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CARBON DIOXIDE FIRE FIGHTING SYSTEMS

DESIGN MANUAL

CO_2 FIRE FIGHTING SYSTEMS

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1. INTRODUCTION

This manual has been prepared primarily for the use of designers/installers of Tyco Carbon Dioxide Fire Fighting Equipment. Its purpose is to provide general information on carbon dioxide and its use in fire fighting systems and to give more detailed information covering the design, installation, testing and servicing of these systems.

It has been assumed that users of this manual have sufficient experience of Fixed Fire Fighting Systems to enable the correct interpretation to be made of the contents.

It must be recognised that correct system design, installation and maintenance are fundamental to the safe and effective use of any Gaseous Fire Fighting System.

1.1 GENERAL INFORMATION

Carbon Dioxide systems utilise either High Pressure Storage in the form of one or more containers or Low Pressure Storage in the form of refrigerated bulk storage vessels.

This manual provides information only on High Pressure Storage systems.

High Pressure Storage containers are designed to hold pressurised CO_2 in liquid form at a nominal pressure of 58.6 bar (850 psi) at 21 ºC.

Handling and installation of High Pressure CO_2 equipment must only be carried out by persons experienced in dealing with this type of equipment.

1.2 DESCRIPTION OF CO_2 SYSTEMS

Carbon Dioxide Fire Fighting Systems have been used for many years to extinguish fires involving flammable liquids, gases and electrical equipment.

CO_2 extinguishes fire by reducing the amount of oxygen to a point where combustion will not be sustained.

A space which has been filled with a CO_2 concentration sufficient to extinguish a fire does not have sufficient oxygen to support life; therefore, it is dangerous to enter or remain in a space where CO_2 has been discharged.

A system comprises of a single container or a bank of containers connected to a system of pipework and nozzles. CO_2 is liquified under pressure and is contained in steel containers, each of which is fitted with a specially designed quick opening valve. When the valve opens, liquid CO_2 flows into the distribution pipework which directs the extinguishant to one or more nozzles in the protected area where the discharging liquid rapidly expands to a gas. Discharging CO_2 gives the appearance of a fog which temporarily reduces visibility.

CO_2 Fire Fighting systems are particularly valuable in extinguishing fires in hazards or equipment where an inert electrically non-conductive medium is essential or where the cleaning up of foam, water or powder would be problematic or where the pungent smell of the breakdown products of the chemical extinguishants would be unacceptable.

1.3 PROPERTIES OF CO_2

Under normal conditions CO_2 is an odourless colourless gas with a density around 50% greater than air. CO_2 is easily liquified by compression and cooling. By further cooling and expansion it can be converted to the solid state. CO2 cannot exist as a liquid above its critical temperature of 31 ºC or at a pressure below 60 psi.

For fire fighting applications CO_2 has a number of desirable properties. It is non-corrosive and leaves no residue to clean up after the fire. It will not conduct electricity and can therefore be used on live electrical hazards. It provides it's own pressure for discharge through pipes and nozzles and since it is a gas it will penetrate and spread to all parts of a hazard.

1.4 SAFETY OF CO_2

1.4.1 GENERAL

The atmosphere we breathe contains approximately 0.03% CO_2 (300 ppm), but this level naturally increases inside enclosed spaces where people are present or where industrial processes take place.

Human beings exhale CO_2 and without adequate ventilation the level in a room can increase by a factor of ten to 0.3% or more. The maximum level which can reasonably be tolerated during an eight hour day for people at work has been set at 0.5% (5,000 ppm) - (see 'Occupational Exposure Limits' in Section 1.4.2).

As the CO_2 concentration in the atmosphere increases, air is displaced, which introduces a corresponding reduction in the available oxygen. The effect of this is to cause drowsiness and impaired co-ordination and with further increases up to 3%, breathing will become noticeably laboured together with an increased pulse rate and headache.

Above this level breathing difficulties will become more pronounced and loss of consciousness is likely. **Concentrations in excess of 10% must be considered to be highly dangerous. CO_2 Fire Fighting systems are designed to achieve concentrations in excess of 30% by volume.**

Every precaution must therefore be taken to ensure personnel in a protected area are evacuated before the area is flooded with CO_2. It is very important that accidental release of CO_2 is avoided and it is essential that care is taken at all times when attending to CO_2 systems and control equipment.

It is usual for electrical time delays to be used. However in some circumstances i.e. where mechanical manual release devices are in uncontrolled or vulnerable areas, or where the primary means of release is mechanical, it is recommended that mechanical time delays are fitted.

Stop valves must be fitted on all systems protecting normally occupied areas or any other areas where egress may be difficult.

Consideration must be given to the possibility that in the event of a discharge, CO_2 may flow to adjacent low level areas such as cellars, basements or pits, etc.

1.4.1.1 NOISE

Discharge of a CO_2 system can cause noise loud enough to be startling but ordinarily insufficient to cause traumatic injury.

1.4.1.2 TURBULENCE

High velocity discharge from nozzles may be sufficient to dislodge substantial objects directly in the path of the discharge. General turbulence in the enclosure may be sufficient to move light objects, unsecured paper etc. Ceiling tiles in the vicinity of the nozzles should be clipped in place to prevent them being dislodged during the discharge.

1.4.1.3 COLD TEMPERATURE

Direct contact with vaporising liquid CO_2 will have a strong chilling effect on objects and can cause frostbite burns to the skin. The liquid phase vaporises rapidly when mixed with air and thus limits the hazard to the immediate vicinity of the discharge nozzle.

1.4.1.4 VISIBILITY

Upon discharge, reduced visibility will be evident, especially in humid atmospheres, as a result of the condensation of water vapour.

1.4.1.5 EXITS

Adequate means of escape from the protected area should be provided. Doors should open outwards and be self closing. They should be arranged to open easily from inside and any that need to be secured must be fitted with escape overrides.

1.4.1.6 POST DISCHARGE VENTILATION

In order to allow for the ventilation of CO_2 or the post fire atmosphere, a normally closed means of ventilation with extract arrangements will be required. Any mechanical ventilation provided should not form part of the normal ventilation system. Controls for the ventilation system should be outside the protected enclosure and should preferably be key operated. In some circumstances the normally closed means of ventilation may be provided by doors and windows.

1.4.2 SAFETY DATA SHEET

PRODUCT	Carbon Dioxide
SYNONYM	CO_2 , dry ice (in solid form)
USE	Fire Extinguishing Agent
PHYSICAL PROPERTIES	Physical State: Can exist as a gas, liquid or solid, or a combination of all three.
Specific Gravity	Heavier than air. Specific gravity of 1.53 at 21 ºC (air = 1).
Appearance	When released to atmosphere from a storage container, it cools rapidly and causes a white mist to form.
Vapour pressure in container	33.80 bar at 0 ºC 56.28 bar at 20 ºC 71.10 bar at 30 ºC
Critical temperature	31 ºC
Critical pressure	73 bar
Decomposition products	None
STORAGE	
Fill density	0.666 kg/l
Temperature	Maintain preferably between 0 ºC and 35 ºC. Avoid storing containers in vicinity of heaters. Safety burst disc on valve will rupture at about 55 ºC and release contents to atmosphere.
Sunlight	Avoid exposure to direct sunlight.
Ventilation	Container storage room should be ventilated at low level, preferably to fresh air.
Handling	BEFORE REMOVAL FROM SUPPORTING RACKS, the antirecoil cap and the valve protection cap must be fitted to give protection during transportation.

FIRE HAZARD	CO_2 is non-flammable. CO_2 containers subject to excessive heat should be cooled by spraying with water to avoid over-pressurisation - (see reference under 'Storage' above).
HEALTH HAZARDS	CO_2 is odourless.
CO2 discharge of High Concentrations over 10%	Evacuate all persons from the area immediately and institute rescue operations if necessary. Air is displaced by the discharge of CO_2 and will create an atmosphere which will not support life. The potential hazard of asphyxiation will therefore exist to persons within the room, or in adjacent low lying areas.
Post CO_2 discharge Low Concentrations	The ventilation of CO_2 from an area may result in low concentrations of CO_2 persisting for some time in the immediate neighbourhood. A brief summary of the likely effects are as follows, but it is emphasised that tolerances vary widely depending upon the physical conditions of the individual.
5 - 10%	Breathing will be very laboured and will lead to exhaustion and possible loss of consciousness as the heart rate becomes excessive. Confusion will be experienced and judgement may be impaired.
4 - 5%	Breathing will be approximately four times normal and the heart rate will be much faster than normal.
2 - 3%	Breathing will be more laboured than normal and prolonged exposure will result in headache, increased blood pressure and pulse rate.
1%	Slight increase in the breathing rate above normal.
0.03%	Normal concentration of CO_2 in the atmosphere.
Solid CO_2	Under some circumstances white solid CO_2 may be formed during the discharge which has a very low temperature of minus 79 ºC. Do not touch without protective gloves. Direct contact can cause severe frostbite.

OCCUPATIONAL EXPOSURE LIMITS	Long Term: 8 hour TWA value 5,000 ppm 9,000 mg/m³ Short Term: 10 minutes value 15,000 ppm 27,000 mg/m³ Ref. Health & Safety Publication EH40.
RESCUE	DO NOT PLACE YOURSELF AT RISK. Do not enter a high concentration of CO_2 without self contained breathing apparatus (B.A.). Move affected person from the hazardous area to fresh air.
FIRST AID	Having moved the person to fresh air, apply artificial respiration immediately. Keep the person warm and at rest. Seek medical attention as soon as possible.

2. SYSTEM DESIGN

2.1 DESIGN STANDARDS

Information contained in this manual has been based generally on the following standards:

BS 5306 : Part 4 : 2001 - Specification for Carbon Dioxide Systems

BS 5306 : Part 0 : 1986 - Guide for the selection of installed systems and other fire equipment.

NFPA 12 - Carbon Dioxide Extinguishing Systems

The manual has been prepared to give a basic understanding of the design of CO_2 systems, but users are advised to familiarise themselves with BS 5306 : Part 4 as the success of the system is dependent on the use of the correct design concentrations and application rates.

2.2 DETERMINATION OF CO_2 QUANTITIES

Prior to commencing with the design of any CO_2 system, the designer should have a completed 'Extinguishing Systems Sales Enquiry Form' detailing as a minimum the following:

i) Enclosure or hazard dimensions.

ii) Specific details of the hazard.

iii) The minimum and maximum temperatures of the hazard/enclosure.

iv) Confirmation that the containment is adequate (Total Flooding Systems).

v) Details of the ventilation system.

vi) Intended occupancy of the enclosure/ hazard area.

vii) Storage container location. This should preferably be outside the protected enclosure but must not be exposed to weather or other potential hazards. Floor loading should also be taken into consideration.

In determining the quantity of CO_2 required it is important to assess the protected hazard correctly. The following points may be used to guide the designer in doing so.

Is the hazard to be protected using a TOTAL FLOODING or LOCAL APPLICATION system?

A Total Flooding system is used for the protection of enclosed hazards and is designed to discharge CO_2 into a room or enclosure to develop a predetermined concentration throughout the entire space. The efficiency of a Total Flooding system is dependent on maintaining an extinguishing concentration long enough to ensure all smouldering is extinguished and the combustible material is sufficiently cooled to prevent re-ignition. Prior to or in conjunction with the discharge of CO_2, ventilation fans and dampers should be shut down.

A Local Application system may be used for the protection of hazards that are not enclosed or sufficiently enclosed to conform to the requirements for Total Flooding systems. A Local Application system utilises a pipework and nozzle layout specifically designed to discharge CO_2 directly into the fire.

2.2.1 TOTAL FLOODING SYSTEMS

Does the enclosure to be protected present a SURFACE or DEEP-SEATED fire hazard?

A surface fire usually involves flammable liquids, gases or solids which are unlikely to become deep-seated. A concentration of 34% is usually used in such applications, although this may require to be adjusted to take into account special conditions **(see Section 2.2.1.1 - Surface Fires)**.

A deep-seated fire usually involves solids which are subject to smouldering and likely to produce glowing embers. Concentrations from 50% up to 75% are typical, although as with surface fire hazards, the CO_2 quantities may require to be adjusted to take into account special conditions **(see Section 2.2.1.2 - Deep-Seated Fires)**.

2.2.1.1 SURFACE FIRES

To calculate the CO_2 quantity required for the protection of hazards involving surface fires, the following methodology should be used.

Determine the gross room volume. Only permanent impermeable building structures within the area may be deducted from the gross volume.

Multiply the gross volume by the appropriate flooding factor ***(Reference Table 1 of BS 5306 : Part 4)***.

Add extra CO_2 to account for any unclosable openings. If unclosable openings are above a certain size, relative to the volume, it may be necessary to consider the hazards as requiring a Local Application system. ***(Reference Clause 10.3.2.1 of BS 5306 : Part 4)***.

Add extra CO_2 if the area contains hazards with an increased fire risk ***(Reference Table 2 of BS 5306 : Part 4)***.

Add extra CO_2 to account for any abnormal temperature conditions in the area. ***(Reference Clause 10.4.2 of BS 5306 : Part 4)***.

Air Handling systems should be arranged to shut down prior to or in conjunction with the CO_2 discharge. Where this is not possible or there is a run-down period associated with any air handling systems, extra CO_2 is to be provided ***(Reference Clause 10.4.1 of BS 5306 : Part 4)***.

Any interconnected volumes must be considered and extra CO_2 provided if any of the interconnected areas require higher concentrations. The higher concentration is to be used throughout interconnected hazards.

2.2.1.2 DEEP-SEATED FIRES

To calculate the CO_2 quantity required for the protection of hazards involving deep-seated fires, the following methodology should be used.

Determine the gross room volume. Only permanent impermeable building structures within the area may be deducted from the gross volume.

Multiply the gross volume by the appropriate flooding factor ***(Reference Table 3 of BS 5306 : Part 4)***.

Add extra CO_2 to account for any abnormal temperature conditions in the area. ***(Reference Clause 10.4.2 of BS 5306 : Part 4)***.

The CO_2 quantities for deep-seated hazards are based on reasonably tight enclosures. Any possible leakage sites must be given special considerations as no allowances for leakage are included within the basic flooding factors. The system and enclosure must be designed so that the concentration is held for at least 20 minutes. Air handling systems and dampers should be arranged to shut-down prior to or in conjunction with the CO_2 discharge. Where enclosures are leaky, extra CO_2 must be applied at a rate to compensate for the leakage for at least the required holding period ***(Reference Clause 10.3.2.1 of BS 5306 : Part 4)***.

2.2.1.3 OTHER CONSIDERATIONS FOR SURFACE FIRE & DEEP-SEATED HAZARDS

i) Excess Pressure Venting

When CO_2 is discharged from nozzles into an enclosure it rapidly expands to mix with the air in the room. Leakage around doors and windows often provide sufficient pressure relief without the need for special arrangements. However, for airtight enclosures it may be necessary to make provision for excessive pressure venting. ***(Reference Clause 10.3.3 of BS 5306 : Part 4).***

ii) Discharge Times - Total Flooding Systems

For surface fire hazards the design concentration is to be achieved within one minute.

For deep-seated fire hazards the design concentration is to be achieved within seven minutes, but the discharge rate must be such that a concentration of at least 30% is achieved within two minutes. To simplify system design, a discharge time of four minutes will achieve the above requirements.

iii) Container Storage

The container storage temperature should be between -20 ºC and +50 ºC unless the system is designed for operation outside this range.

iv) Nozzles

It is normally recommended that nozzles are uniformly positioned on the ceiling of an enclosure to ensure a satisfactory distribution of CO_2. Where it is not practical to position the nozzles on the ceiling, it may be acceptable depending on the room dimensions to position them around the perimeter at high level.

For CO_2 total flooding systems there are no strict rules governing the number of nozzles that should be applied to any type of hazard, however nozzle spacing is dependant on room height, flow rate etc.; but as a rule of thumb the nozzles may be used to cover an area of 30 square metres in a room 3 metres high. It is better to have too many nozzles than too few. For additional information refer to Section 4.17.

2.2.2 LOCAL APPLICATION SYSTEMS

Does the area to be protected present a three dimensional or flat hazard?

Where a three dimensional or irregularly shaped hazard is involved CO_2 quantities are normally determined using the Rate by Volume method.

The Rate by Area method of calculation is employed where the hazard consists of flat or horizontal surfaces.

2.2.2.1 RATE BY VOLUME

To calculate the CO_2 quantity required, the following methodology should be used.

Determine the assumed volume. The CO_2 quantity is based on the volume of an assumed enclosure surrounding the actual hazard. The assumed walls and ceiling of the enclosure are to be at least 600 mm from the actual hazard unless real walls are involved. The actual hazard area must include all areas of possible leakage, splash or spillage. ***(Reference Clause 11.8.1 and Annex D2 of BS 5306 : Part 4).***

The assumed enclosure must include a real floor unless special considerations are made. This is because CO_2 is heavier than air and would be lost from the enclosure at floor level at an excessive rate. No deductions for solid objects are to be made within the assumed enclosure. Multiply the assumed volume by the required system discharge rate.

The system discharge rate will be at least 4 kg/min per cubic metre of assumed volume for enclosures where actual walls completely surround the hazard. The discharge rate is proportionally adjusted up to 16 kg/min per cubic metre of assumed volume for enclosures with no walls. ***(Reference Clause 11.8.2 and Annex D2 of BS 5306 : Part 4)***.

Multiply the discharge rate by the discharge time.

The discharge time will normally be 0.5 minutes but for certain applications, i.e. where the hazard involves liquids with auto-ignition temperatures lower than their boiling temperatures the minimum discharge time should be 3 minutes. ***(As per Clause 11.6 of BS 5306 : Part 4.)*** (The extended discharge time is intended to maintain an extinguishing concentration until the fuel has cooled below its auto-ignition temperature).

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Add extra CO_2 if the area contains hazards with an increased fire risk. ***(Reference Table 2 of BS 5306 : Part 4)***.

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Add 40% to the calculated quantity to determine the nominal container storage capacity since only the liquid portion of the discharge is effective. ***(As per Clause 11.3.2 of BS 5306 : Part 4.)***

2.2.2.2 RATE BY AREA

The CO_2 quantity required using the Rate by Area method is calculated based on the total discharge rate of a nozzle arrangement sited to cover the entire hazard area.

The area covered by each nozzle and the CO_2 quantity required by that nozzle will increase as the distance of the nozzle from the hazard surface increases.

Where coated surfaces are to be protected the nozzles are permitted to cover an area 40% greater than the listings given for liquid surfaces. A coated surface is defined as a surface designed for drainage so that pools of liquid will not accumulate over an area greater than 10% of the protected area.

