FIRE SUPPRESSION SYSTEM

An effective fire suppression systems work fundamentally in three ways; The corner stone has to be an efficient means of early warning/detection. Followed by either an Oxygen reduction system (achieved by the use of an Inert gas fire suppression system such as IG55 or IG541), or alternatively heat absorption (achieved by the use of a synthetic agent system such as FM200 or Novec1230).

Design: Any fire burns when it has sufficient Heat, Oxygen and Fuel. The suppression system is designed to remove one or more of the elements.

Inert Gas Fire Suppression: These reduce Oxygen to below 15%. With Oxygen levels at around 15% and below, combustion is not possible. Fire suppressants such as INERGEN, IG55 and IG541 are designed to reduce oxygen levels to below 15% but higher than 12%. This means that it is safe for the occupants of the enclosure to egress safely post discharge.

The cost depends on the following parameter:

- Type of gas used
- Type of detection used
- Size of the enclosure
- Number of voids within the enclosure, i.e. Ceiling and floor voids
- Where about in the building will the system be installed
- Cooling systems used that will affect the system
- The integrity of the room, i.e. wall strength etc

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FM200 FLOODING SYSTEM

FM-200 is a clean, colorless, and environmentally friendly fire suppression agent that is electrically non-conductive and safe for humans. It extinguishes flames primarily through heat absorption, leaving no residue, thus minimizing downtime after a fire and making FM-200 suppression systems accepted and respected worldwide with over one hundred thousand installations in more than seventy countries.

These systems consist of the following components and their associated accessories:

1. **FM-200 Storage Components** - Storage components consist of the cylinder assembly(s), which contains the FM-200 chemical agent, and the cylinder bracket(s), which holds the cylinder assembly securely in place.
2. **FM-200 Distribution Components** - Distribution components consist of the discharge nozzles used to introduce the FM-200 into a protected hazard along with the associated piping system used to connect the nozzles to the cylinder assembly.
3. **Trim Components** - Trim components complete the installation of the FM-200 system and consist of connection fittings, pressure gauge, low-pressure supervisory switch, electric valve actuator, and manual valve actuator.
4. **Slave Arrangement Components** - Slave arrangement components consist of the pneumatic valve actuator(s), actuation check valve, vent check, actuation hose, and fittings required for a multiple cylinder (slave) arrangement.
5. **Supplemental Components** - Supplemental components include the discharge pressure switch and manifold check valve. They supplement the core equipment or complete a specific multi-cylinder configuration.
6. **Control Panel** - This device monitors the condition of the electric actuator, detectors, warning devices, cylinder pressure, and any manual release and abort stations. All electric or electronic devices must connect to the control panel in order to function.
7. **Early Warning Detection and Alarm Devices** - Early warning detection devices coupled with manual release and abort stations maximize system efficiency while audible and visual alarm devices alert staff of alarm conditions.
**Equipment Description**

FM-200 fire extinguishing systems are designed to be discharged within 10 seconds into a room, area, or enclosure with the structural integrity to retain the agent. The FM-200 uniformly mixes throughout the protected area achieving a minimum concentration level in accordance with NFPA 2001 and/or agency listings.

**Chemical Properties Of FM-200**

FM-200 (HFC-227ea) is formed from the elements carbon, fluorine and hydrogen (CF₃CHFCF₃ - heptafuoropropane). The primary extinguishing mechanism of FM-200 is heat absorption, with a secondary chemical contribution from the thermal decomposition of FM-200 in the flame.

FM-200 leaves no residue and is safe for use in occupied spaces.
Most common metals, such as aluminum, brass, steel, cast iron, lead, stainless steel, and copper, as well as rubber, plastic, and electronic components, are unaffected when exposed to FM-200.

