Kidde engineers developed carbon dioxide fire extinguishing over 80 years ago and Kidde have been responsible for every major improvement that has been made in this branch of fire protection. Kidde Fire Protection benefits from the accumulated experience of thousands of installations in power plants, industrial plants, oil refineries, electronic processes, on ships and in a wide variety of hazardous areas.

**CO₂ is versatile**
The CO₂ is stored as liquid, under pressure. When a system is activated, the liquid CO₂ flows through discharge pipework to specially designed nozzles. The agent's low boiling point means that the liquid vaporises rapidly during the discharge, providing a penetrative three-dimensional action. The rapid expansion of the gaseous agent allows fires to be targeted even in the most inaccessible areas of the risk.

Fire is extinguished by reducing the oxygen level in the risk area to the point where combustion cannot be sustained. Cooling is a secondary action of the agent; this feature is used in local applications where the liquid phase of the discharge is applied directly to the fire and risk materials.

**CO₂ is fast and efficient**
The Kidde Fire Protection High Pressure CO₂ system uses large bore cylinder valves, enabling high mass flow rates to be achieved. The fast action of the control system and valve enables the system to react within the first few seconds of a fire that can make the difference between a nuisance and a disaster.

**CO₂ is clean**
CO₂ is a colourless, odourless, dry, inert gas and is one of the most familiar of all gases. After extinguishing a fire it vapourises fully leaving no residue. There is no mess, nothing to clear up, no water damage. It is non-corrosive and will not contaminate foodstuffs. It is non-conductive and so can be used on energised electrical equipment. It can be safely used to protect delicate electronic equipment, antiquities or archive materials.

**CO₂ is low cost**
Carbon dioxide is a standard commercial product with many other uses and it is readily available throughout the world. Because of its universal use it can be obtained inexpensively and this is an important consideration when frequent recharging of storage containers is necessary as in local application systems, where fires may be more frequent.
CARBON DIOXIDE CO2

Benefits
- High flow ‘Klem’ cylinder valve
- Manual or Automatic operation
- Pilot cylinder or Direct Acting Solenoid operating system
- Continuous weight monitoring option
- Design compliance with BS5306-4
- Fully compatible with Kidde Fire Protection control panels

Typical applications
- Flammable liquid storage areas
- Printing presses, flow solder machines
- Quench tanks/exhaust fume ducts
- Paint spray booths
- Fryers/ovens
- EDP/computer rooms and floor voids*
- Commercial kitchens
- Transformers
- Generators

* CO2 is not the agent of choice for manned areas. Please contact Kidde Fire Protection Applications Department for more information.

System design
Details of both total flooding and local application systems are contained in the Kidde Fire Protection CO2 Design Manual.

Flexible design
The wide range of components manufactured by Kidde Fire Protection enables systems to be engineered to suit individual customer requirements. Systems can be either automatically or manually operated and arranged to protect single or multi-zone hazards and with any number of reserve discharges. Automatic control can be achieved mechanically, pneumatically or electrically or by any combination of these to suit site conditions.

Facilities are available for providing a pre-alarm and delayed discharge as well as various methods of preventing automatic release while protected rooms are occupied by personnel.

Audible and visual indications of system control can be provided together with facilities to automatically shut fuel valves, fire doors, dampers and shutters by either mechanical or electrical devices.

CO2 is stored in solid drawn steel cylinders manufactured to European Standards. The storage pressure varies with ambient temperature and is 58.6 bar at 21°C.

Any number of cylinders can be manifolded together and simultaneously released to provide the total design requirement of CO2.

Approvals
Major approvals for the Kidde Fire Protection CO2 system include:
- FM Global
- Lloyd's Register
- American Bureau of Shipping
- Det Norske Veritas
- UK Maritime and Coastguard Agency (MCA)
- Germanischer Lloyd
Total Flooding Systems
Total flooding systems extinguish fires by rapidly discharging CO\textsubscript{2} into an enclosed volume to create an atmosphere that is incapable of supporting combustion.

The agent mixes homogeneously in the risk area to generate a CO\textsubscript{2} concentration by volume of at least 34%. This concentration of CO\textsubscript{2} presents a serious hazard to personnel and under no circumstances should CO\textsubscript{2} be released into areas that may be manned at the time of discharge.