Areas of coverage for the local application type nozzle are given in **Table 1**.

Note: Interpolations are not permitted; the higher rate of flow should always be selected.

The coverage areas are based on nozzles being installed centrally, at 90° from the plane of the surface to be protected.

If nozzles are to be installed at an angle the area of coverage will be affected. The aiming point is then dependent on the discharge angle. ***(Reference Clause 11.9.5 of BS 5306 : Part 4)***.

When the discharge rate has been determined, as above, the final CO_2 design quantity is calculated as follows.

Multiply the discharge rate by the discharge time. The discharge time will normally be 0.5 minutes, but for certain applications, i.e. where the hazard involves liquids with autoignition temperatures much lower than their boiling temperatures, the minimum discharge time should be 3 minutes. ***(As per Clause 11.6 of BS 5306 : Part 4.)*** (The extended discharge time is intended to maintain an extinguishing concentration until the fuel has cooled below its auto-ignition temperature). Add extra CO_2 if the area contains hazards with an increased fire risk. ***(Reference Table 2 of BS 5306: Part***

Add 40% to the calculated quantity to determine the nominal container storage capacity since only the liquid portion of the discharge is effective. (**As per Clause 11.3.2 of BS 5306 Part 4.)**

2.2.2.3 OTHER CONSIDERATIONS FOR LOCAL APPLICATION SYSTEMS

Container Storage

The container storage temperature should be between -20 ºC and +46 ºC unless the system is designed for operation outside this range.

Coated Surface		Nozzle		Liquid Surface	
Area (sq.m.)	Side of square (m)	Height (m)	Flow Rate (kg/min.)	Area (sq.m.)	Side of square (m)
1.17	1.08	0.6	14.0	0.84	0.91
1.23	1.11	0.68	15.7	0.88	0.94
1.3	1.14	0.76	17.3	0.93	0.96
1.36	1.17	0.84	19.3	0.98	0.99
1.43	1.19	0.91	20.5	1.02	1.01
1.5	1.22	0.99	21.6	1.07	1.03
1.56	1.25	1.07	23.6	1.11	1.05
1.62	1.27	1.14	25.2	1.16	1.08
1.69	1.3	1.22	26.8	1.2	1.09
1.76	1.33	1.3	28.4	1.25	1.12
1.82	1.35	1.37	30.0	1.3	1.14
1.86	1.37	1.45	31.6	1.35	1.16
1.95	1.4	1.52	33.2	1.39	1.18
2.01	1.42	1.6	34.8	1.44	1.2
2.08	1.44	1.67	36.4	1.49	1.22
2.15	1.46	1.75	38.0	1.53	1.23
2.21	1.48	1.83	39.5	1.58	1.26
2.28	1.5	1.9	41.1	1.62	1.27
2.34	1.53	1.98	42.7	1.67	1.29
2.41	1.55	2.06	44.3	1.72	1.31
2.47	1.57	2.13	46.0	1.76	1.33
2.54	1.59	2.21	47.5	1.81	1.34
2.6	1.61	2.29	49.1	1.86	1.36
2.6	1.61	2.36	50.7	1.86	1.36
2.6	1.61	2.44	52.3	1.86	1.36
2.6	1.61	2.51	53.9	1.86	1.36
2.6	1.61	2.59	55.5	1.86	1.36
2.6	1.61	2.67	57.0	1.86	1.36
2.6	1.61	2.74	58.6	1.86	1.36

Table. 1

2.3 PIPEWORK AND FITTINGS

It is essential that the correct grade and size of pipework and fittings are employed in the system. ***(Reference Clause 19 of BS 5306: Part 4)***.

2.3.1 PIPE SIZE ESTIMATING GUIDE

For estimating purposes **Table 2** may be used as a guide in the selection of pipe sizes based on flow rate.
Accurate hydraulic pipe size calculations are to be performed using a carbon dioxide computer program.

Flow Rate (Kg/min)	Estimated Pipe Diameter
0-45	3/8" (10mm)
45-68	1/2" (15mm)
68-136	3/4" (20mm)
136-227	1" (25mm)
227-409	11/4" (32mm)
409-545	11/2" (40mm)
545-909	2" (50mm)
909-1363	21/2" (65mm)
1363-2272	3" (80mm)
2272-3300	4" (100mm)

Table. 2

2.4 DESIGN DRAWINGS

Following receipt of instructions from the client to proceed with an installation, system layout drawings must be prepared which contain the following information as a minimum:

i) Extent of the protected enclosure.

ii) Details of the hazards.

iii) Location of CO_2 containers and associated equipment.

iv) Layout and size of pipework.

v) Position of nozzles and orifice areas/codes.

vi) Calculations to show how CO_2 quantity was determined.

Drawings are to be submitted to the client for approval and installation must only proceed against approved drawings.

2.5 ROOM INTEGRITY

The successful performance of a Gaseous Total Flooding system is largely dependent on the integrity of the protected enclosure. It is strongly recommended that a room integrity test is performed on any protected enclosure to establish the total equivalent leakage area and enable a prediction to be made of the enclosure's ability to retain CO_2. The required retention time will vary depending on the particulars of the hazard but will not normally be less than 10 minutes for surface fire hazards. Longer retention times of over 20 minutes may be necessary if enclosures contain deep seated hazards.

2.6 DETECTION AND CONTROL SYSTEMS

Detection and control systems associated with fixed fire fighting systems are outside the scope of this manual. Reference should be made to the applicable relevant standards, in particular BS 7273: Code of Practice for: The operation of fire protection measures. Part 1. Electrical actuation of gaseous total flooding extinguishing systems.

2.7 ELECTRICAL EARTHING AND SAFETY CLEARANCES

All exposed metalwork in a CO_2 system housed within electrical substations or switchrooms shall be efficiently earthed to prevent the metalwork from bcoming electrically charged. (***Adequate earthing of C02 systems, wherever located, will minimise the risk of electrostatic discharge. BS 5958-1 gives basic information on earthing practice.)***

Where exposed electrical conductors are present ensure sufficient clearance is provided. ***(Reference Clause 20.11 and Table 14 of BS 5306: Part 4)***.

3. EQUIPMENT CONFIGURATIONS

A Fixed CO_2 Fire Fighting system is composed of a large number of components which may be assembled in various configurations providing the system designer with a very flexible system.

Whilst no two hazards will be identical the equipment detailed later in this section will be sufficient for the majority of system design requirements.

The following two figures indicate typical layouts for the two most common container arrangements which are governed by the method of operation.

3.1 SOLENOID OPERATION WITH LOCAL MANUAL CONTROL

The arrangement shown in figure 1 allows for solenoid operation which is supplemented by a means to mechanically, manually operate the system at the container location. This arrangement must not be used when the containers are located inside the protected area as operation of the manual release lever will result in the immediate discharge of CO_2. Remote mechanical manual operation is possible by connecting the manual actuator to a T528 manual release unit via a system of cable and conduit (see Section 4.5 & 4.28).

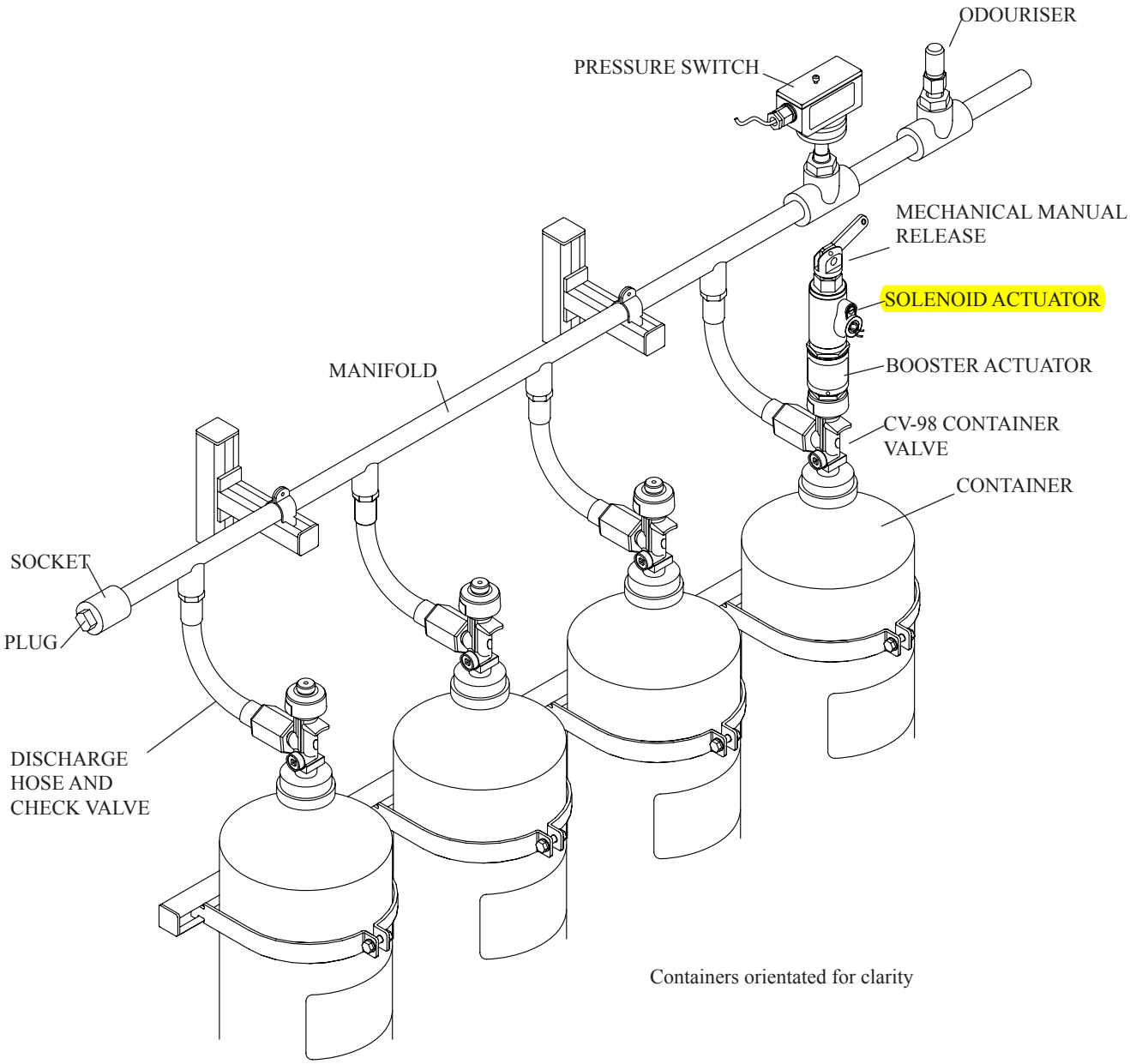


Fig. 1 Solenoid Operation with Local Manual Control

3.2 MECHANICAL MANUAL CONTROL

The arrangement in figure 2 allows for the system to be operated by mechanical manual means only.

Operation of the system is possible either locally at the container location by using the manual actuator (as shown) or from a remote location using the manual actuator connected to a T528 manual release unit via a system of cable and conduit - not shown (see Section 4.5 & 4.28). When using the manual actuator remotely, operation of the system is still possible at the container location. However this means of manual release should not be used when the containers are inside the protected area, as operation of the manual release lever will result in the immediate discharge of CO_2.

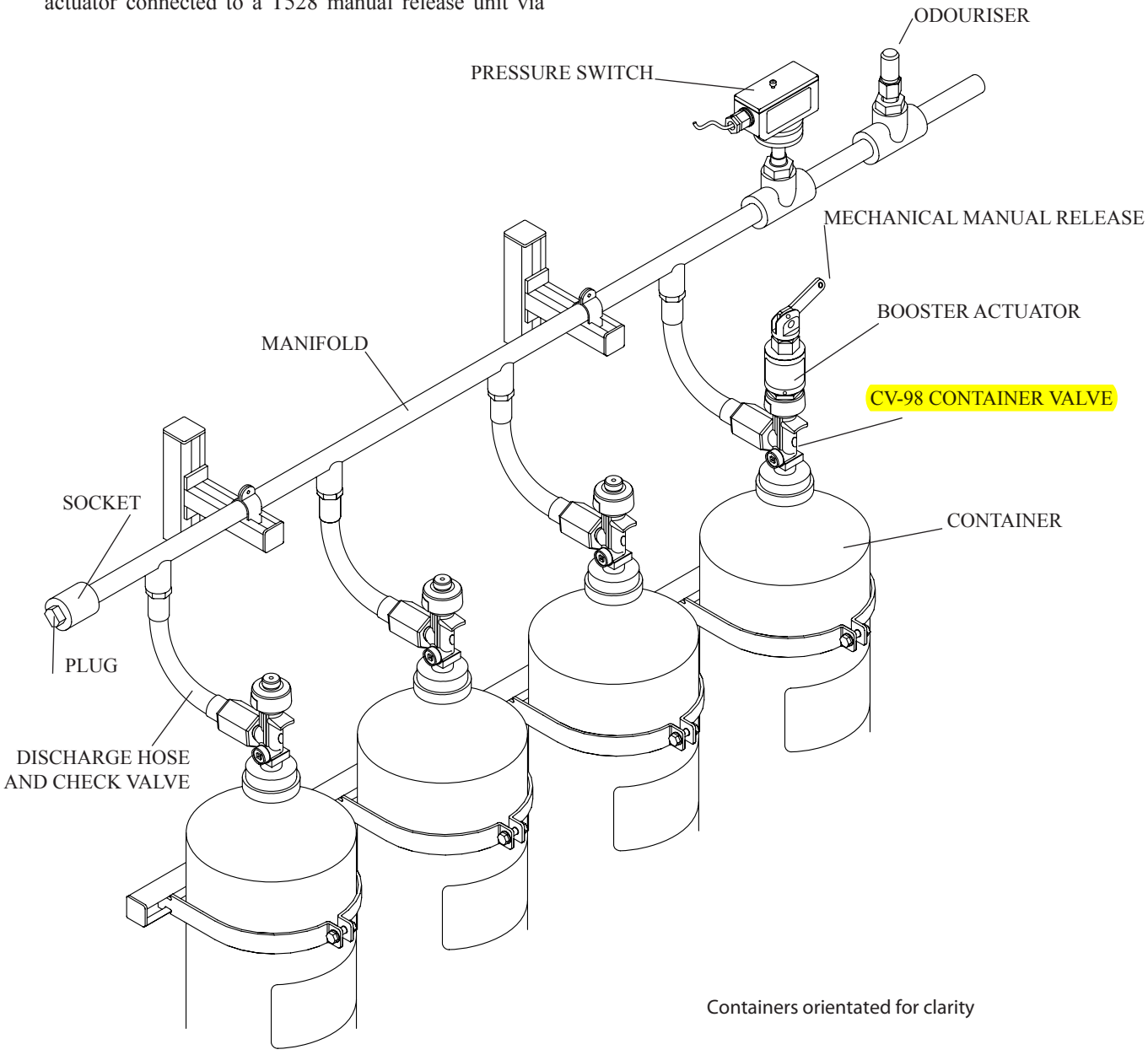


Fig. 2 Mechanical Manual Control

3.3 DISTRIBUTION VALVE SYSTEM

The arrangement shown in figure 3 shows a typical distribution valve system
The distribution valves are operated by pilot pressure as is the master container of the required system. Slave containers are operated by back pressure from the manifold.
If the system requires a different number of containers to be discharged into the different rooms then inline manifold check valves are required. A bleed valve is included in the manifold when manifold check valves are used.
Any system that has a 'potentially' closed valve in the discharge pipework when the system is activated requires a manifold burst disk incuded on the end of the manifold to prevent the unwanted build up of pressure in the manifold. A means of by-passing the burst is also required. This is detailed in section 4.21.

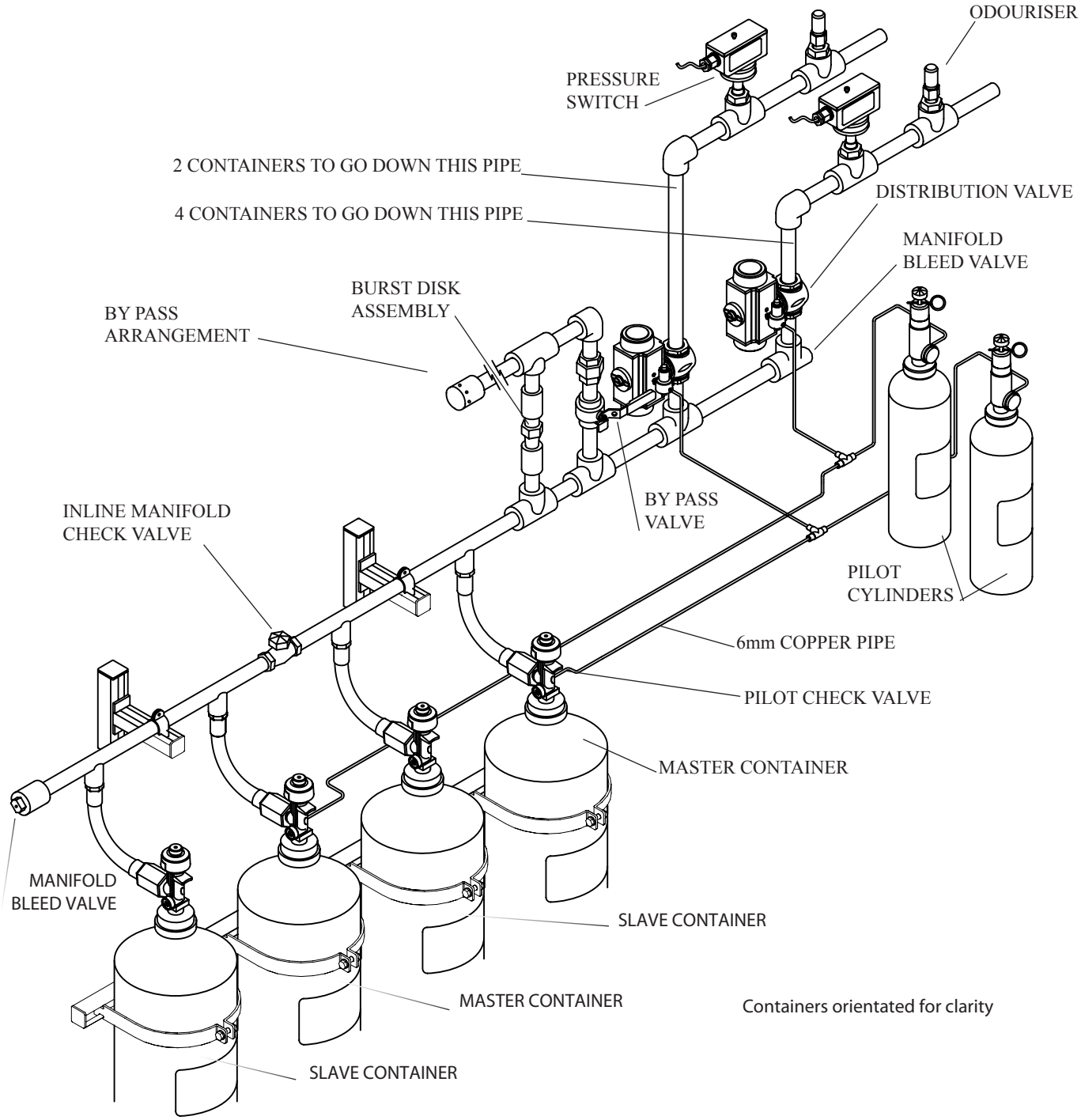


Fig.3 Distribution Valve System With Nitrogen Pilot Cylinder Control.