**Typical Areas Of Fire Protection**

- Telecommunication facilities
- Computer rooms
- Control rooms
- Museums
- Historical archive storage
- Art galleries
- Pharmaceutical and medical facilities

**Benefits of Installing an FM-200 Fire Suppression System**

1. **The FM-200 fire suppression is fast.**
   
The FM-200 fire suppression system contains sensitive detectors that can detect even the smallest fires. Once the FM-200 fire suppression system discovers a fire in the room, the FM-200 system can respond in a matter of seconds, flooding the area with the extinguishing agent and preventing the fire from getting out of control.

2. **The FM-200 fire suppression system is clean.**
   
   When the FM-200 fire suppression system discharges, it releases as a gas rather than as a foaming agent, so there’s no leftover residue to damage even the most sensitive equipment. Since there’s no clean up, you can quickly get back to business with all your systems intact.

3. **The FM-200 fire suppression system is safe.**
   
   When there’s a fire and the FM-200 fire suppression system floods the room with gas to eliminate the fire, people may be exposed to and breathe in the gas. However, the FM-200 agent is entirely safe and will not cause any issues with breathing or vision.

4. **The FM-200 fire suppression system is environmentally friendly.**
   
   The FM-200 fire suppression systems are popular for being a “green” alternative to the previous Halon fire suppression systems. The clean FM-200 fire suppression systems are eco-friendly and actually have a zero Ozone Depletion Rate! When using an FM-200 fire suppression system, you won’t have to worry about hurting the environment.

   The FM-200 fire suppression system is one of the most technologically advanced fire protection systems on the market today. With its ability to protect your most valuable assets quickly and efficiently while being environmentally friendly, the FM-200 fire suppression system is a must for any commercial business.
CARBON DIOXIDE SUPPRESSION SYSTEMS

Carbon dioxide (CO₂) is a colorless, odorless, and chemically inert gas that is both readily available and electrically non-conductive. It extinguishes fire primarily by lowering the level of oxygen that supports combustion in a protected area. This mechanism of fire suppression makes CO₂ suppression systems highly effective, requiring minimal clean-up, but should be used in normally unoccupied hazard locations or otherwise avoided by personnel when discharged. CO₂ suppression systems may utilize the gas through a total flooding approach but carbon dioxide is also the only gaseous agent that may be utilized through local application. Carbon dioxide may be stored in either high pressure spun steel cylinders (HPCO₂ suppression systems) or low pressure light wall refrigerated tanks (LPCO₂ suppression systems).

NOTE: Both HPCO₂ and LPCO₂ systems are equally effective at fighting fires. Neither one is better than the other in terms of extinguishment.

Types of Carbon Dioxide Fire Suppression Systems

Today, the NFPA Standard on CO₂ extinguishing systems recognizes two types of carbon dioxide systems. The first type is the familiar high pressure CO₂ systems, and the second type is the low pressure CO₂ system. The basic difference between the two types of systems lies in the method of storing the carbon dioxide.

The high pressure system utilizes DOT spun steel storage cylinders. These cylinders are kept at room temperature and the pressure within the cylinder varies according to temperature. At a 70 degrees F ambient temperature, the internal pressure in such a unit would reach 850 PSI. These cylinders are available in 50, 75 and 100 pound capacities.

On the other hand, the low pressure storage unit maintains the CO₂ in a refrigerated pressure vessel. Typical storage temperature is 0 degrees F with a corresponding CO₂ vapor pressure of 300 PSI. The refrigerated storage concept uses an ASME coded pressure vessel with a 350 PSI working pressure. Such units are available in standard capacities from 1 1/4 through 60 tons. Larger units have been made for special applications.

From this basic difference in storage configuration, different methods of application and control for the two types of systems are derived. Since the maximum capacity of a high pressure cylinder is 100 pounds of CO₂, most systems consist of multiple cylinders manifold together to provide the required quantity of carbon dioxide. Each cylinder has its own individual discharge valve and once opened, the cylinder contents will completely discharge.

