CO_2 Gas Fire Suppression system

PRE - INTRODUCTION:

The importance of erection, testing and commissioning are overlooked, in many projects while installing fixed CO_2 extinguishing system. It is very common that CO_2 cylinder bank including manifold fabricated locally at site.

It is very difficult to ensure the proper integration of entire cylinder bank assembly which involves critical instrumentation activities like solenoid connection, pneumatic actuation, continuous gas weight monitoring arrangement etc to ensure proper function of entire system.

bala-wa series.. High pressure fixed installation CO_2 cylinder banks are fully pre-assembled integrated and tested for its proper operation at the factory itself. Customer and consultant may strongly recommend to use factory pre-assembled and tested CO_2 cylinder bank assembly.

INTRODUCTION :

CO_2 can be used to extinguish most type of fires, including flammable liquid hazards, deep-seated fires and electrical equipment fires. **CO_2** extinguishes the fire by reducing the oxygen content of the atmosphere to a point where it will not support combustion. By reducing the oxygen content from the normal 20.9% in air to about 15% will extinguish the majority of surface fires.

2. TYPE OF SYSTEM

CO_2 system is generally classified as high *pressure* **CO_2** *system and low pressure* **CO_2** *system based* on nature of storage arrangement. Based on application **CO_2** system is further classified as ***Total Flooding*** and ***Local Flooding System.***

2.1 TOTAL FLOODING:

Total flooding with ***CO_2*** is a method of fire extinguishing whereby the air in the enclosed protected area is diluted to a point where burning cannot continue i.e. in general cases a 34% by volume of CO_2 will extinguish a fire (15% by volume of oxygen).

Extinguishing of surface fires involving flammable liquids, gases and solids is the most common application of total flooding, but deep-seated fires involving solids subject to smoldering can also be controlled by this method.

Total flood extinguishing depends upon filling an enclosure with a predetermined concentration of CO_2 and maintaining that concentration for as long as possible. It is therefore important that leakage of CO_2 from the enclosure is kept to a minimum; however calculations can be made to compensate for CO_2 losses through Un closable openings. Ventilation fans and dampers should be shut down and closed prior to the CO_2 discharge.

2.2 LOCAL APPLICATION:

Local application systems extinguish fires by discharging CO_2 directly into the fire. In this method, air necessary for combustion is starved from the immediate vicinity of the fire and replaced by an inert atmosphere until the fire is extinguished. The basic principle with local application is the prompt discharge of the CO_2 so that the fire can be extinguished before excessive heat can be absorbed by materials within the protected area.

3. EXTENDED DISCHARGE FOR TOTAL FLOODING AND LOCAL APPLICATION:

An extended discharge system discharges CO_2 at a high initial rate followed by the release of additional CO_2 to maintain the designed concentration for a predetermined period of time.

Extended discharge may be used on total flood or local application systems and is used where re-ignition of the fire is possible due to change in inerted atmosphere created initially.

Typical extended discharge systems are those for rotating electrical equipment, motors and gas turbines where the inerting effect of the CO_2 would be dissipated.

An extended discharge system is designed to compensate for CO_2 leakage and to maintain the design CO_2 concentration for such a period of time where the temperatures of the equipment have been reduced to below their auto-ignition temperature.

4. HIGH PRESSURE CO_2 SYSTEM

1. Seamless CO_2 cylinder
2. CO_2 cylinder valve solenoid operated (Master valve)
3. CO_2 cylinder valve pneumatic operated (Slave valve)
4. Pilot CO_2 cylinder
   - 4.1 Pilot N2 cylinder
5. Fully integrated CO_2 cylinder frame type / Cabinet Enclosure type assembly
   - 5.1 Master valve
   - 5.2 Slave valve
   - 5.3 Actuation Hose
   - 5.4 Discharge Hose

5.5 Online monitors
5.6 Bleeder valve
5.7 Manifold safety valve

6. Pressure switch
7. Manual gas discharge station
8. Inhibit / Abort switch
9. Discharge warning display unit
10. Lock out valve
11. Directional valve
12. CO_2 Nozzle
13. Schedule 80 seamless pipe & fittings
14. Pneumatic horn
15. Electronic Hooter with flasher

5. OPERATION PHIOLOSOPHY:

The system can be operated by any one of the following method:

Automatic Fire Detection using Detectors & alarm panel and & Automatic Extinguishing arrangement.

Automatic Fire Detection using Fire Detection tube and Automatic extinguishing arrangement.

Manual Detection and Manual Discharge with push buttons through control panel.

Mechanical Manual Discharge by operating Manual discharge lever.

There are many type of operation philosophy's are used. However very common method is as follows,

1. On receipt of the fire signal, Control Panel will do the following function:
   - Receipt of signal from one detector, Control Panel will give Fire Alarm Only.