4. EQUIPMENT DESCRIPTIONS

Section	Equipment Description	Part Number
4.1	C02 High Pressure Container Assembly	303.200.013
4.2	CV-98 Container Valve	302.200.049
4.3	Booster Actuator	304.200.016
4.4	Solenoid Actuator HF	304.200.017
4.5	Manual Actuator Lever	304.200.018
4.6	Manifold Bleed Valve	302.200.068
4.6	Pilot Bleed Valve	302.200.021
4.7	6mm OD X 1/8" NPT Male Pilot Non Return Valve	302.200.067
4.8	Pneumatic Actuation Fittings 6mm	Various
4.9	Flexible Discharge hose and Check Valve	302.200.051
4.10	In Line Manifold Check Valve 1"	302.200.054
4.10	In Line Manifold Check Valve 2"	302.200.055
4.10	In Line Manifold Check Valve 3"	302.200.056
4.11	1" Manifold 2 point	307.400.001
4.11	1" Manifold 3 point	307.400.002
4.11	1" Manifold 4 point	307.400.003
4.11	1" Manifold 5 point	307.400.004
4.11	2" Manifold 2 point	307.400.005
4.11	2" Manifold 3 point	307.400.006
4.11	2" Manifold 4 point	307.400.007
4.11	2" Manifold 5 point	307.400.008
4.11	3" Manifold 3 point	307.400.010
4.11	3" Manifold 4 point	307.400.011
4.11	3" Manifold 5 point	307.400.012
4.12	Odouriser 2000	305.200.003
4.13	Pressure Switch 250 bar	305.205.002
4.14	1" Distribution Valve c/w P.R.	308.208.006
4.14	11/4" Distribution Valve c/w P.R.	308.208.007
4.14	11/2" Distribution Valve c/w P.R.	308.208.008
4.14	2" Distribution Valve c/w P.R.	308.208.001
4.14	3" Distribution Valve c/w P.R.	308.208.010
4.14	4" Distribution Valve c/w P.R.	308.208.011
4.15	Pilot Cylinder Assembly 50 bar N2 (4 litre)	311.006.030
4.16	Curtain Trip	305.200.001
4.17	Total Flooding Nozzle GRD 1/2"	309.200.001
4.17	Total Flooding Nozzle GRD 1"	309.200.002
4.18	Local Application Nozzle LA 1/2" S	309.200.003
4.18	Local Application Nozzle LA 1/2" L	309.200.004
4.18	Local Application Nozzle LA 1"	309.200.005
4.19	Local Application Nozzle Flange Ring LA 1/2" S	309.200.006
4.19	Local Application Nozzle Flange Ring LA 1/2" L	309.200.007

4. EQUIPMENT DESCRIPTIONS continued

Section	Equipment Description	Part Number
4.20	Manifold Burst Disk Assembly	305.200.012
4.21	1/2" Manual By- Pass Valve	302.001.008
4.22	1/2" Manual Lockable / Contacted Stop Valve	302.200.016
4.22	3/4" Manual Lockable / Contacted Stop Valve	302.200.017
4.22	1" Manual Lockable / Contacted Stop Valve	302.200.018
4.22	11/4" Manual Lockable / Contacted Stop Valve	302.200.019
4.22	11/2" Manual Lockable / Contacted Stop Valve	302.200.057
4.22	2" Manual Lockable / Contacted Stop Valve	302.200.058
4.22	3" Manual Lockable / Contacted Stop Valve	302.200.059
4.22	4" Manual Lockable / Contacted Stop Valve	302.200.060
4.23	Container Racking - Single Container	311.006.015
4.24	Container Racking - Two Containers - Single Row	311.006.011
4.24	Container Racking - Three Containers - Single Row	311.006.012
4.24	Container Racking - Four Containers - Single Row	311.006.019
4.24	Container Racking - Five Containers - Single Row	311.006.021
4.25	Container Racking - Four Containers - Double Row	311.006.017
4.25	Container Racking - Six Containers - Double Row	311.006.016
4.25	Container Racking - Eight Containers - Double Row	311.006.023
4.25	Container Racking - Ten Containers - Double Row	311.006.025
4.26	Manual Release Caution Plate	314.200.001
4.27	Door Caution Plate	314.200.002
4.28	T528 Manual Release Unit	526.001.018

4.1 CO_2 HIGH PRESSURE CONTAINER ASSEMBLY

(PART No. 303.200.013)

The High Pressure CO_2 systems are designed around the 67 litre, 45 kilogram capacity CO_2 container designed, manufactured and marked in accordance with EN1964 Part 1 or Part 2. The basic container assembly consists of:

1) CO_2 Container

2) Valve Protection Cap

3) CV-98 Valve

4) Syphon Tube

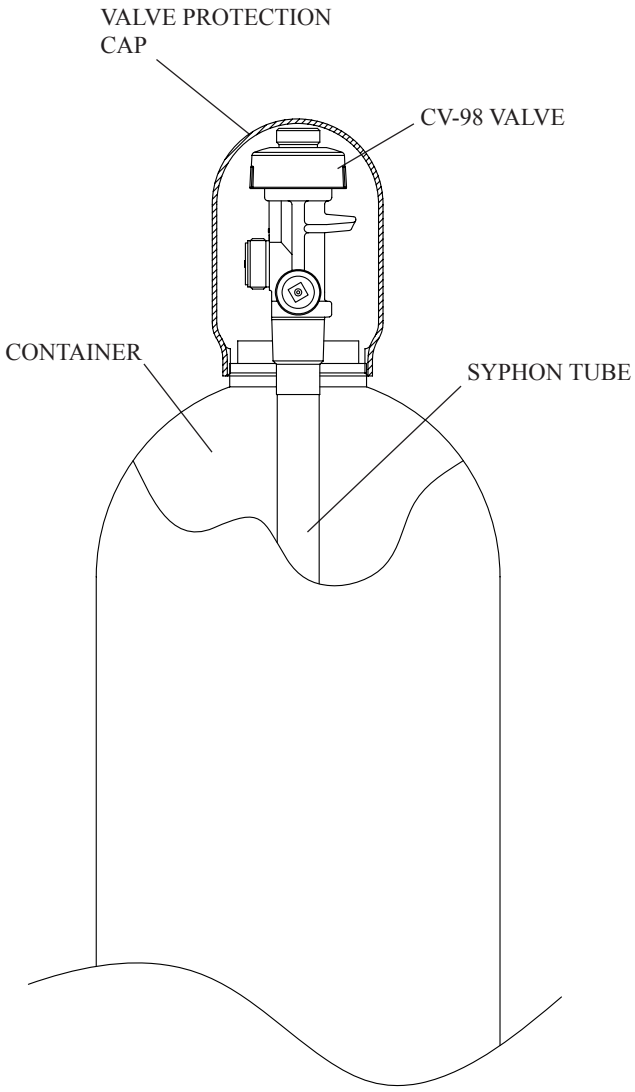
*Under no circumstances should the capacity of 45 kg be exceeded as this will cause an increase in pressure, due to temperature, which is likely to cause the safety disc to rupture.

Climatic area class 'E' is defined in BS 5355 *(BSEN 13096:2003, BSEN13099:2003)*** as a geographical region where the maximum shade temperature is equal to or greater than 52.5 ºC. The container should be located in a position which is as close to the hazard as possible and be protected from high ambient temperatures and from radiant sources of heat such as radiation of direct sunlight.

Containers must be protected from the weather.

If possible the containers should not be installed within the hazard area they are protecting. However, when the containers are located within the hazard area it is strongly recommended that a remote mechanical manual release unit is located outside the hazard area in addition to any electrical controls.

Container Details	
Water Capacity	67.0 litres (nominal)
Gas Capacity *	45 kg
Length	1507mm
Outside Diameter	267 mm
Maximum Working Pressure	194 bar.
Test Pressure	250 bar
Climatic Area **	Class 'E'
Nominal Tare Weight	76.9 kg
Nominal Gross Weight	122 kg



Part No. 303.200.013
CO_2 High Pressure Container Assembly

4.2 CO_2 CONTAINER VALVE TYPE CV-98

(PART No. 302.200.049)
This component is part of assembly 303.200.013.

The quick opening valve is operated either by a solenoid actuator or by a mechanical manual actuator. A booster-pack fits directly on top of the container valve. The solenoid is fitted on top of the booster and the mechanical release unit fits on top of the solenoid actuator. On mechanical manual only systems the solenoid only is omitted. On a system this assembly would then be designated the 'master' container.

The remaining containers on the system would have the designation 'slave' containers and these would be operated via back pressure from the 'master' container.

On operation of either the solenoid actuator or the mechanical manual actuator C02 gas from the master container would pressurise the manifold. C02 would then pressurise the discharge hoses of the slave containers and would create a back pressure on the slave container valves. This backpressure will cause the valves to open and their contents will discharge through the same discharge pipe.

A safety burst disc is incorporated in the container valve. This is designed to rupture at approximately 190 bar which corresponds to a temperature of approximately 65 ºC.

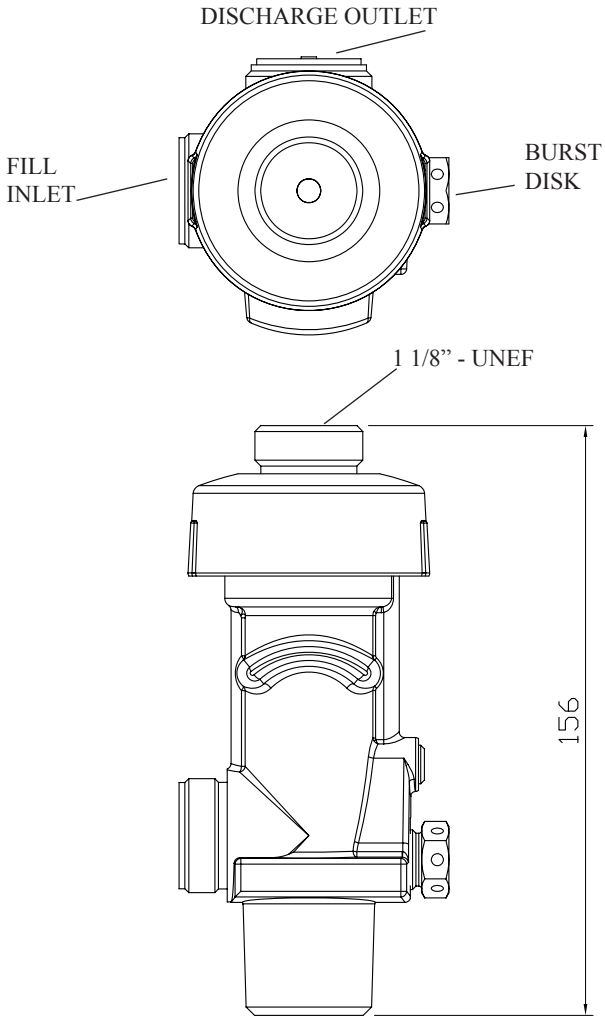
For hydraulic calculation purposes the equivalent length of the container valve, dip tube and flexible discharge hose is 5.8 metres of 1/2″ schedule 80 steel pipe.

Test Pressure: 720 bar

Working Pressure: 200 bar

Material: Brass UNS C37700

Net Weight: 1.8kg



CV-98 Container Valve Part No. 302.200.049 and Dip Tube Part No. 302.200.053

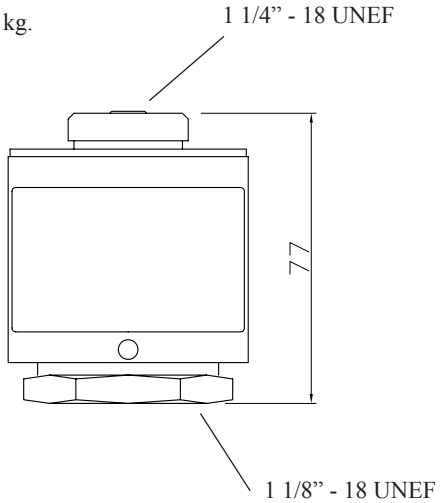
4.3 Booster Actuator

(PART No. 304.200.016)

The Booster Actuator is used on the 'master' container to provide the pressure to open the container valve. It is used in conjunction with either the solenoid actuator or mechanical actuator and fits on top of the container valve. The Booster Actuator requires resetting after actuation. A Reset Tool is available for this operation.

Material: Brass UNS C87500

Net Weight: 1.2 kg.



Booster Actuator Part No. 304.200.016

4.4 SOLENOID ACTUATOR HF

(PART No. 304.200.017)

The Solenoid Actuator fits directly on top of the Booster Actuator.
The nominal voltage is 12vdc @ 0.57 amps.
The minimum rated voltage is 10.4vdc.
The maximum rated voltage is 14.0 vdc.
The actuator meets the requirements of N.E.C. Class 1,Div 1, Groups B,C,D and Class II, Div.1 Groups E,F,G.
Body material - Brass
Plunger material - Stainless Steel
Once operated the actuator will latch in the operated position. A reset tool is provided.
A resistor, part number 304.200.019 is required for 24 volt operating systems to enable correct actuation of the solenoid actuator. This item is included when the solenoid is ordered.
It is imperitive that the solenoid is reset before fitting it to the booster actuator. Failure to do this would result in the immediate discharge of the container.

Material: Brass Composition 85-5-5-5

Net Weight: 1.9 kg

4.5 MANUAL ACTUATOR LEVER

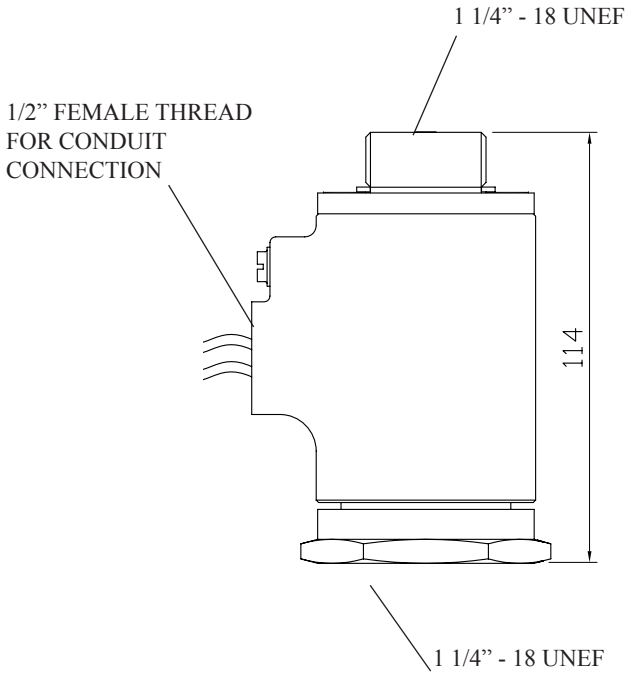
(PART No. 304.200.018)

The manual actuator may be used to operate the CO_2 container by means of local mechanical action or by remote mechanical action.

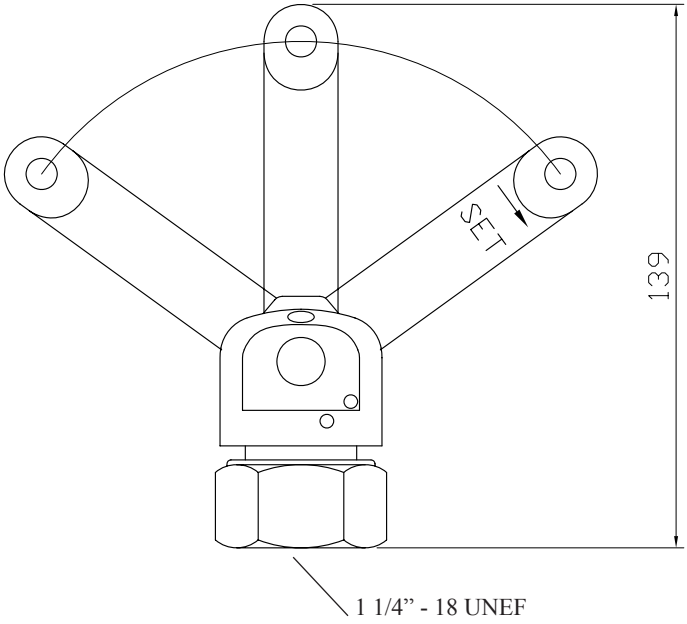
The actuator is fitted directly onto the top of the booster actuator or solenoid actuator.

Accidental manual release is prevented by means of a steel safety pin. The steel safety pin must be removed to allow the use of the operating lever. After removing the safety pin manual operation is caused by moving the operating lever. The lever contains a forged mechanical detent which secures the lever in the open position when actuated.

Net weight: 0.6 kg



Solenoid Actuator HF Part No. 304.200.017



Mechanical Manual Actuator Lever Part No. 304.200.018

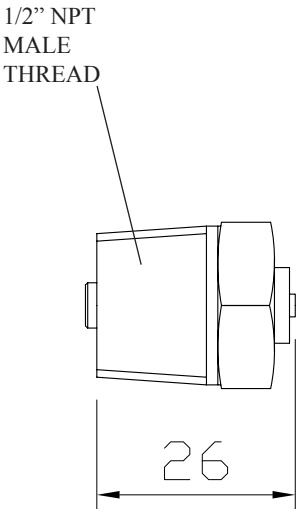
4.6 MANIFOLD BLEED VALVE 1/2" NPT

(PART No. 302.200.068)

The manifold bleed valve is used to release low pressure build up that may occur in systems with distribution valve systems. It should be located where there is a possibility of a manifold check valve leaking.

