



Pre - Introduction :

The importance of erection, testing and commissioning are overlooked, in many projects while installing fixed CO₂ extinguishing system. It is very common that CO₂ 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 CO₂ 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 CO₂ cylinder bank assembly.

1. Introduction :

CO₂ can be used to extinguish most type of fires, including flammable liquid hazards, deep-seated fires and electrical equipment fires. CO₂ 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 :

CO₂ system is generally classified as high pressure CO₂ system and low pressure CO₂ system based on nature of storage arrangement. Based on application CO₂ system is further classified as [Total Flooding](#) and [Local Flooding System](#).

2.1 Total Flooding

Total flooding with CO₂ is a method of fire extinguishing where by 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 CO₂ 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 flooding extinguishing depends upon filling an enclosure with a predetermined concentration of CO₂ and maintaining that concentration for as long as possible.

It is therefore important that leakage of CO₂ from the enclosure is kept to a minimum; however calculations can be made to compensate for CO₂ losses through unclosable openings. Ventilation fans and dampers should be shut down and closed prior to the CO₂ discharge.

2.2 Local Application

Local application systems extinguish fires by discharging CO₂ 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 CO₂ so that the fire can be extinguished before excessive heat can be absorbed by materials within the protected area.

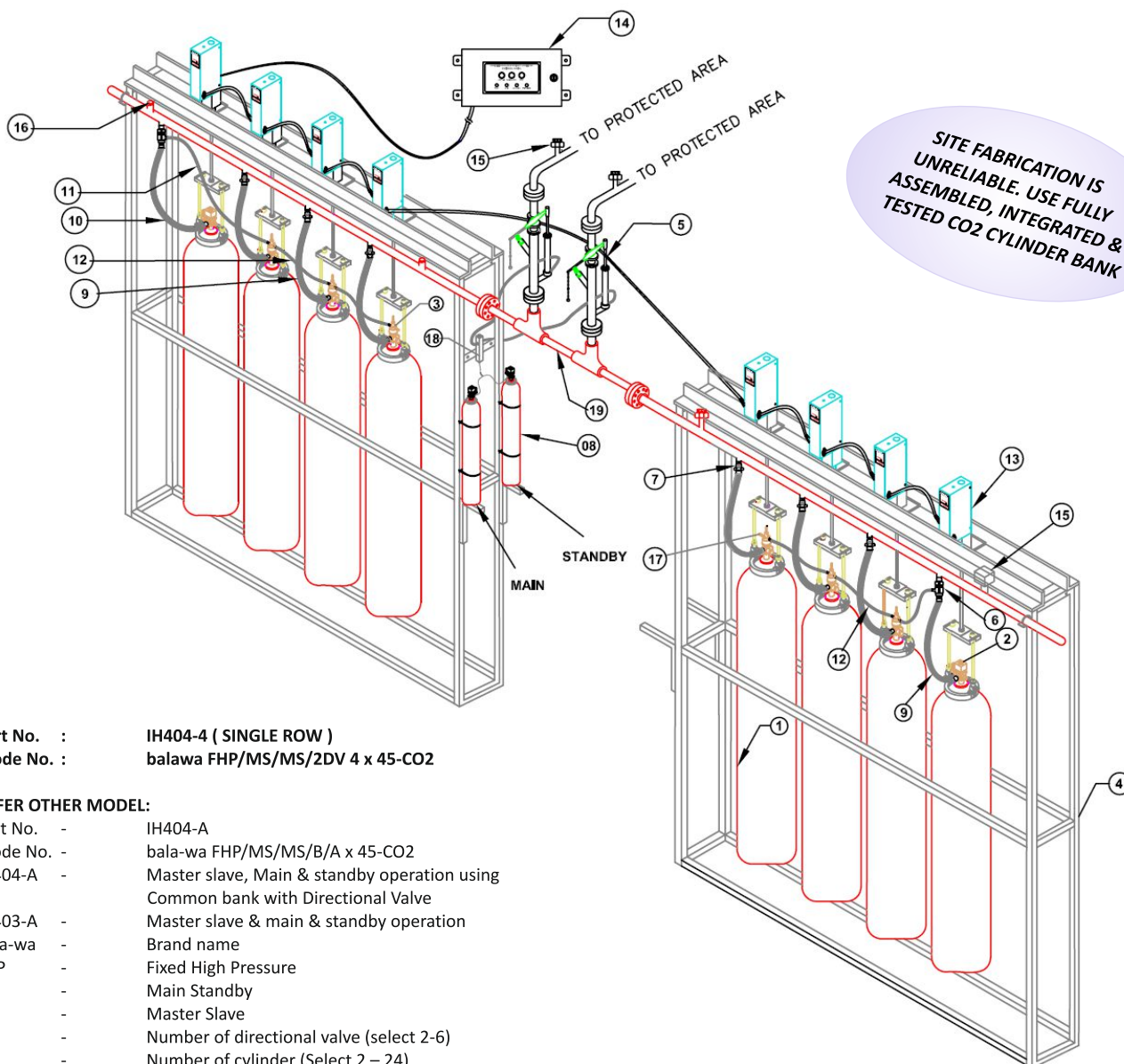
3. Extended Discharge for Total Flooding and Local Application

An extended discharge system discharges CO₂ at a high initial rate followed by the release of additional CO₂ 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 CO₂ would be dissipated.