Low Pressure vs High Pressure

Before we enter into a more detailed examination of the low pressure CO₂ fire protection concept, let us review some of the comparative features of low pressure and high pressure CO₂ systems. In the area of design flexibility and fire fighting capability, we find that with a low pressure system, it is usually impractical to protect many small hazards scattered throughout a facility. The high pressure system does lend itself to covering very small hazards with individual cylinders located through a plant facility. In
contrast, low pressure easily can handle much average to large size hazards plus hose reel systems from a single storage unit.

Multiple hazard protection by single cylinder bank of high pressure cylinders is often limited by design complexities as well as hazard to storage distance. The low pressure system can cover hazards at distances of 500 feet or more from the storage unit. In the area of fire fighting capability, we find that 47 percent of a discharge from low pressure storage reaches the hazard as dry ice particles. This provides a greater local application and hand hose line effectiveness and also greater cooling capacity. With high pressure, only 28 percent of the discharge is dry ice particles and the local application and hose line effectiveness is somewhat diminished.

With a low pressure system, almost all of the liquid in the storage container is effective for local application fire fighting. When using high pressure for local application, at least 40 percent additional liquid is required in storage. With the low pressure concept, a second discharge into the same or in another hazard is available without any manual manipulation, switch over or time loss. A switch over to a reserve bank is required before a second discharge can be accomplished with a high pressure system. We find that extension of protection to future hazards is more easily accomplished in a properly sized low pressure system than in a high pressure system. It is also possible to design for simultaneous discharge into several inter-exposed hazards with a low pressure system. Simultaneous discharge would require added controls and/or storage capacity when utilizing high pressure CO₂.

**HPCO₂ Advantages**

HPCO₂ systems have several advantages over LPCO₂ systems.

- Less expensive for smaller systems
- Stored in US-DOT compliant High spun cylinders.
- Cylinders come in 3 different sizes
- Easy to install
- Readily Available
- Fewer Components
**LPCO₂ Advantages**

LPCO₂ systems have several advantages over HPCO₂ systems.

- Do not require hydrostatic testing
- Continuous monitoring of the liquid level and tank pressure; the liquid level gauge provides standard alarm outputs or an optional 4-20mA output (HPCO₂ cylinders must be removed from service semi-annually to be weighed)
- Require 40% less floor space and less floor loading than HPCO₂ systems
- Multi-shot capabilities without any switch over to a reserve
- Hazards may be added to an existing LPCO₂ system at anytime
- LPCO₂ Storage Units can be refilled while remaining in service; HPCO₂ cylinders must be uninstalled, sent out to a refill location, and replaced
Lower material cost when systems require more than 4000 lbs (1814kg) of carbon dioxide (40 or more 100 lb (45 kg) HPCO₂ cylinders)
- For critical installations, dual refrigeration options are available for LPCO₂ Storage Units
- LPCO₂ systems are 30% more efficient than HPCO₂ systems at local application
- LPCO₂ systems have lower overall maintenance costs than HPCO₂ systems

**Typical Areas Of Fire Protection**
- Flammable liquid storage
- Transformers
- Rotating electrical equipment
- Power generation
- Metal processing facilities
- Printing industry
- Paint mix

**Benefits of Installing Carbon Dioxide Suppression System**
- Fast fire extinguishing system
- Effective on deep-seated fires in engine rooms, pump rooms and cargo holds
- Safety release delay designed for crew security
- Can utilize CO₂ gas distribution piping to cargo holds for smoke sampling
- Effective on deep-seated fires in engine rooms, pump rooms and cargo holds
- CO₂ has an Ozone Depletion Potential (ODP) of zero and a Global Warming Potential (GWP) of 1
- Uses CO₂ gas recovered from an industrial process – kinder to the environment

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NOVEC 1230

Novec 1230 fire protection fluid is a next generation clean agent Halon alternative. It combines outstanding extinguishing performance with an excellent environmental profile. Novec 1230 fire protection fluid has zero ozone depletion potential, a global warming potential of one, a five day atmospheric lifetime, and a large margin of safety for occupied spaces. Novec 1230 fire protection fluid extinguishes fire primarily by removing heat from the fire. It is also electrically non-conductive.