Material: Brass UNS C36000

Net weight: 0.25 kg



Part No. 302.200.068 Manifold Bleed Valve 1/2" NPT

4.6 PILOT BLEED VALVE 1/4" NPT

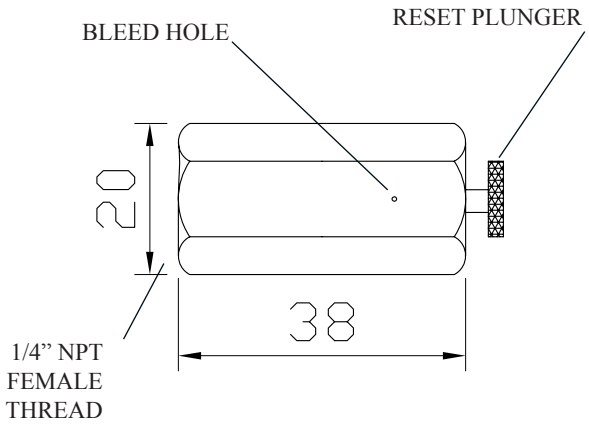
(PART No. 302.200.021)

The pilot bleed valve serves two functions. First it acts to relieve a gradual pressure build-up occurring perhaps as a result of a leaking pilot cylinder or a leaking pilot check valve. Second it provides a means by which pressure trapped in the actuation circuit may be manually relieved.

The manual bleed valve relieves automatically up to a pressure of approximately 2 bar and seals at pressures above this.

Pressure is relieved manually via the knurled reset plunger.

Net weight: 0.12 kg



Part No. 302.200.021Pilot Bleed Valve 1/4" NPT

4.7 6mm OD x 1/8" NPT MALE PILOT NON RETURN VALVE

(PART No 302.200.067)

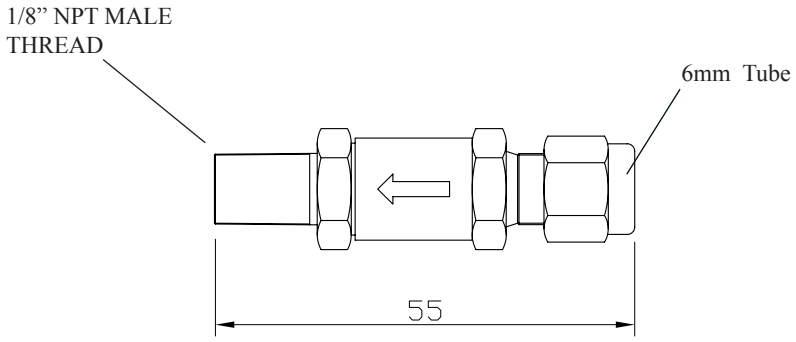
The pilot non-return valve is used when there is a requirement for a nitrogen pilot cylinder arrangement to operate the system.

For example a system using distribution valves with a main and reserve supply of gas may use a pilot cylinder arrangement. The pilot non return valve will ensure that pilot pressure opens only the correct bank of containers and the correct distribution valve. The upstream side of the pilot non return valve should have a manual bleed valve (part no. 302.200.021) fitted to compensate for any leakage through the check valve.

It is essential that it is fitted the correct way round, otherwise the system will not operate correctly.

Material: Stainless Steel

Net weight: 0.02 kg



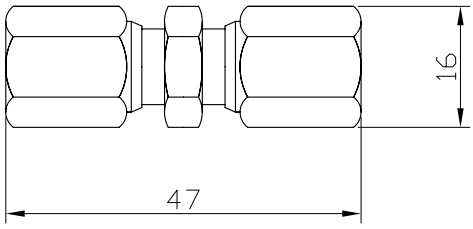
6mm OD x 1/8" NPT MALE PILOT NON RETURN VALVE

Part No. 302.200.067 Pilot Non Return Valve

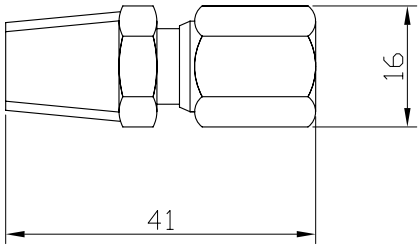
4.8 PNEUMATIC ACTUATION FITTINGS

(PART Nos. Various - see below)

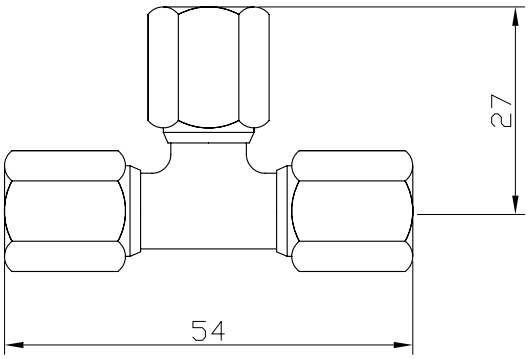
A variety of pneumatic actuation fittings are available. The locations where these may be used are indicated elsewhere in this manual.



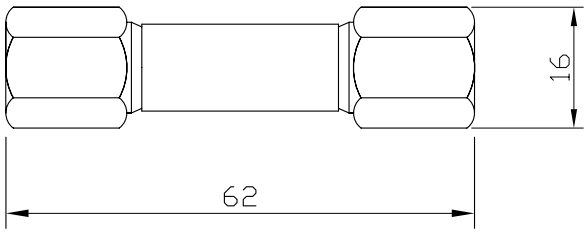
6mm STRAIGHT COUPLING



6mm X 1/4” STUD COUPLING



6mm TEE



6mm CHECK VALVE

Description	Part Number
6mm copper pipe 1M	308.002.001
6mm copper pipe 3M half hard	308.002.002
6mm straight coupling	309.011.001
6mm x 1/4" stud coupling	309.010.003
6mm tee	309.013.001

Pneumatic Actuation Fittings

4.9 FLEXIBLE DISCHARGE HOSE AND CHECK VALVE

(PART No. 302.200.051)

The 5/8″ flexible discharge hose connects the container valve outlet to the manifold and is sufficiently flexible to allow for easy alignment of multiple container banks to fixed piping.

The female connector that fits to the container valve incudes a check valve to prevent loss of agent should the system discharge while the container is removed. The connector includes a swivel to enable ease of installation.

A washer (part no. 302.200.052) needs to be inserted between the container valve and the discharge hose. This item is supplied with the discharge hose and does not have to be ordered seperately.

The outlet of the hose has a fixed 1/2” NPT male thread for connection into the manifold.

Test pressure is 621 bar

Working Pressure: 200 bar

Material: Fittings Brass UNS C36000

Material: Hose

Net weight 1.4 kg

Part No. 302.200.051 Flexible Discharge Hose and Check Valve

4.10 IN LINE MANIFOLD CHECK VALVE

(PART No. 302.200.054, 302.200.055, 302.200.056)

In line manifold check valves are used in main/reserve systems and distribution valve systems when a different number of containers are required for each risk area. The check valve is located between manifolds and is used to prevent gas pressure from passing down the manifold in the wrong direction.

On distribution valve systems the manifold check valve prevents the containers from the selected hazard from pressurising the manifold of the containers required for protecting a larger hazard. Only the containers required for the particular hazard are activated

The check valves are threaded NPT female to suit the manifold or pipe size.

The check valves are available in three sizes.

1" Part no. 302.200.054 Weight = 3.2kg.

2" Part no. 302.200.055 Weight = 10.5 kg

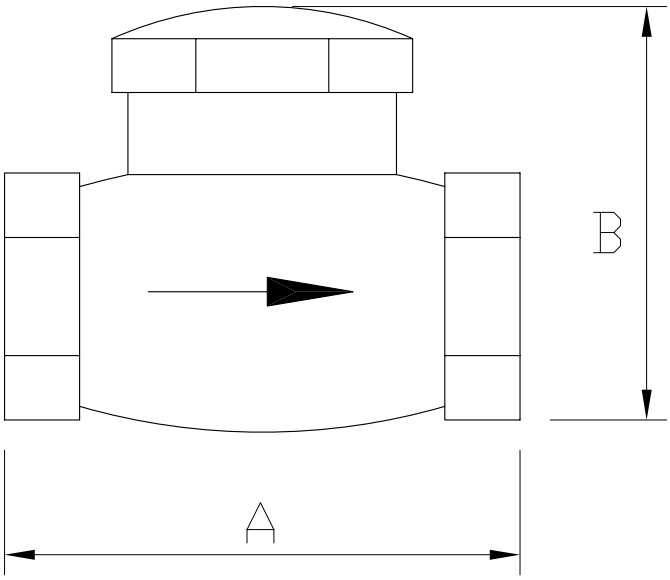
3" Part no. 302.200.056 Weight = 53 kg

Note: The 3" valve includes screwed flanges. These are complete with flanges, gaskets, nuts and bolts

Test Pressure: 241 bar

Working Pressure: 150 bar

Material - Manganese Bronze ASTM B-147



	A	B
1"	104	95
2"	165	146
3"	292	241 *

* This figure is to the outside of the loose flanges supplied with this diameter of valve

Part No. 302.200.054, 302.200.055, 302.200.056 In Line Manifold Check Valve

4.11 CO_2 MANIFOLD

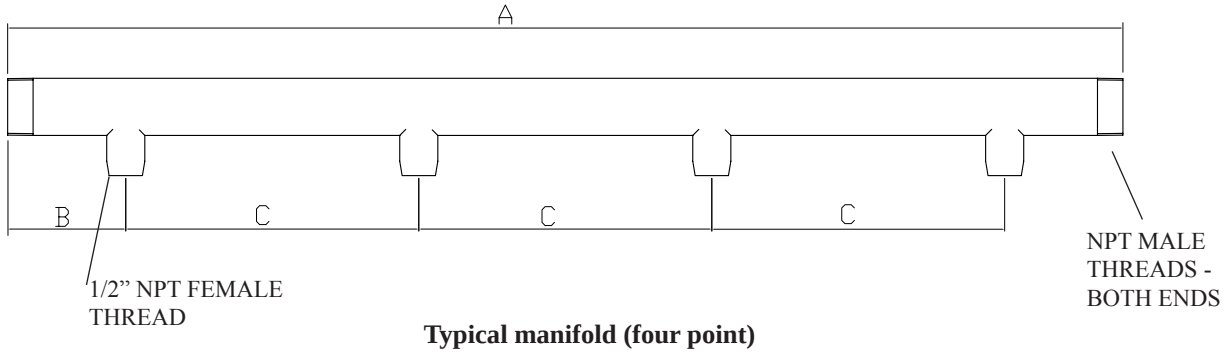
(PART Nos. Various - please see below)

The CO_2 manifold is designed to enable all the containers in a row to be connected to the supply pipe.

The standard manifolds have inlets for between 2 & 5 containers and are available in three sizes, 1″, 2″ & 3”. The manifolds may be joined using sockets or tees to produce any configuration to suit any number of containers on a system.

Non standard sizes may be made to order.

All manifolds are manufactured from schedule 80 pipe, galvanised inside and out and pressure tested to 190 bar.



Typical manifold (four point)

MANIFOLDS						
Nominal Bore	Ports	A	B	C	Weight	Part No.
		mm	mm	mm	Kg.	
1"	2	580	135	310	2.5	307.400.001
1"	3	890	135	310	3.5	307.400.002
1"	4	1200	135	310	4.5	307.400.003
1"	5	1510	135	310	5.5	307.400.004
2"	2	560	125	310	3	307.400.005
2"	3	870	125	310	4	307.400.006
2"	4	1180	125	310	6	307.400.007
2"	5	1490	125	310	7.4	307.400.008
3"	3	850	115	310	18	307.400.010
3"	4	1160	115	310	24.5	307.400.011
3"	5	1470	115	310	31	307.400.012

Part No. shown above. Manifolds

4.11 CO_2 MANIFOLD

PART No.'s Please see below

Universal clamps fix the manifold to the cantilever bracket which in turn is fixed either directly to the wall or to a length of vertical channel which provides adjustment in height.

The 450mm bracket is used for a single row and the 600mm is used for a double row.

Two brackets are required per manifold each comprising of a cantilever bracket, pipe clamp and fixing nut and bolt.

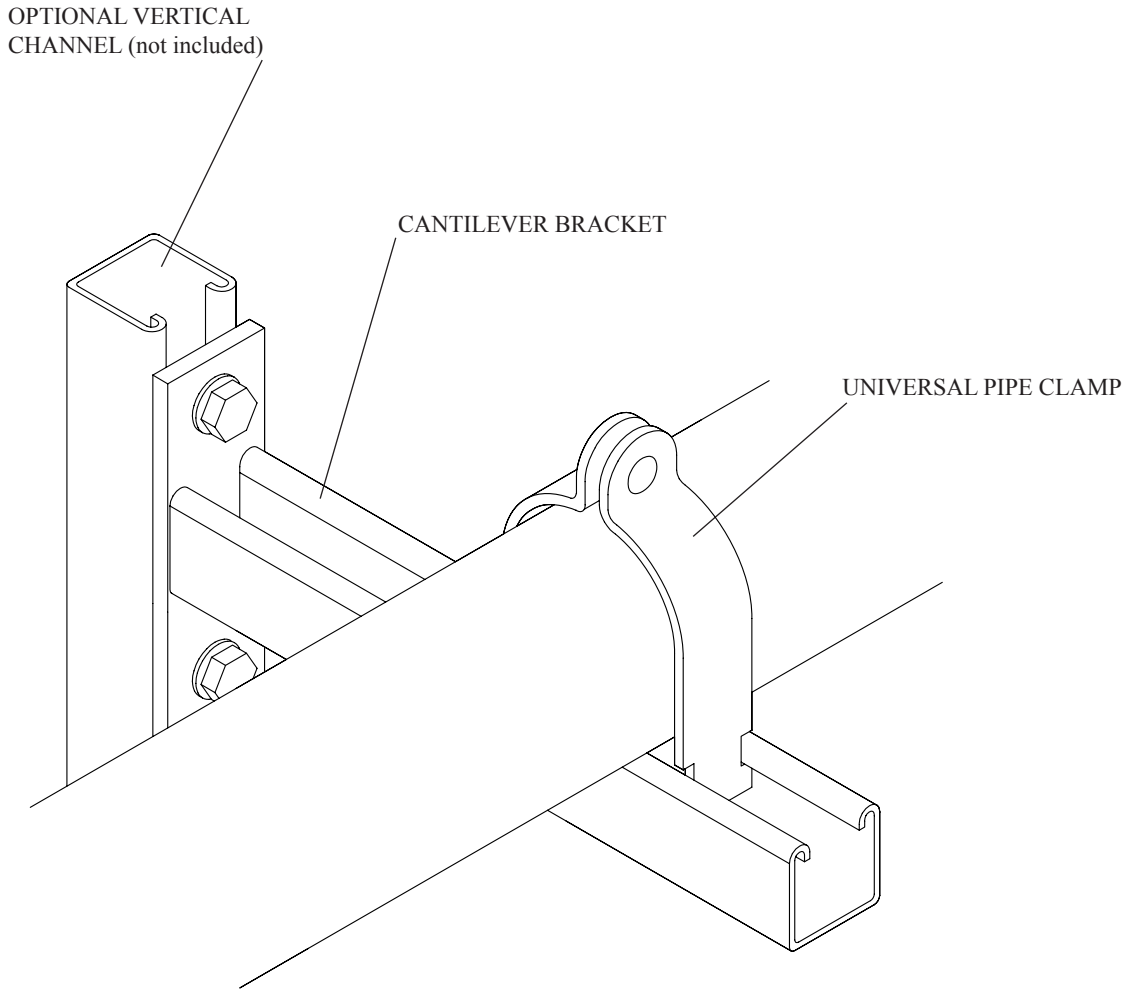
450mm Cantilever bracket - part number 311.003.012

600mm Cantilever bracket - part number 311.003.018

1" Universal pipe clamp - part number 311.002.011

2" Universal pipe clamp - part number 311.002.016

3" Universal pipe clamp - part number 311.002.017



Part No. showm above. Manifold Brackets

4.12 ODOURISER 2000

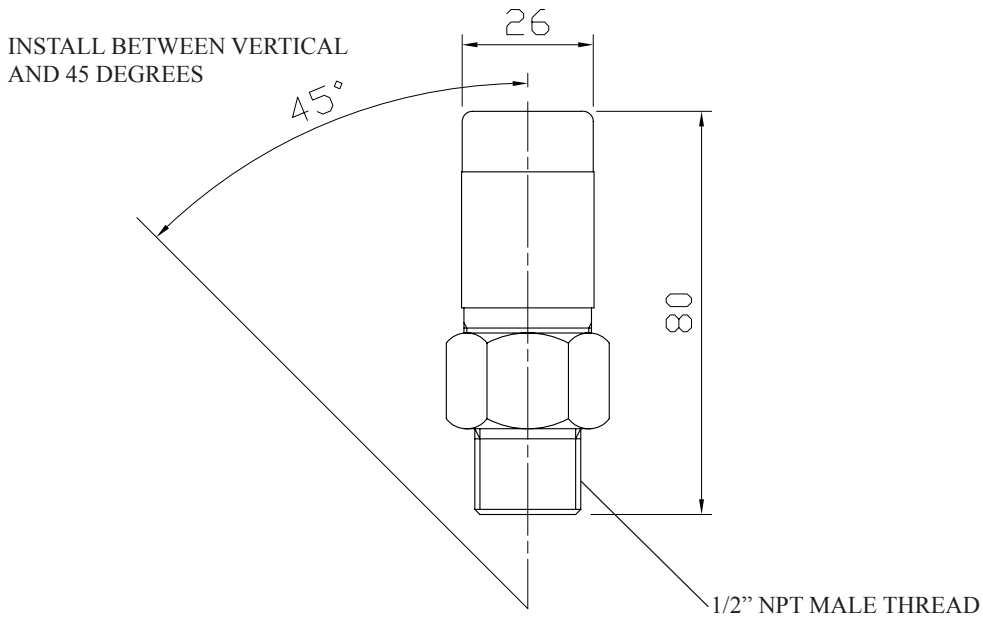
(PART No. 305.200.003)

The Odouriser 2000 is designed to give a distinctive smell to the CO_2 and is particularly useful in basements or low lying areas in the vicinity of the system or any place where CO_2 could drift to following a discharge.

Liquid citrus odour is contained in the body of the odouriser and is sealed in by a lead disc. Pressure of the discharging CO_2 causes the disc to rupture and allows the liquid to escape and mix with the CO_2. One type 2000 odouriser is used for each 2000 kg of CO_2. The odouriser must be replaced after each operation of the system.