An extended discharge system is designed to compensate for CO₂ leakage and to maintain the design CO₂ concentration for such a period of time where the temperatures of the equipment have been reduced to below their auto-ignition temperature.



Part No. : IH404-4 (SINGLE ROW)
 Mode No. : balawa FHP/MS/MS/2DV 4 x 45-CO2

REFER OTHER MODEL:

- Part No. - IH404-A
- Mode No. - balawa FHP/MS/MS/B/A x 45-CO2
- IH404-A - Master slave, Main & standby operation using Common bank with Directional Valve
- IH403-A - Master slave & main & standby operation
- balawa - Brand name
- FHP - Fixed High Pressure
- MS - Main Standby
- MS - Master Slave
- B - Number of directional valve (select 2-6)
- A - Number of cylinder (Select 2 – 24)

Sl.No	Part No.	Description	Qty
01	BIH048-68	68 Ltrs water capacity CO2 cylinder to fill 45kg CO2 gas	8
02	BIH001/DIN	CO2 master valve with 24 V DC solenoid & Manual release lever	2
03	BIH004/DIN	CO2 slave valve with pneumatic actuator & manual lever	6
04	IH030-4 WD	CO2 cylinder bank frame assembly & accessories (Suitable to fix 4 nos. of 45kg capacity CO2 cylinder)	2
05	IH015	Directional valve	2
06	IH018	Non-Return valve suitable for CO2 Master cylinder	2
07	IH019	Non-Return valve suitable for CO2 Slave cylinder	6
08	BIH302	6.8 ltr water capacity CO2 cylinder filled with 4.5kg CO2 gas or 1cu.m N2 gas	2
09	BIH020	High Pressure Discharge Hose-400mm	6

Sl.No	Part No.	Description	Qty
10	BIH021	High Pressure Discharge Hose-350mm	2
11	BIH022	High Pressure Actuation Hose-550mm	2
12	BIH023	High Pressure Actuation Hose-300mm	4
13	IH007R NI	Online monitor Analog type with Normal Indication	8
14	IH009R	Online monitor control panel	1
15	BIH143	Weather proof pressure switch	2
16	IH138	Manifold safety valve	1
17	IH138/1	Bleeder valve	2
18	IH024/1-2SV	Distributor assembly with 2 no. 24 v dc operated solenoid valve and electrical terminal box (to be used with BIH302 - N2 & BIH302-N2-PS	1
19	IH136-2	Joining manifold for 2 nos. Of directional valve	1

CO₂ GAS FIRE SUPPRESSION SYSTEM COMPONENTS

01 **BIH048-68** 68 Ltrs water capacity CO₂ cylinder to fill 45 kg CO₂ gas

Application:

68litres water capacity high pressure seamless cylinders are provided to store 45 Kg of CO₂ gas in the filling ratio of 0.667kg/l.



02 **BIH540/
MV-
48/68** 45kg CO₂ Cylinder Assembly (Master)
- Solenoid Operated

Application:

Master valve with Solenoid coil is used to discharge CO₂ gas from the Cylinders. When 24 VDC supply is given to the Master valve, the Solenoid Coil energises and opens the valve.



03 **BIH004-TI
/SV-
48/68** 45kg CO₂ Cylinder Assembly (Slave)
- Pneumatically Operated

Application:

Slave valve are also used to discharge CO₂ gas from the cylinders. It Operates on differential pressure principle. It can be actuated through pneumatic actuator. Gas from Master valve is directed to the slave valves and this differential pressure opens the valve.



04 **BIH302** Pilot CO₂ Cylinder 6.8 litres water capacity Filled with 4.5kg CO₂ Gas with 24v DC Solenoid operated cylinder valve with manual lever to operate Slave Cylinder valves / one No. Directional valve pneumatic actuator.

04-1 **BIH302-E** Pilot CO₂ Cylinder 5.1 litres water capacity Filled with 4.5kg CO₂ Gas with 24v DC Explosion proof solenoid operated cylinder valve with manual lever to operate Slave Cylinder valves / one No. Directional valve pneumatic actuator. Hazardous Area Classification - CL-I, DIV-I, GRP-A,B,C & D. CL - II, DIV - I, GR - E

04-2 **BIH302-N2-LP** Pilot N₂ Cylinder 5.1 litres water capacity Filled with 1m³ N₂ Gas at 150 bar Pressure fitted with 24v DC Solenoid cylinder valve with Pressure Gauge and Manual Lever to Operate Slave Cylinder valves / one No. Directional valve pneumatic actuator.

Application:

Suitable for CO₂ / Inert Gas Suppression System to Operate Slave Cylinder valves / one No. Directional valve pneumatic actuator.



- 05 **IH324/*** Wintergreen Odorizers suitable for *Cylinder Bank Arrangement (* No.of Cylinders)

Application:

Wintergreen odorizers to be installed in distribution pipe after directional valve to provide alert sign for evacuation in the protected area.