Receipt of signal from any two detectors of different zone will actuate:

1. Fire Hooter (External)
2. Delay Timer
3. Fire Hooter (In-Built)
4. Tripping Signal

After the lapse of preset delay time, Electric Signal will be sent to Main/Standby Master Cylinder Solenoid valve as per Main/Standby Mode selection or any other built in logics. Gas discharged from master cylinder will actuate the slave cylinders. Then the gas is routed through the pipe network and discharge nozzle into the protected compartment. Please refer scheme for more details.

6. STANDARDS FOLLOWED:

- National Fire Protection Association (NFPA – 12)
- Indian Standard (IS – 15528)
- British Standard (BS – 5306)

7. WHY CO2 SYSTEM :

Some of the salient features of CO2 Fire Extinguishing System:

The value of CO2 as a fire extinguishant was recognized in the USA, the concept developed, and the first six page standard for the systems was published by the ***NFPA in 1928***.

Before halon or halon alternative was ***even conceived*** CO2 system had already extinguished thousands of fires. All the gaseous systems have their own positive points as well as negative points.

All the gaseous systems are having their own limitations.

Halocarbon extinguishing system such as FM 200 / FE 227 / NAF SIII is not safe in occupied area, if discharge concentration exceeds NOAEL (No Observed Adverse Effect Level).

Inert gas at present only 160 bar & 200 bar system only included in Indian standard IS15525:2004, 300 bar system is not included due to safety and maintenance reason.

CO2 IDEALLY SUITES TO:

- Permanently unoccupied areas;
- Areas where evacuation of personnel can be assured before discharge of agent (manual discharging method is recommended);
- 'Local' application to machineries or flammable liquid hazards in larger enclosures.

SOME OF THE IMPORTANT LIMITATION OF HALOCARBON GAS SYSTEM (FM 200 / FE 227 / NAF SIII) WHILE COMPARING TO CO2 SYSTEM:

- Halocarbon extinguishing agent cost is very high (approx. 50 times costlier than CO2).
- Maintenance and Re-filling cost is also equally very high.
- Dump test is not recommended and feasible.
- Cylinder bank should be located within 35 miters of the protected area.
- All of the present Halocarbon contains fluorine which produces Hydrogen Fluoride (HF) and it creates corrosive atmosphere.

Purity of the Halocarbon is to be established with lengthy and expensive procedures.

	Ozone Depleting Potential	*Global Warming Potential Vs. CO2 (100 yrs.)*	*Agent Breakdown to Corrosive By-products*
Carbon dioxide	*Zero*	*1*	*none*
Halon 1301	x 16	3500	HF
FM 200	zero	2900	HF x 7
Inert Gas	zero	zero	none

The following four main techniques are adopted:

- Total flooding for surface fires and deep seated fires;
- Total flooding for initial & Extended discharge for rotating machinery and turbines.
- Local application for surface application.
- Local application for volume or object protection;

10. RECOMMENDED FIRE RISK AREAS:

- Switch rooms, control cabinets, floor voids, electrical and electronic equipment rooms, engine test bays, ships engine and cargo holds;
- Drying ovens, large electrical and electronic cabinets;
- Paint spray booths, dip varnishing units, vapour exhaust systems, Transformers, generators, turbines;
- Flammable liquids and chemical products, foam materials;
- Rolling mills, Lube oil pits, test stands, dust filters, silos, textile and printing machinery; and Stores, archives.

11. LIMITATIONS OF CO2 SYSTEM:

- *Automatic Total flooding* is not recommended for manned area. Not suitable for reactive materials.
- Where *Total flooding* is required in manned area, we recommend to use ***bala-wa series.. N2 IG100 Inert Gas System.***

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ONLINE MONITORING SYSTEM :

How effective is your CO2 Fire Extinguishing System ?:

Your system may look Normal.
However the loss of gas could affect fire extinguishing efficiency.
What is the method to monitor gas loss?

The Solution is:

"ONLINE MONITORING SYSTEM"
is the best solution to ensure the correct quantities of CO2 gas.

Introduction:

Online Monitoring System is used in Gas based Fire Extinguishing system like CO2, FE-13, FM-200, Inert System, NAF S-III System, FE-227 System to monitor weight of the agent in the cylinder to meet NFPA & OISD standard.

Necessity of Online Monitoring System:

Loss in weight of cylinders shall be checked once in 3 months. Refilling should be done if loss in weight is more than 10%.
As per NFPA-12, quantity of gas should be checked at least once in 6 months.

Advantage of Online Monitoring System:

Fire extinguishing efficiency depends on the correct design concentration of extinguishing gas. If the gas loss due to leakage or any other reason, cylinder has to be refilled for designed quantity. It is very obvious, continuous monitoring of the gas weight is required.

This requirement is simply fulfilled by Online Monitoring System.
Without this system, once in 3 months / 6 months each cylinder is to be removed from the cylinder bank and weight is to be measured. After measuring the weight, again cylinders are to be re fixed and re commissioned for proper function.

This is time-consuming process for maintenance department with highly skilled manpower.