Material: Brass

Net Weight: 0.3 kg



Part No. 305.200.003 Odouriser 2000

4.13 PRESSURE SWITCH 250 bar

(PART No. 305.205.002)

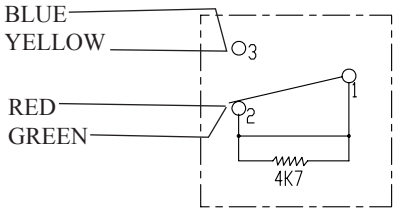
The pressure switch is mounted either in the distribution pipework or on the manifold and may be used to provide an electrical indication of the release of CO_2, to perform ventilation shut-downs or to initiate indication of gas trapped in manifold where there are stop valves in the distribution pipework.

The pressure switch requires to be manually reset following operation.

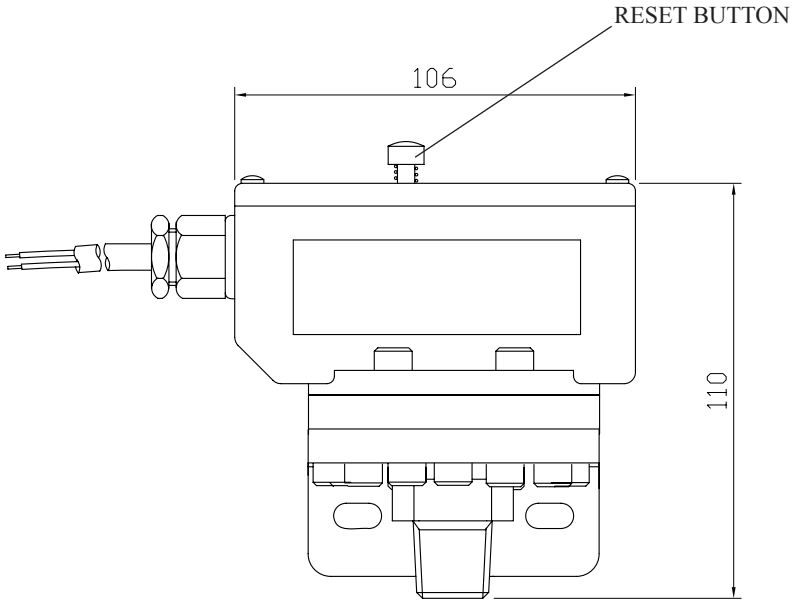
A minimum pressure of 3 bar is required to ensure satisfactory operation.

Connection to the pressure switch may be either 1/2″ NPT (male) or 1/4″ NPT (female).

Net weight:1.4 kg



ELECTRICAL CONNECTIONS



Part No. 305.205.002 Pressure Switch 250 bar

4.14 DISTRIBUTION VALVE & PRESSURE REDUCER

(PART No. as shown)

The distribution valve is used in applications where multiple areas require to be protected from a single bank of containers.

The valve may be operated either via pilot pressure from a nitrogen pilot cylinder or by direct mechanical manual operation.

Nominal Valve Diameter	Part Number	Net Weight (kg)
1" (25mm)	308.208.006	tba
11/4" 32mm)	308.208.007	tba
11/2" (40mm)	308.208.008	tba
2" (50mm)	308.208.001	17.5
3" (65mm)	308.208.010	tba
4" (100mm)	308.208.011	tba

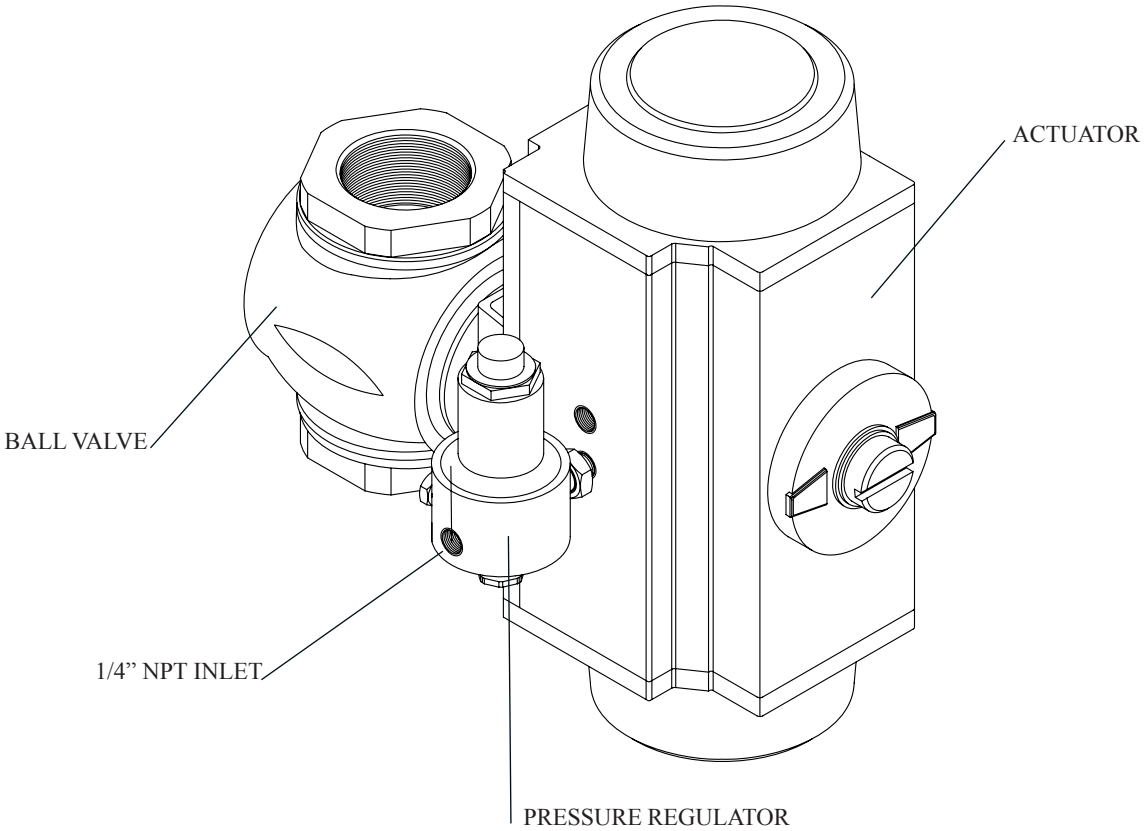
The distribution valve requires a minimum pressure of 7 bar to satisfactorily operate it and the precise configurtion of the actuation system is critical to ensure that the system operates as intended.

The actuation port is 1/4" NPT female. The 6mm x 1/4" stud coupling part number 309.010.003 allows connection to the 6mm copper actuation tubing.

The standard valve is 50mm nominal bore with 50mm NPT female connections. Other sizes are available but are not stocked.

The distribution valve assembly comprises of a ball valve, actuator, pressure regulator, bleed valve and pressure relief burst disk. The bleed valve ensures that a leaking check valve does not build up sufficient pressure to open the valve.

Net weight 17.5 kg



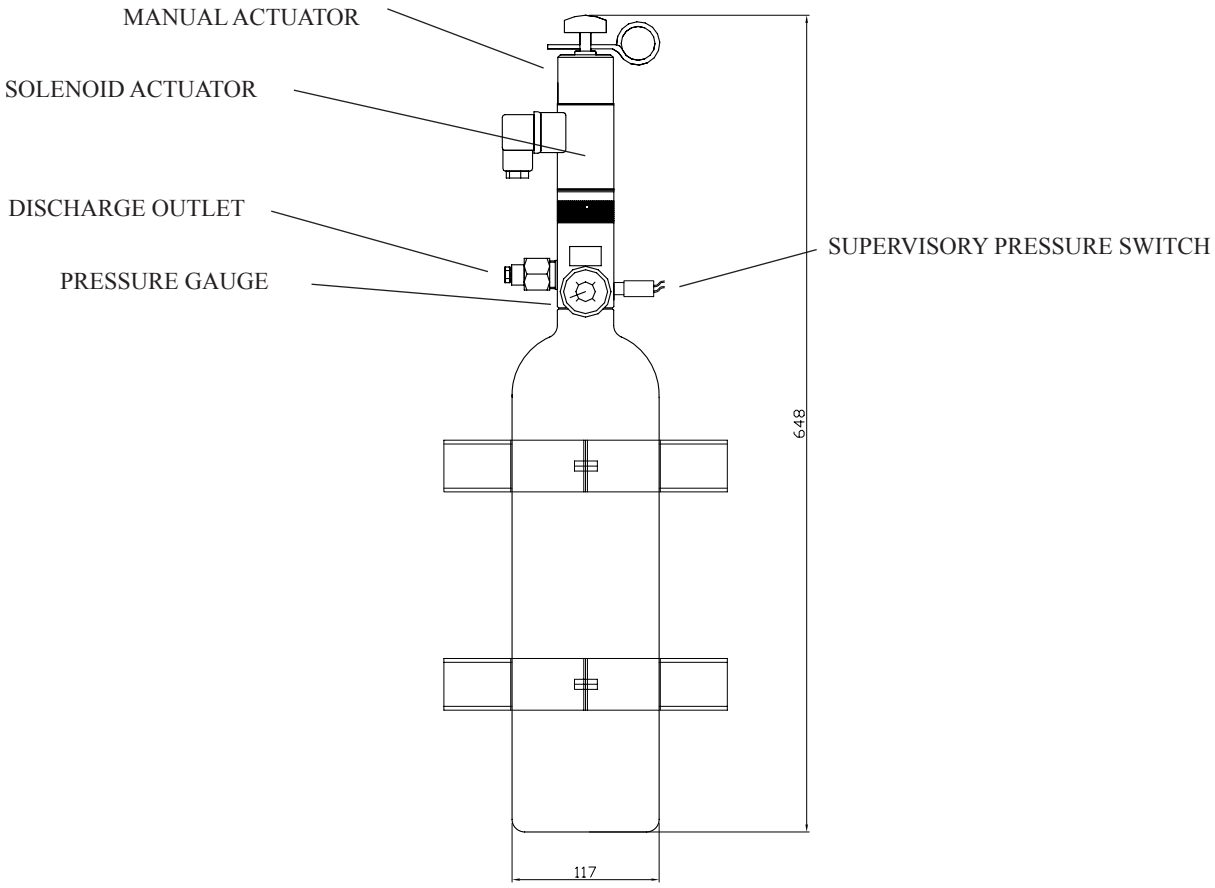
Part No. 308.208.006/011 Distribution Valve & Pressure Reducer

4.15 PILOT CYLINDER ASSEMBLY 50bar N2 (4 LITRE)

(PART No.311.006.030)
The pilot cylinder may be used to pneumaticaly operate the master container and/or distribution valve. It may be operated electrically or by manual means.
The 4 litre cylinder is manufactured in accordance with EN1964 Part 2 and is pressure tested to 250 bar.
The cylinder is charged to 50 bar and is fitted with a pressure gauge and supervisory pressure switch as standard. The supervisory pressure switch has normally open contacts.

A mounting bracket is included.
The solenoid and manual actuator are ordered seperately.
The solenoid part number is 304.205.001. It operates at 24VDC 0.2Amps.
The solenoid requires a solenoid lead part number 304.001.001.
The manual actuator part number is 304.205.003.
An outlet adaptor, part number 311.006.028 , is included and provides an outlet thread size of 1/4" NPT female.

Weight: 12kg (including solenoid and manual actuator)



Part No. 311.006.030 4 Litre Nitrogen Pilot Cylinder

4.16 CURTAIN TRIP

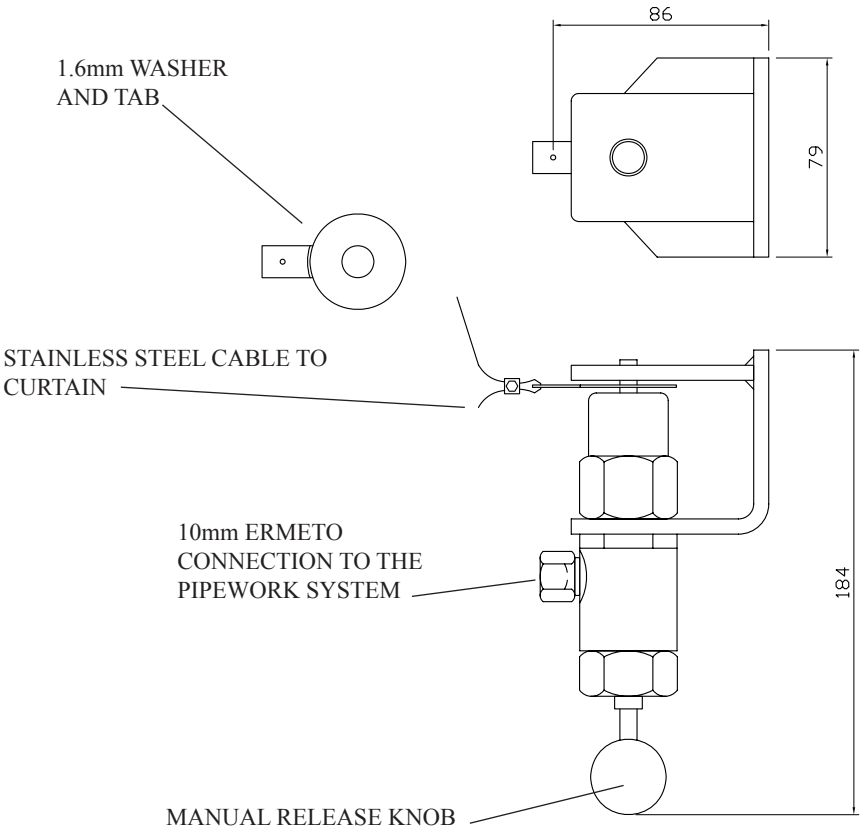
(PART No. 305.200.001)

The curtain trip assembly is a pressure trip designed to pneumatically release drop curtains.

A version of the pressure trip is available to pneumatically operate self closing doors (Part No. 305.005.006). This version is similar to the 'curtain' pressure trip except that a separate bracket is provided for fitting to the door or closing device and the welded bracket is omitted.

Connection to the pressure trip is by means of 3/8″ pipework from the system discharge pipework. The pressure trip is designed to be used in the horizontal plane.

Net weight: 1.5 kg



Part No. 305.200.001 Curtain Trip

4.17 TOTAL FLOODING NOZZLE

(PART No. 309.200.001, 309.200.002

This nozzle is used in most Total Flooding applications. It is normally recommended that the nozzles are uniformly positioned on the ceiling of an enclosure to ensure a satisfactory distribution of CO_2. Where it is not practical to position the nozzles on the ceiling, it may be acceptable depending on the room dimensions to position them around the perimeter at high level.

For CO_2 total flooding systems there are no strict rules governing the number of nozzles that should be applied to any type of hazard, however, nozzle spacing is dependent on the room height, flow rate, potential obstructions etc.Generally the nozzles have a maximum coverage area of 30 square metres in a room up to 5 metres high

In order to reduce the possibility of the nozzle orifice becoming blocked during discharge, terminal nozzles should be installed in a tee and a short length of pipe (100 mm) capped/plugged should be fitted to act as a dirt trap.

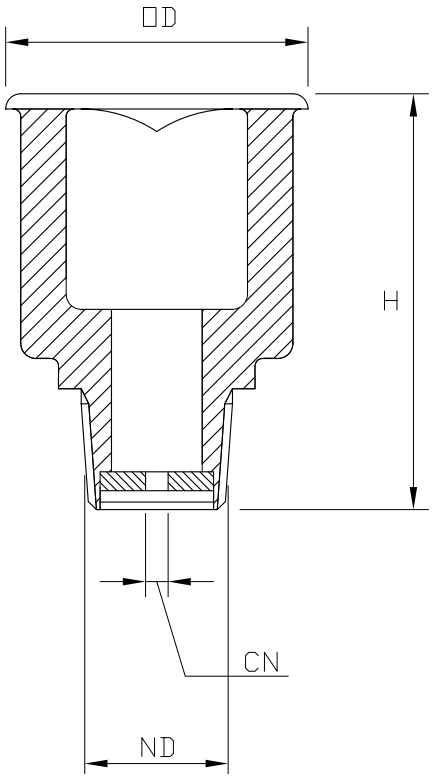
Orifice codes must be stated at the time of order.

The GRD total flooding nozzle is available in two sizes 1/2" and 1" and connects to the pipe via a 1/2" NPT male or 1" NPT male thread.

Material: Brass

Net weight: 1/2" 0.05 kg

1" 0.15 kg



	GRD 1/2"	GRD 1"
ND	1/2"	1"
H	55mm	55mm
OD	40mm	40mm
CN	min. 2.0 max. 16.0	min. 14.0 max. 20.0
P.No.	309.200.001	309.200.002

Part No. 309.200.001, 309.200.002 Total Flooding Nozzle

4.18 LOCAL APPLICATION NOZZLE

(PART No. 309.200.003, 309.200.004, 309.200.005.)

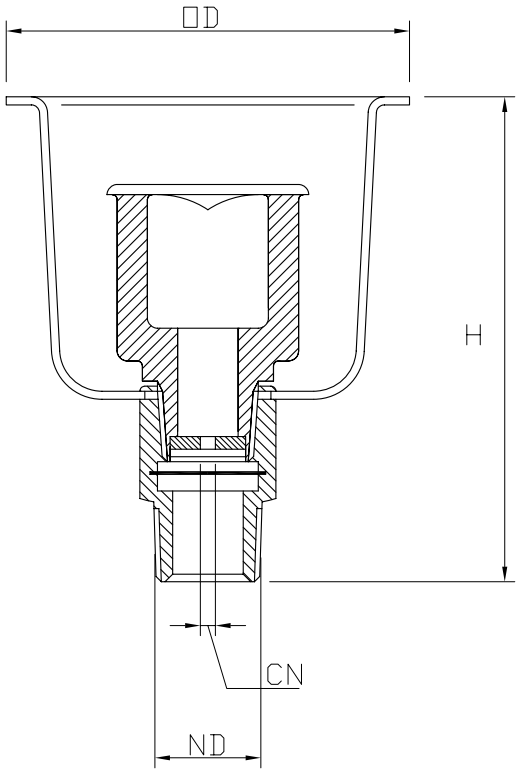
The Local Application nozzle is designed to project CO_2 in the direction of the fire hazard.

CO_2 is discharged in the form of a mist or fog and the discharge velocity is relatively low, thus making it suitable for use in local application systems particularly where flammable liquids are involved and there could be a danger of splashing from the impingement of CO_2.

Nozzle positioning is dependent on the type of hazard, the method employed in calculating the CO_2 quantity, the nozzle height and flow rate required. (See Local Application System Design Section 2.2.2).

Connection to the pipework is either 1/2" or 1" NPT male.