- 06 **IH018-R** Non-Return Valve suitable for CO₂ Master Cylinder

Application:

Master Non Return valve suitable for connection between master cylinder discharge Hose and manifold Header in CO₂ fixed fire Extinguishing system. Non return valves prevents the back flow of the gas.



- 07 **IH019** Non-Return Valve suitable for CO₂ Slave Cylinder

Application:

Slave Non return valve suitable for connecting between slave cylinder discharge hose and manifold header in CO₂ fixed fire extinguishing system. The slave valve is designed to prevent complete backflow of the CO₂ manifold. However it is not designed to give complete sealing at low pressures.



- 08 **IH138** Manifold Safety Valve

Application:

The Manifold Safety valve is designed to use in closed piping network section where there is a risk of pressure increase.



- 09 **IH012 / IH012-C** CO₂ Nozzle with cone horn

Application:

The nozzle releases the gas/agent into the area to be protected. IH012 Nozzles are designed in such a way that proper flow rate is achieved throughout the discharge period. Orifices are drilled as per design.



- 10 **IH 011 Series...** CO₂ Nozzle with cone horn suitable to fit in the machinery / small area.

Application:

The nozzle releases the gas/agent into the area to be protected. IH011 Nozzles are designed in such a way that proper flow rate is achieved throughout the discharge period. Orifices are drilled as per design.



11 **IH015-*** * NB CO₂ Directional valve with pneumatic actuator & Limit Switch (* - 20/25/32/40/50NB)

11.1 **IH015-*E** * NB CO₂ Directional valve with pneumatic actuator & Flame Proof Limit Switch and Matching flange (* - 20/25/32/40/50NB)

Application:

Directional valves are used in the gas suppression systems when multiple areas are protected using a common cylinder bank.



12 **IH237-*** * NB Manual Lock-out Valves with supervisory Limit Switch (* - 20/25/32/40/50NB)

12.1 **IH237-* E** * NB Manual Lock-out Valves with supervisory Explosion proof Limit Switch (* - 20/25/32/40/50NB)

Application:

Manual lock-off valves are designed to use in CO₂ discharge line where the CO₂ system is installed in normally occupied area.



13 **IH007R NI / IH007R NI-4W** Online Monitor with Normal Indication - Analogue LED Type

Application:

Online Monitor Normal Indication is used in Gas based Fire Extinguishing System to monitor the weight level agent in the cylinder. When the quantity of the gas is reduced below 10% of its original filled quantity, the alert Indication (YELLOW LED) is shown.

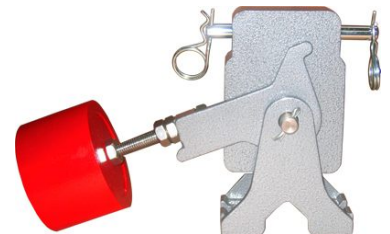


4 WIRE INPUT

14 **IH006R** Online Monitor - Mechanical Indicator Type

Application:

Online Monitor mechanical indicator is used in Gas based Fire Extinguishing System to monitor the weight level agent in the cylinder mechanically. No power is required. When the quantity of the gas is reduced below 10% of its original filled quantity, the counter weight will come down. Suitable limit switch can be connected for taking electrical output.



15 **IH009R/ IH009R-2A** Online Monitor Control Panel

Application:

Online monitor control panel will be used to get alert indication from online monitor analog LED type. One single area control panel can be used upto 25 nos of online monitors.



TWO AREA

**Fixed Installation High Pressure CO₂ Extinguishing System
Fully Assembled, Integrated & Tested Cylinder Bank
in Air Conditioned Container**



**Modular Type CO₂ Extinguishing
Cylinder Assembly Kit**

**Cabinet Type CO₂ Extinguishing
Cylinder Bank Assembly**





4. Operation Philosophy

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.

4.1 Online Monitor System

Your system may look Normal?

However the loss of gas could affect fire extinguishing efficiency.

The Solution is:

“ONLINE MONITORING SYSTEM”

is the best solution to ensure the correct quantities of co2 gas.

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.

As per IS – 15528, all high pressure cylinders shall be weighed atleast once in 6 months.

5. 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 150 bar & 200 bar system only included in Indian standard IS 15525:2004, 300 bar system is not included due to safety and maintenance reason.

CO₂ IDEALLY SUITES TO:

- Permanently unoccupied area;
- 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 is very high (approx. 50 time 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 meters 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. CO ₂ (100 yrs.)	Agent Breakdown to Corrosive By-products
Carbon dioxide	zero	1	none
Halon 1301	x 16	3500	HF
FM 200/ HFC227ea	zero	2900	HF x 7
Inert Gas	zero	zero	none

6. Vds Approved CO₂ Calculations

7. Typical Method of Application

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

8. 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.

9. Standards Followed

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

10. 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..IG100/IG541 Inert gas fire suppression system and balawa-mist series.. IH950 Engineered High pressure water mist fire suppression system.

FOR MORE DETAILS, VISIT OUR WEBSITE

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