Total flood CO\textsubscript{2} systems are ideal for unmanned applications such as transformer rooms, remote switch rooms, generators and archives. All systems should be installed with safety systems in place to prevent the inadvertent release of agent into occupied spaces. Kidde Fire Protection offers time delays, isolating valves including distribution valves and control head lockout pins to facilitate the safe use of CO\textsubscript{2}.

Legend
1. CO\textsubscript{2} cylinder
2. Cylinder valve and actuator
3. Solenoid
4. Nitrogen pilot cylinder and control head
5. Manual push button
6. Pressure relief device
7. Isolating valve
8. Discharge pressure switch
9. Pilot bleed
10. Pressure trip
11. Extinguishing Control Panel
12. Status indicator unit
13. Status indicator with release control
14. 1st stage alarm sounder
15. 2nd stage alarm sounder
16. Discharge nozzle
17. Fire door
18. Smoke detector
19. Air exhaust duct
20. Self-closing weight operated damper

Automatic CO\textsubscript{2} Extinguishing System

Key
- CO\textsubscript{2} Pipework
- Electrical Transmission Path
- Pilot Circuit
Local Application
This method of system design is used to protect hazards that are open or have only partial enclosure, situated within a larger area that would be unsafe or uneconomic to protect using a total flood system. Discharge nozzles are placed so as to provide direct agent flow at the points and areas prone to fire. The direct contact of the rapidly expanding CO₂ provides efficient cooling and the gas dramatically reduces the oxygen concentration in the hazard zone.

Local application systems are designed to provide extremely fast discharges to ‘knock down’ the fire in a matter of seconds. These systems are very effective and are often installed with connected reserve banks so that the systems can be reinstated during the same shift as a fire event, while the empty cylinders are recharged.

Legend
1  CO₂ cylinder
2  Cylinder valve and actuator
3  Pneumatic actuator
4  Nitrogen pilot cylinder and control head
5  Discharge pressure switch
6  Pressure relief device
7  Isolating valve
8  Pressure trip
9  Break glass pull box
10 Discharge nozzle, multi-jet horn
11 Pneumatic, rate of rise detector
12 Flanged, multi-jet nozzle
13 Self-closing weight operated damper
System Information

Total Flooding Systems

Surface Fires
Fires involving flammable liquids, gases or solid materials not subject to smouldering are known as surface fires.

The design concentration of CO₂ provided must be maintained for 10 minutes.

Basic quantities of CO₂ for various space volumes may be calculated from Table 1.

The basic quantity of CO₂ is factored according to the risk material. Some typical values are shown in Table 2.

Deep-Seated Fires
A fire involving a solid material that is subject to smouldering is called a deep-seated fire.

Rooms containing these materials should have no openings that cannot be automatically closed, other than small openings or pressure vents near the top of the enclosure.

Additional quantities of CO₂ are needed and held within the space for not less than 20 minutes.

Recommended design concentrations for various hazards are shown in Table 3.

Integrity and Venting Requirement
Total flood suppression systems rely on the enclosure retaining the required gas concentration for a period of time known as the hold time. The ability of the hazard enclosure to retain the gas for the required hold is usually determined by door fan integrity testing. If the test shows that the leakage would reduce the hold time below that specified for the fire type, additional CO₂ must be provided.

The release of CO₂ into a tightly sealed enclosure could result in damage caused by pressure variations during discharge. Normally the natural leakage of an enclosure is adequate to prevent damage but in some cases pressure relief venting may be required.

System Information

Local Application Systems

Volume Method
The volume method of system design is used where the fire hazard consists of three dimensional irregular objects that cannot easily be reduced to equivalent surface area.

The total discharge rate of the system is based on the volume of an assumed enclosure surrounding the hazard. The basic design rate is 16 kg/min/m³ but this can be reduced according to the degree of existing enclosure on site.

Area Method
The quantity of CO₂ required is based upon the total discharge rate from a carefully sited nozzle arrangement, a sufficient number of nozzles being used to adequately cover the entire area on the basis of the unit area protected by each nozzle.