Net weight : 1/2"S 0.03 kg
1/2"L 0.5 kg
1" 1.15kg



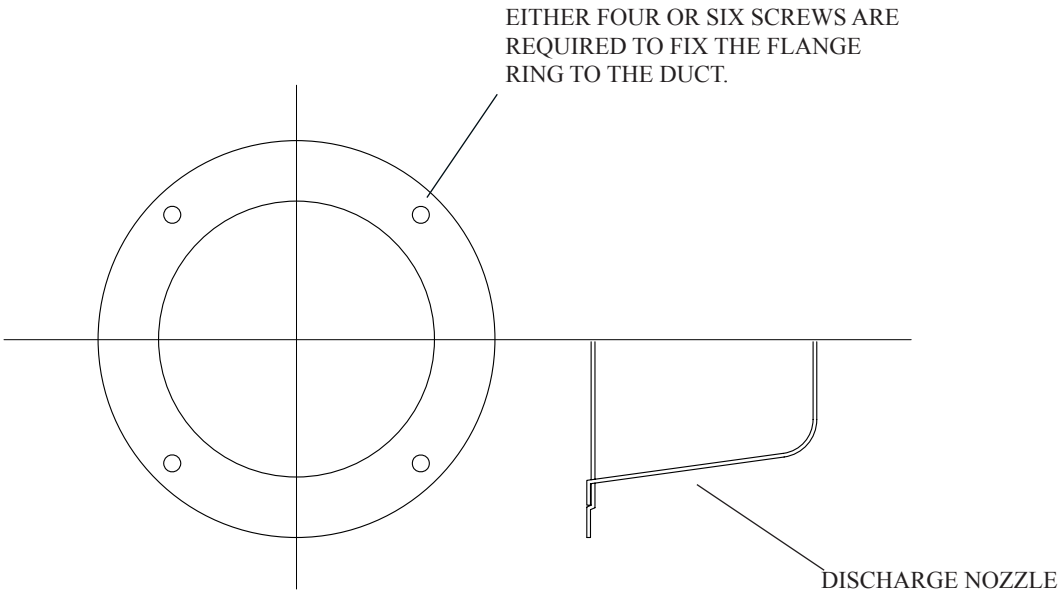
	LA 1/2" S	LA 1/2" L	LA 1"
ND	1/2"	1/2"	1"
H	97mm	128mm	296
OD	70mm	110mm	110mm
CN	min. 4.0 max. 11.5	min. 12.0 max. 16.0	min. 16.0 max. 25.0
P.No.	309.200.003	309.200.004	309.200.005

Part No. 309.200.003, 309.200.004, 309.200.005 Local Application Nozzle

4.19 LOCAL APPLICATION FLANGE RING

(PART No. 309.200.006 / .007)
In order to fix a Local Application nozzle to a duct a flange ring is required.
The flange ring fits over the discharge nozzle and clamps it to the duct with self tapping screws.
It is available for both of the 1/2" nozzles but not the 1" nozzle.

Net weight : 1/2"S 0.1 kg
1/2"L 0.15 kg



Flange ring for nozzle type	OD	PCD	ID	Part No.	No. of screws
LA 1/2" S	105	93	83	309.200.006	4
LA 1/2" L	145	133	123	309.200.007	6

Part No. 309.200.008 / .009 Local Application Flange Ring

4.20 MANIFOLD BURST DISK ASSEMBLY

(PART No. 305.200.012)

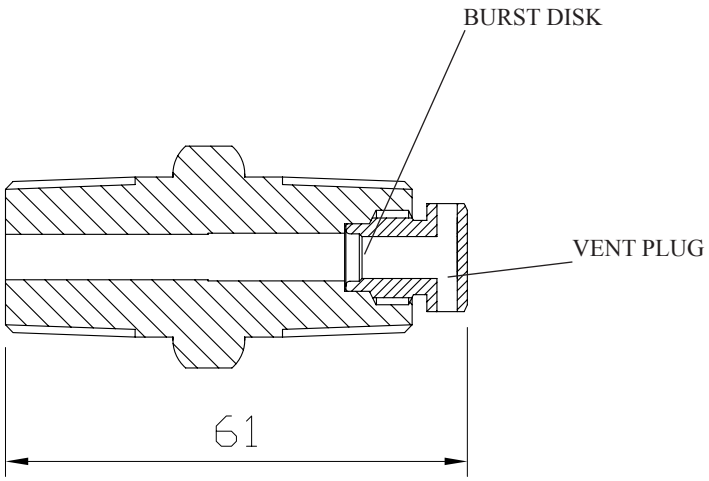
The manifold burst disk is designed to automatically relieve excess pressure that may be created in a closed section of pipe. A section of pipe between the containers and a stop valve is a 'closed section.'

An increase in pressure in the manifold due to trapped gas and high temperature will cause the burst disk to operate and relieve the pressure. It is a requirement that the outlet of the burst disk is piped to atmosphere away from personnel and should terminate in a discharge nozzle.

A by-pass valve is fitted in parallel with the burst disk. Manual venting of the closed section of pipe can be achieved if required.

The burst disk is set to operate at 146 bar.

Net weight: 1.0 kg



Part No. 305.200.012 Manifold Burst Disk Assembly

4.21 MANUAL BY-PASS VALVE

(PART No. 302.001.008)

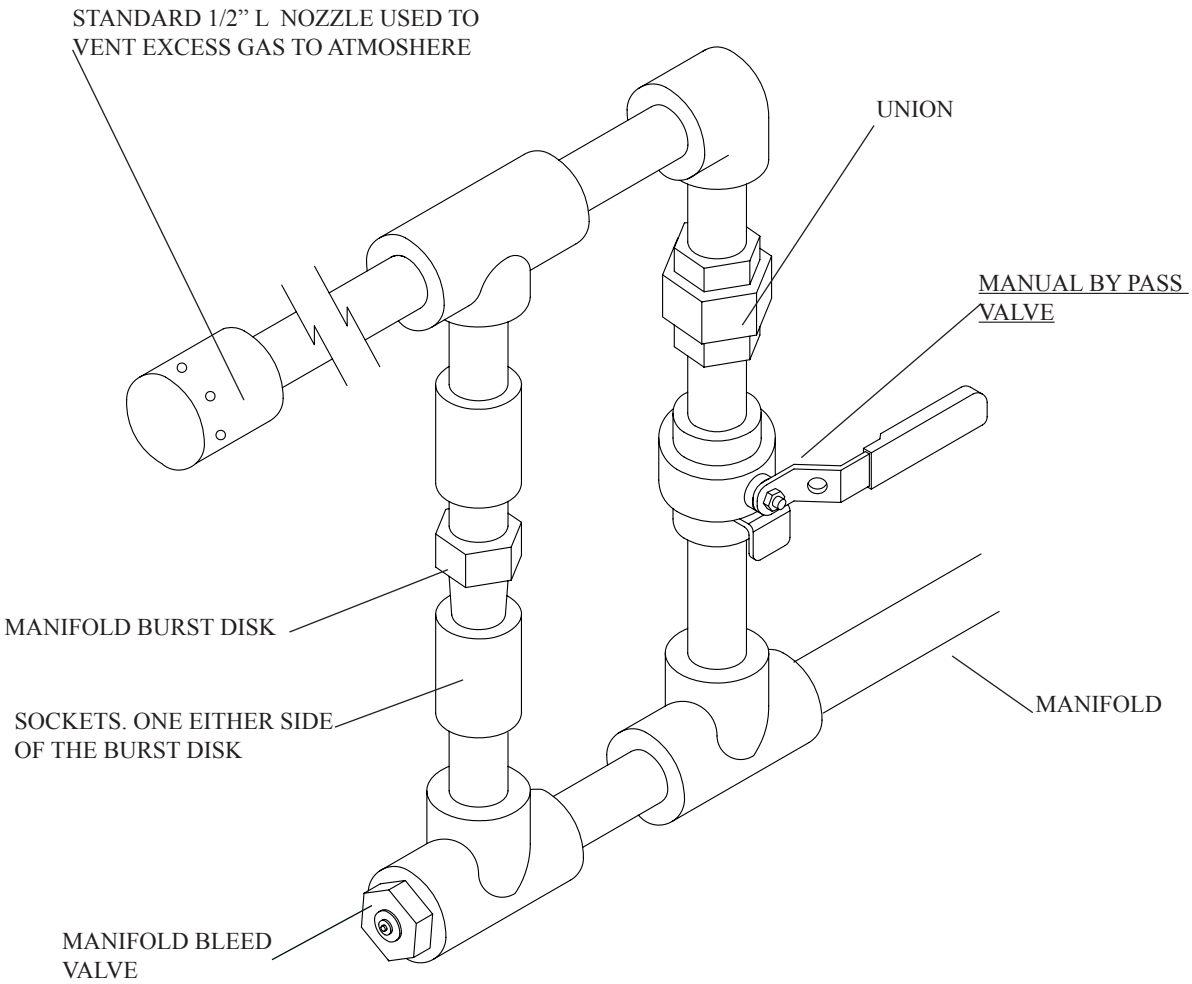
The manual by-pass valve is used to allow CO_2 to be safely vented to atmosphere if it becomes trapped within a closed pipework section.

The standard valve is 1/2″ nominal bore.

The valve is used in the normally closed position and is provided with a locking bracket into which a standard padlock may be fitted.

The valve is shown below as part of the standard by pass arrangement assembly.

Net weight: 0.25 kg



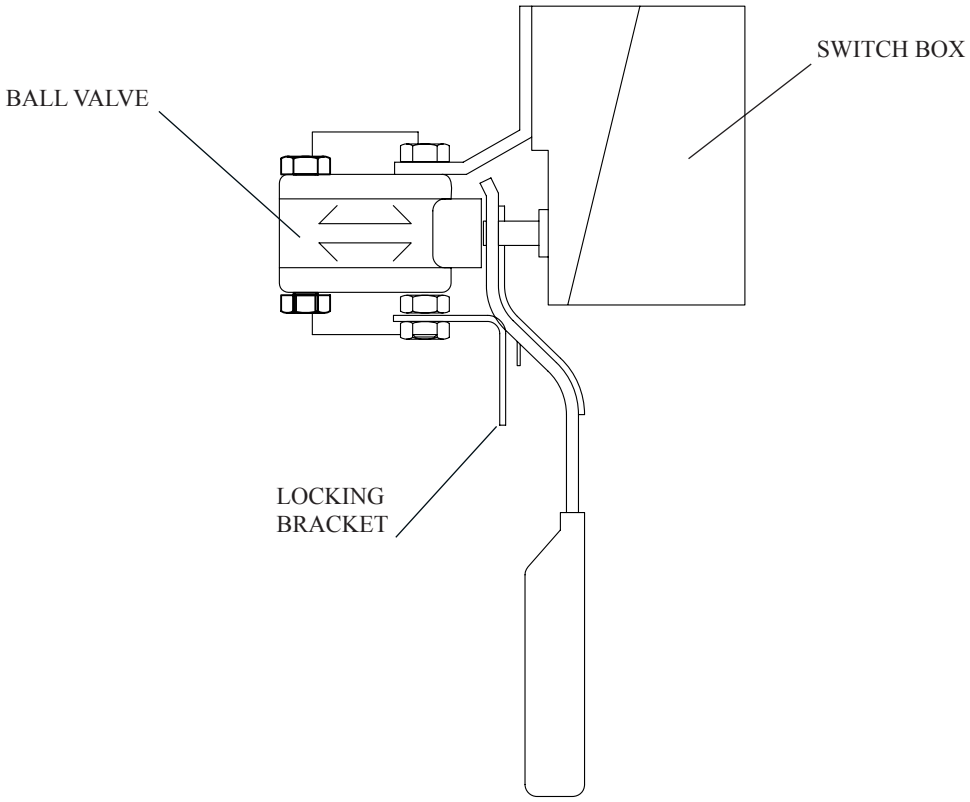
Part No. 302.001.008 Manual By-Pass Valve

4.22 MANUAL LOCKABLE/CONTACTED STOP VALVES

(PART Nos. Various - see table)

Manual stop valves are used to isolate the supply of CO_2, (usually at the container manifold location), from the discharge pipework.

The valves are available as standard in four sizes, 1/2″, 3/4″, 1″ and 1¼″ and each are fitted with a 007 switchbox to enable an indication of 'valve open' or 'valve closed' to be given. The valves are also provided with a locking bracket into which a standard padlock may be fitted. Other sizes are available to order.



Nominal Valve Diameter	Part Number	Net Weight (kg)
1/2" (15mm)	302.200.016	1.2 kg
3/4" (20mm)	302.200.017	1.42 kg
1" (25mm)	302.200.018	1.6 kg
11/4" 32mm)	302.200.019	1.75 kg
11/2" (40mm)	302.200.057	tba
2" (50mm)	302.200.058	tba
3" (65mm)	302.200.059	tba
4" (100mm)	302.200.060	tba

Part No. Various see table Manual Stop Valve - Lockable/Contacted

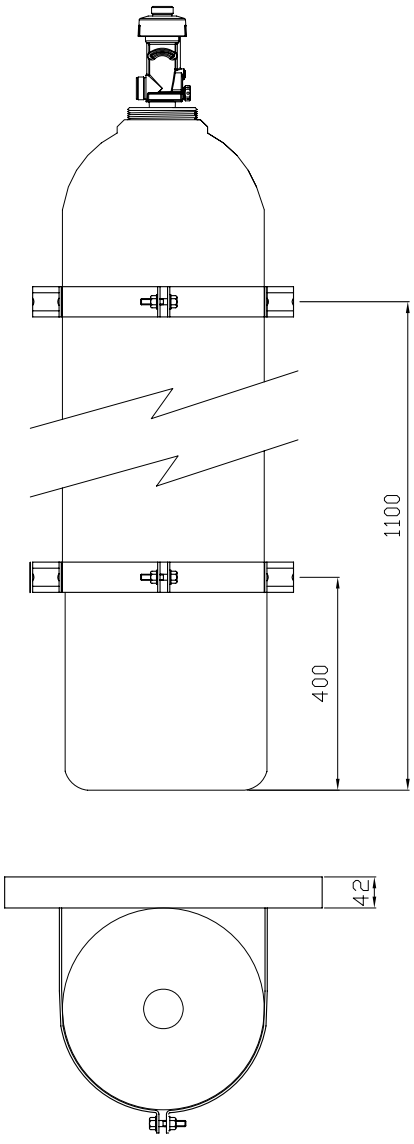
4.23 CONTAINER RACKING - SINGLE CONTAINER

(PART No. 311.006.015)

The racking is designed to securely fix a single container to a wall or supporting structure. It comprises of two sections of steel channel and two pairs of universal clamps.

The steel channel sections are fixed securely to the wall or supporting structure. The universal clamps have a special slotted section which allows each half to be fitted into the steel channel. The two halves are clamped together in position around the container using a nut and bolt.

Net weight: 3.0 kg



Part No. 311.006.015 Container Racking - Single Container

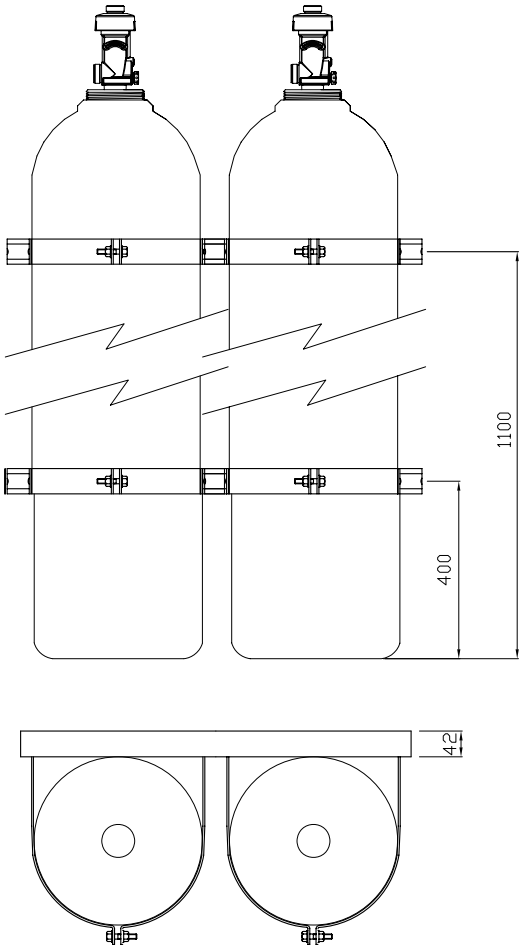
4.24 CONTAINER RACKING - TWO/THREE/ FOUR/FIVE CONTAINERS - SINGLE ROW

(PART Nos. 311.006.011 / 012 / 019 / 021).

The racking is designed to securely fix a single row of containers to a wall or supporting structure. It comprises of two sections of steel channel and two pairs of universal clamps for each container used.

Additional containers may be racked using any number or configuration of the two, three, four or five container racking assemblies.

Two containers Part no. 311.006.011 Weight: 7.2 kg
Three containers Part no. 311.006.012 Weight: 10.7 kg
Four containers Part No. 311.006.019 Weight: 14.3 kg
Five containers Part No. 311.006 021 Weight: 17.9 kg



TWO CONTAINER RACKING SHOWN

Part No. 311.006.011 / 012 / 019 / 021 Container Racking Single Row

4.25 CONTAINER RACKING - FOUR/SIX/EIGHT/ TEN CONTAINERS - DOUBLE ROW

(PART Nos. 311.006.015 / 016 / 023 / 025)

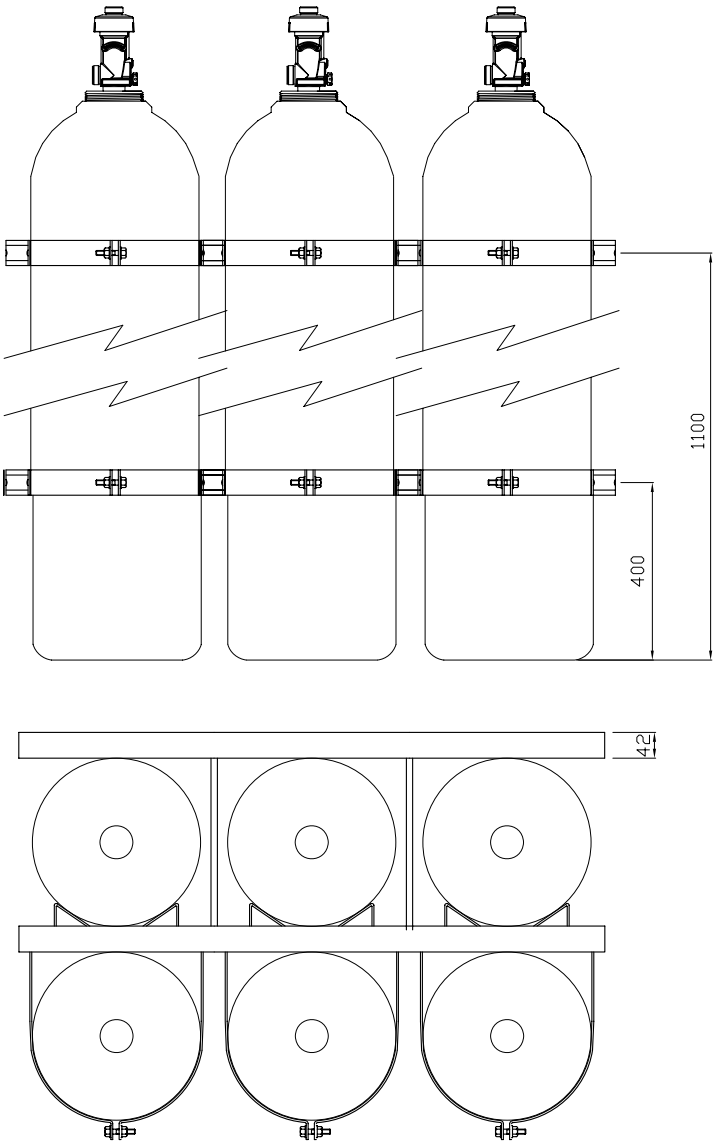
The racking is designed to securely fix a double row of containers to a wall or supporting structure. It comprises mainly of two sections of steel channel, two sections of centre rack a number of threaded rod and two pairs of universal clamps for half of the number of containers used.