Each system consists of the following components and their associated accessories:

1. **Agent Storage Components** - Storage components consist of the cylinder assembly(s), which contains the Novec 1230 fluid, and the cylinder bracket(s), which holds the cylinder assembly securely in place.

2. **Agent Fluid Distribution Components** - Distribution components consist of the discharge nozzles used to introduce the Novec 1230 fluid into a protected hazard along with the associated piping system used to connect the nozzles to the cylinder assembly.

3. **Trim Components** - Trim components complete the installation of the suppression system and consist of connection fittings, pressure gauge, low-pressure supervisory switch, electric valve actuator, and manual valve actuator.

4. **Slave Arrangement Components** - Slave arrangement components consist of the pneumatic valve actuator(s), actuation check valve, vent check, actuation hose, and fittings required for a multiple cylinder (slave) arrangement.

5. **Supplemental Components** - Supplemental components include the discharge pressure switch and manifold check valve. They supplement the core equipment or complete a specific multi-cylinder configuration.

6. **Control Panel** - This device monitors the condition of the electric actuator, detectors, warning devices, cylinder pressure, and any manual release and abort stations. All electric or electronic devices must connect to the control panel in order to function.

7. **Detection and Alarm Devices** - Detection devices coupled with manual release and abort stations maximize system efficiency while audible and visual alarm devices alert staff of alarm conditions.
Equipment Description

Fire suppression systems utilizing Novec 1230 fluid are designed to be discharged within 10 seconds into a room, area, or enclosure with the structural integrity to retain the agent. The Novec 1230 fluid uniformly mixes throughout the protected area achieving a minimum concentration level in accordance with NFPA 2001 and/or agency listings.

Fire Systems cylinder assemblies are available at either 360 psi (24.8 bar) or 500 psi (34.48 bar) storage pressures for Novec 1230 fluid. Storage at 500 psi allows the capability to pipe greater distances, to use smaller diameter piping, and to design more complex piping configurations.

Below is a list of the available cylinder assembly sizes Fire Systems offers for Novec 1230 fluid:

<table>
<thead>
<tr>
<th>Nominal Cylinder Size</th>
<th>Fill Capacity Minimum</th>
<th>Fill Capacity Maximum</th>
<th>Valve Discharge Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lb</td>
<td>kg</td>
<td>lb</td>
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<tr>
<td>40 lb</td>
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<td>41</td>
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<tr>
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<tr>
<td>1000 lb</td>
<td>561</td>
<td>254.5</td>
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</table>
Chemical Properties Of Novec 1230 Fluid

Novec 1230 fluid is formed from the elements carbon, fluorine and oxygen [CF$_3$CF$_2$C(O)CF(CF$_3$)$_2$ - dodecafluoro-2-methylpentan-3-one]. The primary extinguishing mechanism of Novec 1230 fluid is heat absorption, with a secondary chemical contribution from the thermal decomposition of Novec 1230 fluid in the flame.

Novec 1230 fluid leaves no residue and is safe for use in occupied spaces.

Ozone Depletion Potential (ODP) – Novec 1230 fluid is a highly fluorinated ketone containing no chlorine or bromine. As a result, the ODP for Novec 1230 fluid is zero, meaning it has no effect on stratospheric ozone.

Global Warning Potential (GWP) – Novec 1230 fluid has an atmospheric lifetime of only 0.014 years. The global warning potential for all practical purposes is negligible.

Typical Areas Of Fire Protection

- Computer Rooms
- Data Storage Facilities
- Telecommunications
- Oil & Gas Petrochemical Facilities
- Museums
- Libraries and Archives
- Medical Facilities
- Manufacturing Facilities & Storage Areas

Benefits:

- Provides a high safety margin with a 4.2% use concentration and a 10% NOAEL level.
- Listed for protection against Class A, Class B and Class C fires.
- Is a fluid a atmospheric pressure and can be gravity fed for easy re-charge.
- Extinguishes fire through heat absorption and not oxygen reduction.