For this method of design, where a horizontal or vertical flat surface is protected, nozzles are to be positioned in accordance with the guidance of the Kidde Fire Protection CO₂ Design Manual. The position and distance from the hazard has a critical effect on the quantity of CO₂ required.

This protection methodology is well suited to painting, dipping and drying type applications.

Table 1
Determination of basic CO₂ quantity

<table>
<thead>
<tr>
<th>Volume (m³)</th>
<th>Factor (kg m⁻³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;4</td>
<td>1.15</td>
</tr>
<tr>
<td>&gt;4 &gt;14</td>
<td>1.07</td>
</tr>
<tr>
<td>&gt;14 &gt;45</td>
<td>1.01</td>
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<tr>
<td>&gt;45 &gt;126</td>
<td>0.90</td>
</tr>
<tr>
<td>&gt;126 &gt;1400</td>
<td>0.80</td>
</tr>
<tr>
<td>&gt;1400</td>
<td>0.74</td>
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</table>

Table 2
Determination of higher concentrations for specific hazards

<table>
<thead>
<tr>
<th>Capitalise factor</th>
<th>Factor</th>
</tr>
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<tbody>
<tr>
<td>Acetylene</td>
<td>2.5</td>
</tr>
<tr>
<td>Benzene</td>
<td>1.1</td>
</tr>
<tr>
<td>Butadiene</td>
<td>1.3</td>
</tr>
<tr>
<td>Ethyl Ether</td>
<td>1.5</td>
</tr>
<tr>
<td>Ethylene</td>
<td>1.6</td>
</tr>
<tr>
<td>Hexane</td>
<td>1.1</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>3.2</td>
</tr>
<tr>
<td>Kerosene</td>
<td>1.0</td>
</tr>
<tr>
<td>Petrol</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Note: MCF of 1.0 is equal to a concentration of 34%

Table 3
Concentrations for deep-seated hazards (BS5306-4)

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Flooding Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry electrical wiring and insulation</td>
<td>1.35 kg m⁻³</td>
</tr>
<tr>
<td>Computer equipment</td>
<td>1.50 kg m⁻³</td>
</tr>
<tr>
<td>Data processing and tape storage</td>
<td>2.25 kg m⁻³</td>
</tr>
<tr>
<td>Record stores/archives</td>
<td>2.00 kg m⁻³</td>
</tr>
<tr>
<td>Dust collectors</td>
<td>2.70 kg m⁻³</td>
</tr>
</tbody>
</table>
### Ordering information for typical pilot cylinder actuated CO₂ system (up to 10 off 45kg cylinders)

<table>
<thead>
<tr>
<th>Description</th>
<th>Part No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 kg CO₂ Cylinder (full)</td>
<td>K24069/FM or E7194-001-01</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
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<td>10</td>
</tr>
<tr>
<td>2 Cylinder 1” Manifold</td>
<td>K21207</td>
<td>1</td>
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<tr>
<td>3 Cylinder 1” Manifold</td>
<td>K21209</td>
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<td>4 Cylinder 1” Manifold</td>
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<td>5 Cylinder 1” Manifold</td>
<td>K21213</td>
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<tr>
<td>Combination of 1” or 1 1/4” manifolds as required</td>
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<td>*</td>
<td>*</td>
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<tr>
<td>Single Row M/Fold Blt. 1”</td>
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<td>2</td>
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<td>Flexible Loop</td>
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<tr>
<td>Pressure/Lever Actuator</td>
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<td>2 Cylinder Backrack</td>
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<tr>
<td>3 Cylinder Backrack</td>
<td>K17235</td>
<td>2</td>
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<td>4</td>
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<tr>
<td>2 Cylinder Frontstrap</td>
<td>K13744</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>2</td>
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<tr>
<td>3 Cylinder Frontstrap</td>
<td>K13745</td>
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<tr>
<td>Single Row Rack Bolt inc nuts</td>
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<tr>
<td>Hose/ Pipe Adapter</td>
<td>K62755</td>
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<tr>
<td>System Control Head</td>
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<tr>
<td>Solenoid (std) 24V DC</td>
<td>K62422B</td>
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<tr>
<td>Pilot Cylinder</td>
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<tr>
<td>Wall Mount</td>
<td>K62487</td>
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<tr>
<td>Pilot Vent (Bleed)</td>
<td>K24051</td>
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<td>1</td>
<td>1</td>
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<tr>
<td>Pilot Loop (Long)</td>
<td>K93434</td>
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<tr>
<td>Pilot Loop (Short)</td>
<td>K93433</td>
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<td>1</td>
<td>1</td>
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<td>1</td>
<td>1</td>
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</tr>
<tr>
<td>Single Cylinder Strap</td>
<td>K62943</td>
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</tr>
</tbody>
</table>