Two sections of steel channel are fixed securely to the wall or supporting structure. A centre rack clamps the first row of containers in place and provides a fixing for the universal clamps which hold the second row of containers.

Additional containers may be racked using any number or configuration of the four, six, eight, ten container racking assemblies.

Four container Part no. 311.006.017 Weight: 16.0 kg
Six container Part no. 311.006.016 Weight: 19.3 kg
Eight container Part no. 311.006.023 Weight: 25.8 kg.
Ten container Part no. 311.006.025 Weight: 32.2 kg.

SIX CONTAINER RACKING SHOWN



Part No. 311.006.017 / 016 / 023 / 025 Container Racking Double Row

4.26 MANUAL RELEASE CAUTION PLATE

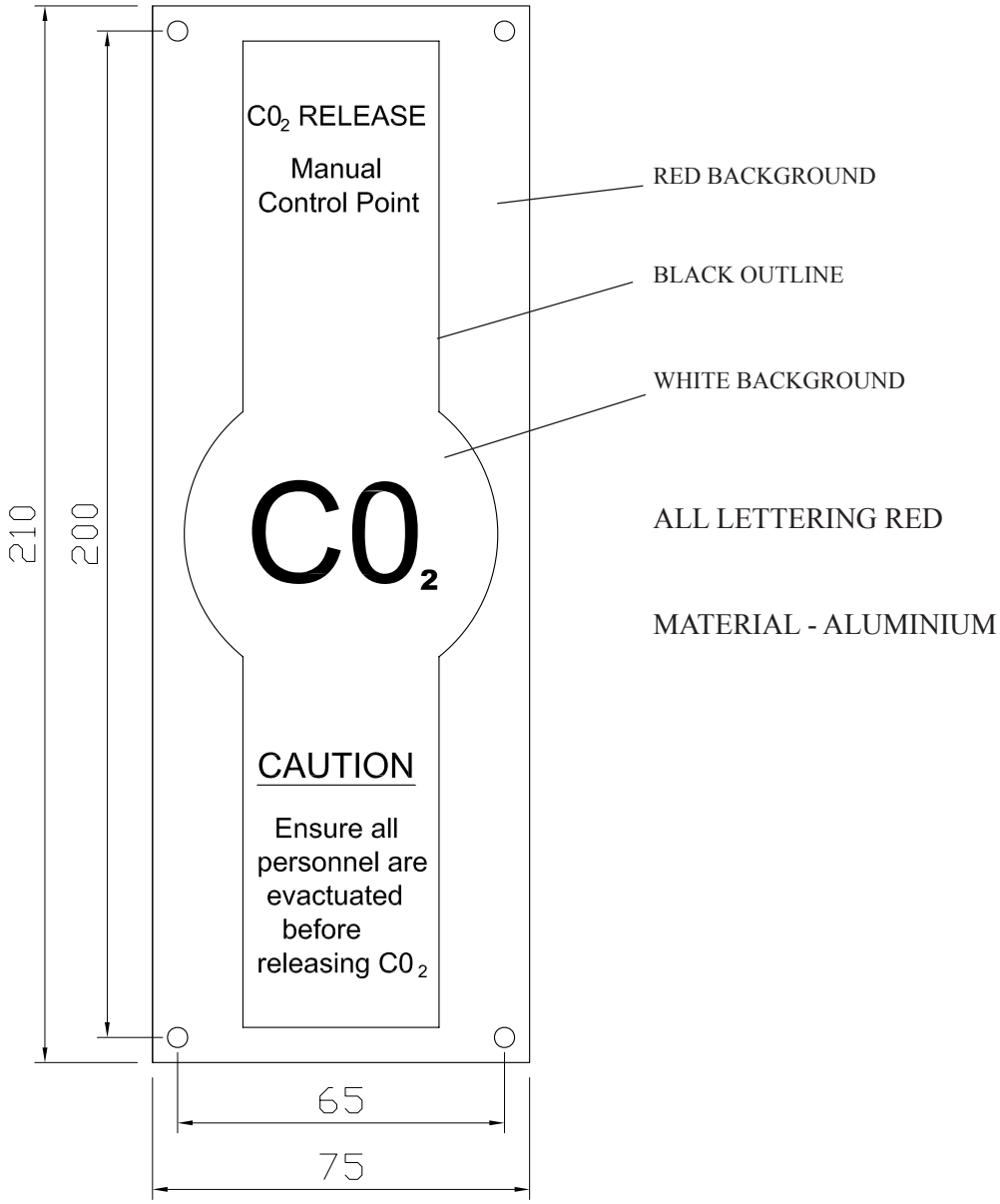
(PART No. 314.200.001)

The manual release caution plate provides instructions to personnel on the use of manual controls.

One plate is to be fixed adjacent to all positions from where CO_2 can be released manually.

An English/Arabic version is also available (Part No. 314.200.006).

Net weight: 0.035 kg



Part No. 314.200.001 Manual Release Caution Plate

4.27 DOOR CAUTION PLATE

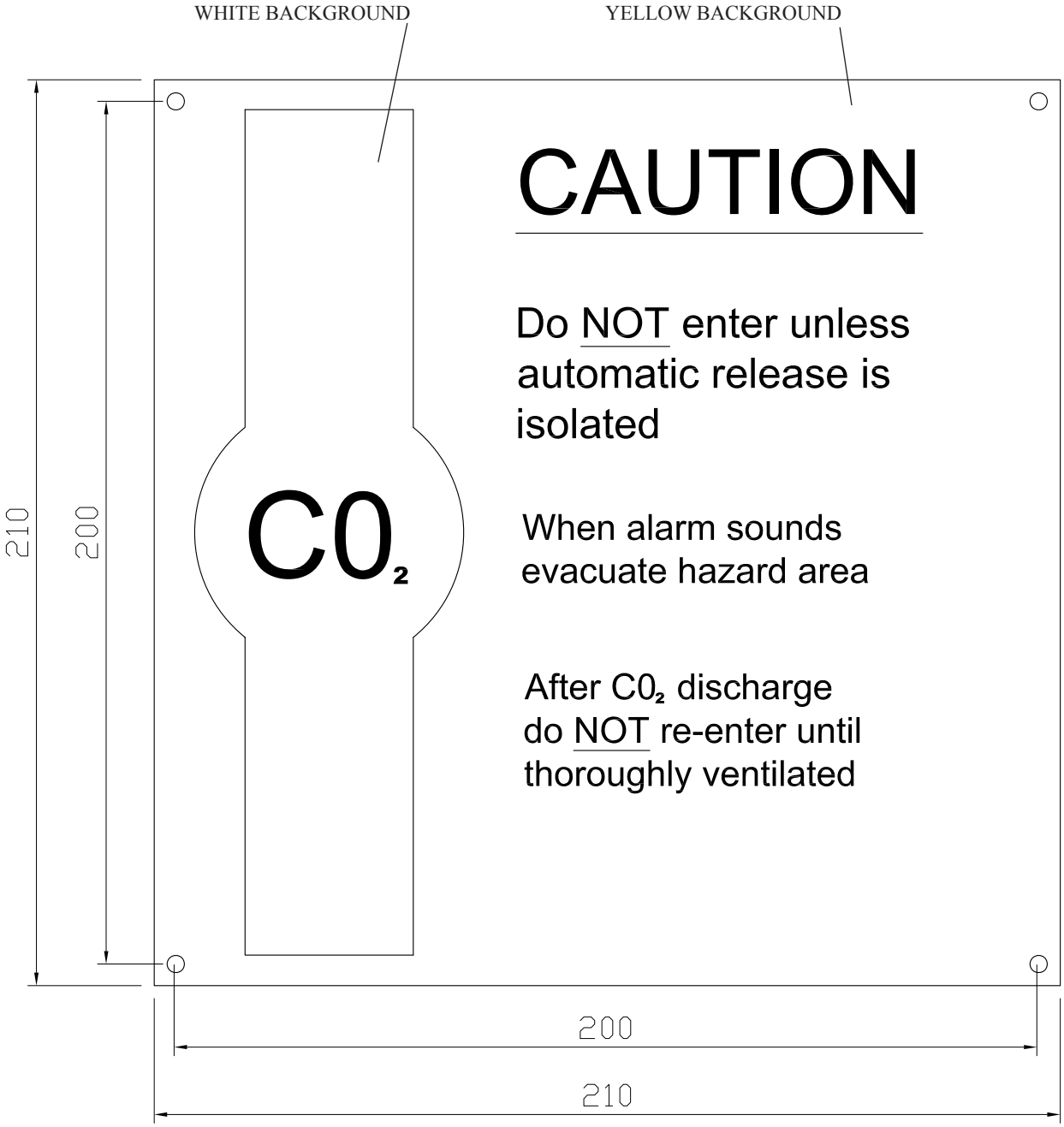
(PART No. 314.200.002)

The door caution plate provides instructions to personnel who may enter a CO_2 protected area.

One plate is to be fixed to all entrance doors into a CO_2 protected area.

An English/Arabic version is also available (Part No. 314.200.005).

Net weight: 0.085 kg



Part No. 314.200.002 Door Caution Plate

4.28 T528 MANUAL RELEASE UNIT

(PART No. 526.001.018)

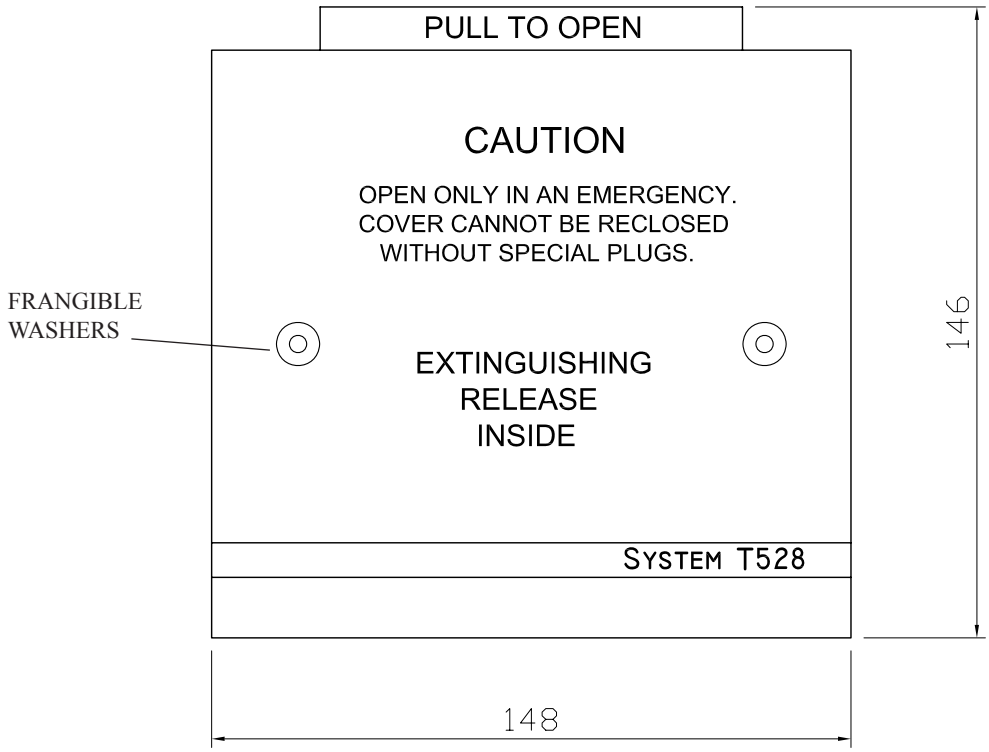
The T528 manual release unit is used where remote mechanical manual release of the CO_2 system is required.

The unit comprises of a box with a hinged yellow lid which is held in the closed position by two frangible washers.

Inside the unit is a red bar which is connected via wire rope run through a system of conduit and corner pulleys to the Manual Actuator part number 304.200.018. The stainless steel safety pin associated with the Manual Actuator must be removed to enable remote operation.

Operation of the CO_2 system using the T528 is a two stage action. Firstly the hinged lid is pulled downwards towards the operator. This action will break the frangible washers and expose the red operating bar. System operation is caused by pulling hard on the red bar. System discharge will occur immediately.

Net weight: 0.9 kg



Part No. 526.001.018 T528 Manual Release Unit

5. INSTALLATION

This section provides general guidance on the installation of CO_2 Fire Fighting systems. However, it is of paramount importance that persons involved in the installation of this equipment have had previous experience in the installation of this or similar equipment and have read and understood the contents of sections 1, 3 and 4 of this manual.

Equipment is to be installed in accordance with an approved drawing. It is not permitted for changes to equipment, pipework or nozzle positions to be made without the authority of the Extinguishing Systems Design Engineer.

Installation steps:

i) Check all equipment delivered against the Extinguishing Supply Note.

ii) It is usual, but not essential, for the installation to commence at the container bank.

Make no attempt to move CO_2 containers unless they are fitted with anti-recoil caps and valve protection caps (transport caps).

iii) Fix 2-off back channel sections to wall or supporting structure. Where more than five containers are to be installed in a single row there should be no gap between the channel sections

iv) Place CO_2 containers in position against channel sections. The container centre line dimensions are to be 310mm.

v) Secure the containers in position using the universal clamps. The universal clamps have a special slotted section which allows each half to be fitted into the channel sections. The two halves of each clamp are secured using a nut and bolt.

vi) If a double row of containers are to be installed, The first bank are clamped to the wall with the centre rack. The second bank are then held in place with the universal clamps.

vii) Locate and fix manifold support brackets to wall, or supporting structure, to allow manifold to be installed at 1880 mm ±25 mm above floor level.

viii) Place manifold on supporting brackets with inlets approximately 250 mm towards the right hand side of container centrelines. (if the system utilises distribution valves the manifold may have to be constructed of Schedule 80 pipe and 3000 lb. fittings to enable the inline check valves to be accommodated.) Secure manifold to supporting brackets using universal clamps. Fit a manifold bleed valve on to the end of the manifold.

ix On single container systems, steps vi) - viii) do not apply.

x) Install pipework from the manifold to the nozzle positions in accordance with the approved installation drawing and BS 5306: Part 4.

Fit any ancillary equipment into the pipework such as pressure switches, odourisers, distribution valves, etc.

xi) On systems employing remote mechanical manual release, install conduit and T528 Manual Release Unit, as indicated on the approved installation drawing. All changes in direction must be accomplished using corner pulleys and conduit ends fitted with cable bushes. Feed wire rope through conduit system and make off one end (at the T528 Manual Release Unit red pull bar) using a cable clamp.

xii) When satisfied that all of the pipework is complete with nozzles and all ancillary equipment fitted, fit the discharge hoses to the manifold only.

It is important to check all actuators are in the reset (unoperated) position before fitting otherwise fitting will cause the container to discharge.

xiii) Note the required termination position for wire rope connections to the Remote Manual Actuators (if fitted). Make off the end of the wire rope to the lever using a cable clamp.

xiv) Fit all caution plates

xv)Visually check installation for completion in accordance with approved installation drawing.

xvi) If a requirement at the time of installation carry out purge of pipework using CO_2 from a hand held portable extinguisher connected to the pipework at the manifold/ container position.

Due to the many equipment configurations available, the precise method for pipework purging on each installation is to be agreed with the Extinguishing Systems Design Engineer.

6. COMMISSIONING

This section provides guidance on the commissioning of CO_2 Fire Fighting Systems and is in the form of a check list to be completed by the person carrying out the commissioning. The commissioning schedule is document 14A-02-C1 (example provided on pages 52 to 56) intended to cover the majority of the equipment or control configurations likely to be encountered, however, where appropriate it may be necessary to carry out additional checks to those listed.

Pages 52 to 56 are an example of the schedule to be completed by the responsible person. The schedule is to be completed for all new systems and those that have been modified.

No section must be left incomplete. If not applicable, write N/A in the appropriate space.

It is essential that persons carrying out commissioning of CO_2 Fire Fighting Systems are experienced in the commissioning of this type of equipment.

Any pneumatic activation tubing is to be tested in accordance with the procedure outlined below, using Pneumatic Test Kit Part No. 300.203.004.

Test procedure for Pneumatic Activation Tubing:

a) Ensure all pneumatic actuators are removed from containers.

b) Be aware that by pressurising the pneumatic actuation tubing, all pressure actuated devices including pressure switches will operate. Ensure that the consequences of this are recognised, otherwise unexpected alarms or signalling could occur.

c) Disconnect the actuation tubing from the adaptor fitted into the master (or submaster) container valve actuation port.

d) Connect the end of the hose from the Pneumatic Test Kit to the end of the actuation tubing. Ensure the joint is tight.

e) Set the outlet pressure on the Test Kit regulator to 10 bar.

f) Open the Test container valve to allow Nitrogen at 10 bar into the pneumatic actuation tubing for a period of 10 seconds and then close the valve.

g) Check all pneumatic actuators, pressure switches and trips have operated.

h) Check after 60 seconds that the pressure in the pneumatic actuation line has not fallen by more than 10%.

i) If any devices fail to operate or pressure falls by more than 10% over 60 seconds, investigate and rectify the problem. Then repeat the test procedure until a satisfactory outcome is achieved.

