphon tube, trigger solenoid, (feeding 24V and 500mA of consumption), flange and protection cap.

- System for continuous weighing, where the weight of each bottle is individually controlled by an analogue equipment Mod. AEX/CPC2. Programmable unit detecting weight loss from 200 gr., basically formed by an electronic cell, micro-processor and digital display showing the weight permanently. Provided with an anchorage system allowing the bottle to be easily lifted, connectors with hoses assembled for connection and the rest of complements.
- Assembled on a metal frame special for continuous weighing and discharge collector with thread coupling to the installation.



## Centralised systems with continuous weighing

High pressure arrays composed of High pressure arrays composed of 67 and 80 L-capacity bottles. Made of thermally-treated steel, without welding (according to European Directive 84/525/CEE). Working pressure 60 bar, test pressure 250 bar, service temperatures from -10°C to +60°C. Engraved and painted according to the regulations.

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## Directional valves

Directional valves approved according to the EN 12094-5 standard. Useful for performing the protection of several risks through a single extinguishing system, autonomous bottle or bottle array. Manufactured in different sizes depending on the flows needed:

$\frac{3}{4}$ ", 1", 1 1/4", 1 1/2", 2", 2 1/2" and 3".

Pneumatic operation is performed through a small pilot bottle of propellant agent and a trigger system designed according to the risk to be protected for 2 or 3 directional valves.

Both the small pilot bottle and the trigger system can operate in automatic or manual mode. Operation causes the propellant agent outlet towards the corresponding directional valve making it open. With this configuration, the directional valve opening is produced with the valve idle and when the extinguishing agent is discharged, the directional valve is in open position.

The valve is provided with an anchorage system in its opening position, which can only be modified in manual mode. Such position is shown with the plunger spindle protruding from the valve body.

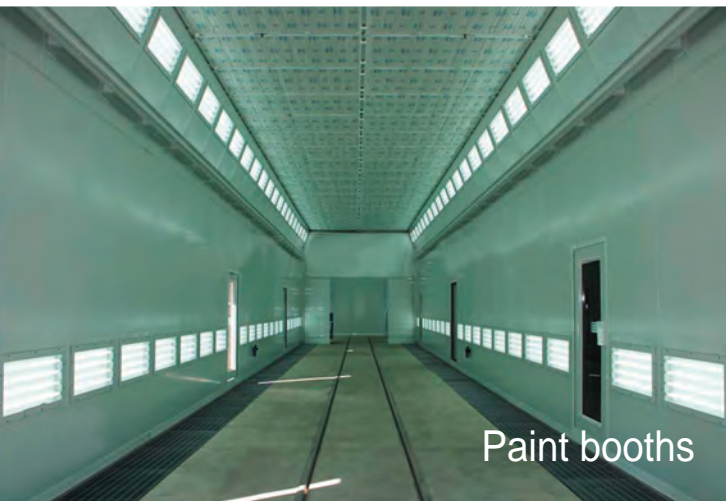




Storage areas



Transformation centres



Paint booths



Electrical power stations  
and substation



# Applications

- Storage areas for flammable liquids.
- Printing processes.
- Cooling tanks.
- Fume exhaust ducts.
- Paint processes.
- CPU/False floors in computer rooms.
- Switching electrical substations
- Deep-fryers-/furnaces.
- Cooker hoods.
- Electrical cabinets.
- Transformation centres.



# Characteristics of the installations

In order to achieve appropriate discharge from the extinguishing agent through diffusers and allowing homogeneous concentration in the place to be protected, the following points should be observed:

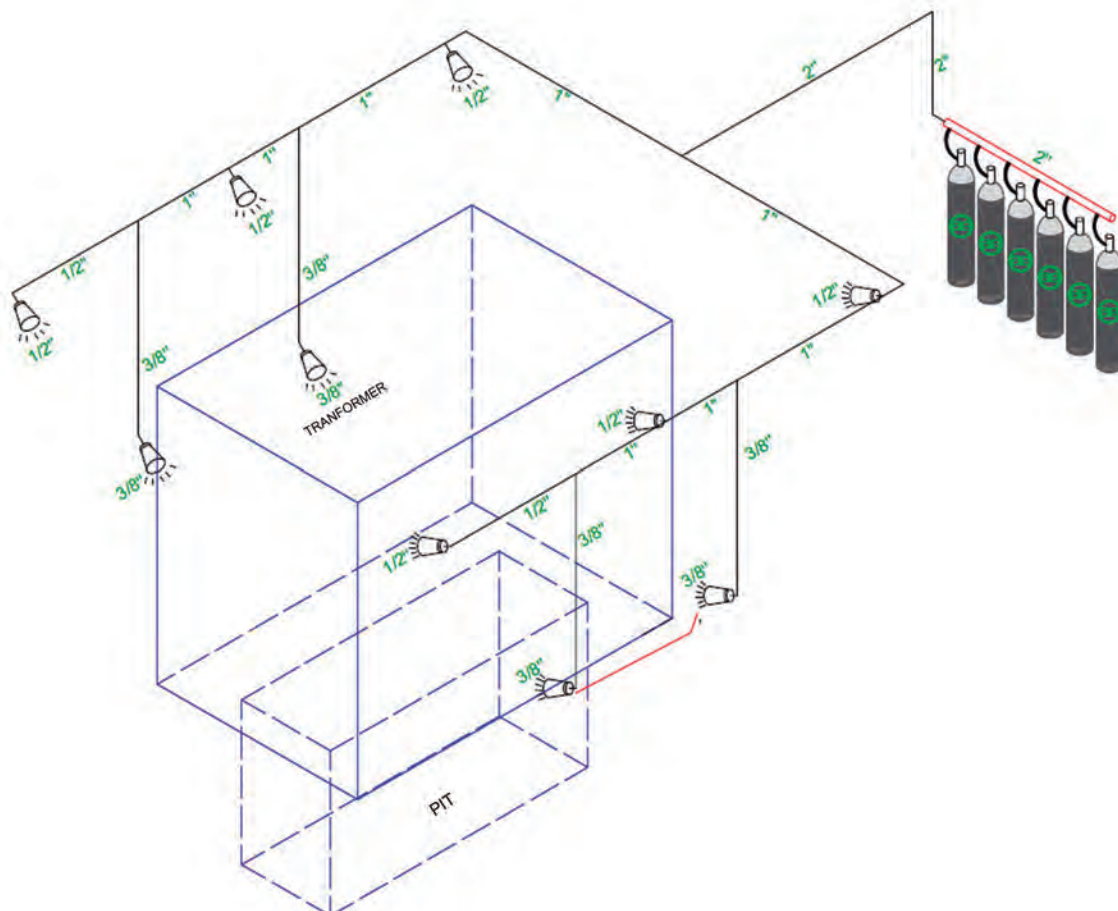
- The minimum discharge flow for liquefied gases should be sufficient for maintaining the speed needed for the turbulent flow and therefore avoiding the separation of the liquid phase from the gas phase which would generate unpredictable flow characteristics.
- Pressure reached at the discharge diffuser inlet after discounting losses by friction and height changes, should be the minimum needed to allow the extinguishing agent gasification on that point as well as the covering required.
- The installation geometry and the location of the storage tanks should be fixed in such a way that the system is balanced and not causing unneeded leaks due to long trips along the installation from the storage to discharge points.

- The extinguishing agent discharge should be performed in a short time (60 sec.) for the fire not to reach size and temperature making the extinguishing agent decompose, which would damage the persons in the place to be protected.

- Any change on the original design would produce variations in the diffuser calibration and sizing of the distribution network piping of the extinguishing agent.

To ensure an appropriate diffuser discharge, a suitable hydraulic program calculation should be provided, which should be able to carry out reiterations needed, considering the limitations mentioned above and variables entered.

Aguilera Extinción has the best hydraulic program in the market for carrying out the pipe sizing calculation and diffuser calibration of the installations through the CO<sub>2</sub> extinguishing agent.



# Our commitment: services and y guarantees



## Projects

Grupo Aguilera offers engineering companies its support in the detection, control and extinguishing of fires advising on systems and covering for each building. The project department develops

The system design and dimensioning, hydraulic calculations, diffusers calibration and installation isometric advising on the effectiveness of the units in each risk and setting out the operating capacity .



## Trainig

Aware of the need to know and control what we are doing, apart from the technical support provided to the installations where our products are used, Grupo Aguilera offers training courses on our equipment performance, installation and programming.



## Customer service

At Grupo Aguilera each customer is important, we are aware of the different needs for each customer, this is the reason why our team of experts offers customized service meeting your requirements.



## Maintenance

Grupo Aguilera commits itself to offering services on repair, reprogramming and original spare part supply after the guarantee period.



## Technical support

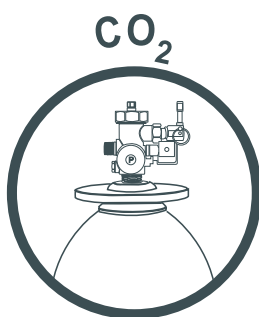
With the aim of guaranteeing the correct operation of the installations, Grupo Aguilera Technical department carries out the operation and start-up test of the units, apart from collaborating with the installer in all the steps. Once the system is installed with the suitable power and water supply, and the hydraulic test has been previously carried out, Grupo Aguilera technical staff carries out the operation test and the start-up of the units.



## Equipment guarantee

Grupo Aguilera guarantees the correct performance of the equipments for 2 years since the delivery date: we are responsible for the replacement and repair of the equipments where anomalies or manufacturing faults are observed and are delivered from our factory in Madrid.





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