**Other equipment to suit specific systems**
- Discharge nozzles
- Warning labels (metal or self-adhesive)
- Pressure switch
- Break glass pull box
- Pneumatic time delay unit
- Pressure relief devices
- Pressure Operated Direction valve
- Isolating valve
- Control and detection equipment
- Alarm devices
- Mechanical detection/actuation (As required)
**Direct-acting CO₂ solenoid**
Designed for use with standard Kidde Fire Protection 45kg CO₂ cylinders, the direct-acting solenoid allows CO₂ systems to be actuated electrically without the need for a separate pilot nitrogen supply.

The solenoid actuation system uses a modified version of the existing cylinder valve, replacing the nitrogen pilot cylinder with a solenoid directly coupled to the CO₂ cylinder valve. The system also retains the facility for local manual release or via a mechanical pull cable.

**Operation**
The pressure/manual actuator (K62341) is fitted to the cylinder (Klem) valve, with the solenoid assembly (D8522-003) attached to the poppet orifice connection by means of a swivel nut and O-ring seal. The solenoid assembly has a flexible hose connection to the pressure/manual actuator.

In the unactivated state, the pneumatic actuator is subject only to atmospheric pressure and the Klem valve remains closed. On receipt of an electrical signal from an extinguishant release control panel, the solenoid coil is activated, releasing high pressure CO₂ from the cylinder. The CO₂ passes through a short flexible hose to the pressure/manual actuator, which then operates the Klem valve, allowing CO₂ to exit via the discharge port. Further CO₂ cylinders may be discharged by interconnecting the pressure/manual actuators using flexible pilot hoses (K93433).

Metron actuator with manual lever (D8521-002), ideal for single cylinder electrical operation, is also available.
### Specification

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>E7772-004</td>
<td>45kg CO₂ cylinder c/w direct-acting solenoid valve and full assembly, comprises:</td>
<td>1</td>
</tr>
<tr>
<td>D7226-007</td>
<td>45kg CO₂ cylinder assembly c/w Klem valve</td>
<td>1</td>
</tr>
<tr>
<td>D8522-003</td>
<td>Klem valve solenoid assembly</td>
<td>1</td>
</tr>
<tr>
<td>K93433</td>
<td>Bundy tube, flexible loop</td>
<td>1</td>
</tr>
<tr>
<td>K62341</td>
<td>Actuator, pressure/manual</td>
<td>1</td>
</tr>
<tr>
<td>D7564-001</td>
<td>Bleed assembly</td>
<td>1</td>
</tr>
</tbody>
</table>

### Parts Description
- **Pressure/Manual Actuator** K62341
- **Manual Lever** (shown in fired position)
- **Safety Pin**
- **Retention Pin**
- **FLEXIBLE LOOP** K93433
- **Bleed Assembly** D7564-001 (or pilot loop connection to next cylinder)
- **Solenoid Assembly** D8522-003
- **Modified Klem Valve** (included in cylinder assembly)
- **CO₂ Cylinder and Modified Klem Valve Assembly**

### Technical Details

- **Voltage range**: 18V DC to 28V DC
- **Current at 28V DC**: 526 mA
- **Minimum firing pulse**: 60mS
- **Electrical connection**: DIN plug type DIN 43650
- **Maximum working pressure**: 152.5 bar (g)
- **Current at 18V DC**: 338 mA
- **Nominal coil resistance**: 53.2 Ohm
- **Maximum firing pulse**: Unlimited
- **Operating temperature range**: -20°C to +55°C
- **Environmental protection**: BS EN 60529 1991 IP65

Kidde Fire Protection operates a continuous programme of product development. The right is therefore reserved to modify any specification without prior notice.