Testing of Solenoids:

The type ‘D’ solenoid is tested using the following procedure:

a) With the solenoid fitted to the valve, remove the manual/pneumatic actuator from the valve by removing the locating clip.

b) Operate the solenoid and observe the downwards movement of the central operating pin of the manual/pneumatic actuator. (A small quantity of CO_2 may vent temporarily through the bleed hole of the manual bleed valve)

   The central pin should latch in the operated position.

c) Remove the power source.

   After removing the power source the solenoid valve will close.

d) The knurled reset plunger on the manual/ pneumatic actuator must then be pulled to cause the actuator to reset

   By the actuator resetting this confirms that the solenoid has reset correctly.

The type ‘P’ solenoid is tested using the following procedure which is designed to avoid excessive shock during repeated testing:

a) Ensure solenoid is in ‘set’ position.

b) Ensure screw on reset tool is retracted.

c) Screw reset tool hand tight onto solenoid.

d) Turn screw on reset tool clockwise until resistance is detected.

e) Turn screw anticlockwise one turn.

f) Operate solenoid. Operation is confirmed when a click is heard.

Resetting the Solenoid:

g) Use the solenoid resetting tool to reset the solenoid actuator.

h) Unscrew tool from solenoid.

i) Check visually that the solenoid is reset.

Upon completion of commissioning the system, confirm in writing, defects or actions arising to the responsible person within Thorn Security or the clients representative as applicable.

A copy of the completed commissioning schedule and any correspondence arising from defects or outstanding actions must be retained in the project file.

As soon as reasonably practicable after commissioning ensure a User Manual and 'As Installed' drawings are sent to the clients representative and such transmission is recorded/confirmed in writing.

6.1 COMMISSIONING SCHEDULE (EXAMPLE)

Client………………………………………………. **Protected Area……………………………………...**
Address…………………………………………… **Project Ref. ……………………………………**
……………………………………………………. **Commissioned by……………………………..**
Project…………………………………………. **Witnessed by……………………………………**
Address…………………………………………… **Date…………………………………………………**
…………………………………………………….

GENERAL INSTRUCTIONS	Check Completed	Remarks
a)Advise all personell working in or near to the protected area of possible audible or visuable alarms.		
b) Advise client of any equipment which will be switched off during the tests.		
c) Re-measure the protected area and confirm that the quantity of agent supplied is adequate for the measured volume.		
d) Check that the system has been installed in accordance with the drawings and note any changes to the system against the drawings.		
e) Before carrying out any further checks ensure that the Extinguishing system is isolated electrically and mechanically. Remove all electrical and mechanical actuators.		

ELECTRICAL CHECK LIST

Systems with main and reserve containers

a) Carry out checks described in the following sections with the T510 changeover switch in 'main' position.		
b) Repeat the above checks with T510 changeover switch in ' reserve' position.		

Systems with automatic electrical detection (coincidence operation)

a) Place the system in automatic mode and check that the lamps are amber on the control panel and all status indicators.		
b) Operate one detection zone.		
c) Check that the fire alarm sounds.		
d) Check that the extinguishant release solenoid actuator has not operated.		
e) Switch the system to manual mode and check that the lamps are green on the control panel and all of the status indicators.		
f) Operate the second detection zone.		
g) Check that the extinguishant release solenoid does not operate.		
h) Switch the system to automatic mode with two detection zones still in alarm.		
i) Check that the evacuation alarm sounds.		
j) Check that all A/C shutdowns operate.		
k) Check that the extinguishant release solenoid actuator operates after the preset delay period.		
l) Check the operation of the 'extinguishant release' pressure switch and that the red 'discharged' lamps are lit on the control panel and on all system indicators.		
m) Reset the pressure switch. Reset the fire alarm system.		
n) Check the operation of each electrical manual release unit in turn.		
o) Check that the fire alarm and evacuation alarms sound.		
p) Check that the extinguishant release solenoid operates after the preset time delay.		
q) Reset the fire alarm system. Ensure that all frangible washers are re-fitted to the manual release units.		

Systems with automatic electrical detection (single zone operation)	Check Completed	Remarks
a) Place the system in manual mode and check that the lamps are green on the control panel and on all status indicators.		
b) Operate the detection system.		
c) Check that the fire alarm sounds.		
d) Check that the extinguishant release solenoid actuator does not operate.		
e) Switch the system to automatic mode with the detectors still in alarm and check that the lamps are amber on the control panel and on all status indicators.		
f) Check that the evacuation alarm sounds.		
g) Check al A/C shutdowns.		
h) Check that the extinguishing release solenoid operates after the preset time delay.		
i) Check the operation of the 'extinguishant released' pressure switch. Upon operation check that the red lamps are lit on the control panel and on the system indicators.		
j) Reset the pressure switch and then reset the fire alarm system.		
k) Check the operation of each manual release in turn.		
l) Check that the fire alarm and evacuation alarm sounds.		
m) Check that the extinguishant release solenoid operates after the preset time delay.		
n) Reset the system. Ensure that all frangible washers are refitted to the manual release units.		

System with electrical manual release only

a) Operate each electrical manual release in turn.		
b) Check that the fire alarm and evacuation alarm sounds.		
c) Check all A/C shutdowns.		
d) Check that the extinguishant solenoid operates after a preset time delay.		
e) Check the operation of the extinguishant released pressure switch. Upon operation check that the red lamps are lit on the control panel and on all of the system indicators.		
f) Reset the pressure switch and the reset the fire alarm system.		

Systems with hold switches

a) With the system in the quiescent state depress the abort switch to check that a 'fault' is generated.		
b) Initiate the extuinguishing release sequence and during the delay period depress and hold the hold switch. Check that the release sequence is interrupted and that the solenoid does not operate.		
c) Release the hold switch and check that the preset time delay restarts from zero and that after the preset time delay the solenoid operates.		

Systems with abort switches

a) With the system in the quiescent state depress the abort switch to check that a 'fault' is generated.		
b) With the system in automatic mode initiate the extinguishant release sequence and during the delay period depress the abort switch. Check that the release sequence is interrupted, that the solenoid does not operate and that the system switches to manual.		

Systems with stop valves

a) Confirm that the correct grade of pipe work has been used in 'closed' sections of pipe.		
b) Check that an automatic manifold pressure relief device and manual by-pass valve are fitted, piped to atmosphere and terminate with a discharge nozzle into an area that will not be made hazardous by discharging C02 gas.		
c) Close the manual stop valve and check that a 'system isolated' indication is displayed in a prominent position.		
d) Pressure test 'closed' pipe sections to 4 bar to operate the 'gas trapped' pressure switch. Check that this indication is satisfactorily displayed.		
e) Check that all manual valves are lockable.		
f) Agree with the client the arrangements (appropriate for the site) in control of of the locking/unlocking of the manual valves. These details must be confirmed in writing to the client within two weeks of the handover of the system.		

Other items

a) Detach the solenoid lead and check that a fault is gnerated.		
b) Check that adequate and appropriate visual and audible warning devices are incorporated into the system.		
c) Check that contacted door locks are fitted at all entrance doors into the protected area.		
d) Check that 'unlocking' the door causes the system to change to manual mode.		
e) Check that 'locking' the door causes the system to change to automatic mode.		
f) Check that all doors are fitted with escape override handles and that they function correctly.		
g) Record the time delay. This should not normally exceed 30 seconds but must be adequate to enable safe egress from the protected area.		

MECHANICAL CHECK LIST

Pipework/Nozzles

a) Check that the pipe and fittings are to the correct standard as per the approved drawing.		
b) Check that the pipe supports have been fitted at the correct intervals and that they are adequate for the purpose.		
c) Check that all nozzle are fitted in accordance with the design requirements and are aimed in the correct alignment away from obstructions or barriers that could prevent adequate distribution of the gas.		
d) Check that all pipes and nozzles are adequately braced against the reaction to discharge.		
e) Check that the pipe work has been properly painted or identified.		
f) Purge the pipe work to confirm that it is continuous and that it is free from debris.		
g) Remove nozzles to check that they are free of debri following the purge.		
h) Steps f) and g) may be omitted from the commisioning procedure if written evidence is available that the pipe work was purged at an appropriate stage during installation.		

Containers

a) Check that the containers are safe from mechanical damage, corrosion or unathorised interference.		
b) Check that the container brackets are fitted and that all bolts are tight.		
c) Check that all containers are fitted with instructions plates.		

Record C02 Container Details Below

Area Protected	Containers		Liquid Level (mm)	Temp. deg.C	Corrections Required Yes/No
	Size Kg.	Serial No.			

Record Pilot Cylinder Details

Area Protected	Containers		Liquid Level (mm)	Temp. deg.C	Corrections Required Yes/No
	Size Kg.	Serial No.			

Ancillary Equipment

a) Check that all 'extinguishant released' pressure switches are fitted and are securely fixed to the wall or pipe work.		
b) Check that all pressure trips are fitted in the correct plane and are securely fixed.		
c) Check that the pneumatic actuation tubing is securely fixed.		
d) Check that the pneumatic actuation tubing connections are tight.		
e) Check that the pressure switch operates at 4 bar or lower using a regulated nitrogen supply.		
f) Check that any dampers close or curtains drop to fully cover openings.		
g) Check that the supervisory pressure switch is fitted to the pilot cylinder.		
h) Check that a pilot line vent device is fitted into ant pilot lines.		
i) On system utilising a remote mechanical manual release check the satisfactory operation of the T528 unit. Check that the frangible washers are in place.		
j) Check that the solenoid flexible lead is correctly fitted and secured.		
k) Upon completion of all checks ensure that the solenoid actuator is reset. Fit the solenoid actuator to the master container or pilot cylinder as required.		
l) Check that the safety pin is fitted to the manual actuator.		
m) Ensure that the manual actuator is reset and fit it to the master container or pilot cylinder as required.		
n) Ensure that the pneumatic actuators are reset and fit them to the slave containers.		
o) Check that the door caution plates are fitted to all doors into the protected area.		
p) Check that the manual release plates are fitted to all manual release control points.		
q) Check that the odourisers are fitted.		

Enclosure Integrity

a) Record whether a satisfactory Room Integrity Test has been performed on the protected area.		
b) If not, visually inspect the room and record any leakage areas.		
c) If so, record the retention time.		

Completion

a) On completion ensure that the client is informed of any equipment of deficiences requiring attention and that the details are recorded.		
b) Obtain a signature of the clients representative and leave a copy for the clent		

7. TESTING & SERVICING

This section provides general guidance on the maintenance of CO_2 Fire Fighting Systems. Maintenance as detailed should be carried out at least every six months, although local conditions may indicate a need for more frequent visits. However, it is of paramount importance that persons involved in the maintenance of this equipment have had previous experience in the maintenance of this or similar equipment and have read and understood the contents of sections 1, 3, 4 and 5 of this manual as well as documents 14A-01-G1, 14A-01-G2 and 14A-01-S1.

Before carrying out any checks, ensure the extinguishing system is isolated electrically and mechanically. Remove all solenoid and pneumatic actuators if fitted. Close any maintenance valves fitted and lock them. Document 14A- 02-S1 (example provided on pages 55 to 59) is to be completed during each visit and a copy held in the relevant project file for future reference.

a) Check container contents by use of a liquid level device or by weighing if necessary.

   Any check on a CO_2 container that reveals a loss in contents of more than 10% must be identified and reported as requiring attention.

b) Check pilot cylinder pressure gauge readings.

c) Examine containers for signs of external damage or corrosion.

d) Report any containers that require periodic inspection and hydrostatic testing in accordance with the requirements of BS 5430: Part 1.

e) Check operation of release solenoid (see below).

f) Check operation of any pneumatic actuators.

g) Check operation of any mechanical manual release devices.

h) Check operation of any pressure operated trips and the correct functioning of any fibreglass/asbestos curtains to ensure free movement.

i) Check pipes and nozzles to ensure that they are not obstructed and have remained in the designed position.

j) Check all components are free from dust and dirt which might impair the efficiency of the system.

k) Grease mechanical items as required.

l) Reset all pressure/pneumatic trips or actuators.

Testing the Solenoid:

The type solenoid is tested using the following procedure which is designed to avoid excessive shock during repeated testing:

a) Ensure solenoid is in ‘set’ position.

b) Ensure screw on reset tool is retracted.

c) Screw reset tool hand tight onto solenoid.

d) Turn screw on reset tool clockwise until resistance is detected.

e) Turn screw anticlockwise one turn.

f) Operate solenoid. Operation is confirmed when a click is heard.

Resetting the Solenoid:

g) Turn screw on reset tool fully home (as confirmation that the solenoid has operated correctly there should be resistance when the screw is started to be turned).

h) Turn screw anticlockwise until no resistance is felt.

i) Unscrew tool from solenoid.

j) Check visually that the solenoid is reset.

Upon completion of all checks ensure all electrical/mechanical and pneumatic actuators are reset, refitted and maintenance valves opened.

On completion of the work, obtain the signature of the customer's representative on the visit record and leave a copy with the customer.

If any part of the system is left inoperable note this clearly on the visit record and point it out to the customer's representative when signing.

7.1 SERVICING SCHEDULE (EXAMPLE)

Client…… Protected Area……
Address…… Project Ref. ……
…… Commissioned by……
Project…… Witnessed by……
Address…… Date……
……

GENERAL INSTRUCTIONS	Check Completed	Remarks
a)Advise all personell working in or near to the protected area of possible audible or visuable alarms.		
b) Advise client of any equipment which will be switched off during the tests.		
c) Check that the character of the hazard has not altered. If any doubt exists refer to the extinguishing design engineer.		
d) Check that the system has been installed in accordance with the drawings and note any changes to the system against the drawings.		
e) Before carrying out any further checks ensure that the Extinguishing system is isolated electrically and mechanically. Remove all electrical and mechanical actuators.		

ELECTRICAL CHECK LIST

Systems with main and reserve containers

a) Carry out checks described in the following sections with the T510 changeover switch in 'main' position.		
b) Repeat the above checks with T510 changeover switch in ' reserve' position.		

Systems with automatic electrical detection (coincidence operation)

a) Place the system in automatic mode and check that the lamps are amber on the control panel and all status indicators.		
b) Operate one detection zone.		
c) Check that the fire alarm sounds.		
d) Check that the extinguishant release solenoid actuator has not operated.		
e) Switch the system to manual mode and check that the lamps are green on the control panel and all of the status indicators.		
f) Operate the second detection zone.		
g) Check that the extinguishant release solenoid does not operate.		
h) Switch the system to automatic mode with two detection zones still in alarm.		
i) Check that the evacuation alarm sounds.		
j) Check that all A/C shutdowns operate.		
k) Check that the extinguishant release solenoid actuator operates after the preset delay period.		
l) Check the operation of the 'extinguishant release' pressure switch and that the red 'discharged' lamps are lit on the control panel and on all system indicators.		
m) Reset the pressure switch. Reset the fire alarm system.		
n) Check the operation of each electrical manual release unit in turn.		
o) Check that the fire alarm and evacuation alarms sound.		
p) Check that the extinguishant release solenoid operates after the preset time delay.		
q) Reset the fire alarm system. Ensure that all frangible washers are re-fitted to the manual release units.		

Systems with automatic electrical detection (single zone operation)	Check Completed	Remarks
a) Place the system in manual mode and check that the lamps are green on the control panel and on all status indicators.		
b) Operate the detection system.		
c) Check that the fire alarm sounds.		
d) Check that the extinguishant release solenoid actuator does not operate.		
e) Switch the system to automatic mode with the detectors still in alarm and check that the lamps are amber on the control panel and on all status indicators.		
f) Check that the evacuation alarm sounds.		
g) Check al A/C shutdowns.		
h) Check that the extinguishing release solenoid operates after the preset time delay.		
i) Check the operation of the 'extinguishant released' pressure switch. Upon operation check that the red lamps are lit on the control panel and on the system indicators.		
j) Reset the pressure switch and then reset the fire alarm system.		
k) Check the operation of each manual release in turn.		
l) Check that the fire alarm and evacuation alarm sounds.		
m) Check that the extinguishant release solenoid operates after the preset time delay.		
n) Reset the system. Ensure that all frangible washers are refitted to the manual release units.		

System with electrical manual release only

a) Operate each electrical manual release in turn.		
b) Check that the fire alarm and evacuation alarm sounds.		
c) Check all A/C shutdowns.		
d) Check that the extinguishant solenoid operates after a preset time delay.		
e) Check the operation of the extinguishant released pressure switch. Upon operation check that the red lamps are lit on the control panel and on all of the system indicators.		
f) Reset the pressure switch and the reset the fire alarm system.		

Systems with hold switches

a) With the system in the quiescent state depress the abort switch to check that a 'fault' is generated.		
b) Initiate the extuinguishing release sequence and during the delay period depress and hold the hold switch. Check that the release sequence is interrupted and that the solenoid does not operate.		
c) Release the hold switch and check that the preset time delay restarts from zero and that after the preset time delay the solenoid operates.		

Systems with abort switches

a) With the system in the quiescent state depress the abort switch to check that a 'fault' is generated.		
b) With the system in automatic mode initiate the extinguishant release sequence and during the delay period depress the abort switch. Check that the release sequence is interrupted, that the solenoid does not operate and that the system switches to manual.		

Systems with stop valves

a) Check that an automatic pressure relief device and manual by-pass valve are fitted, correctly installed, are piped to atmosphere and that the pipe terminates in a nozzle where the discharge will not be hazardous.		
b) Close the manual stop valve and check that an indication of 'system isolated' is displayed in a prominent position.		
c) Confirm that the 'gas trapped in manifold' condition is satisfactorily displayed.		
d) Check that all manual valves are 'lockable'.		
e) Check that all manual valves are lockable.		

Other items

a) Detach the solenoid lead and check that a fault is gnerated.		
b) Check that adequate and appropriate visual and audible warning devices are incorporated into the system.		
c) Check that contacted door locks are fitted at all entrance doors into the protected area.		
d) Check that 'unlocking' the door causes the system to change to manual mode.		
e) Check that 'locking' the door causes the system to change to automatic mode.		
f) Check that all doors are fitted with escape override handles and that they function correctly.		
g) Record the time delay. This should not normally exceed 30 seconds but must be adequate to enable safe egress from the protected area.		

MECHANICAL CHECK LIST

Pipework/Nozzles

a) Check that the pipe and fittings are to the correct standard.		
b) Check that the pipe supports have been fitted at the correct intervals and that they are adequate for the purpose.		
c) Check that all nozzle are fitted in accordance with the design requirements and are aimed in the correct alignment away from obstructions or barriers that could prevent adequate distribution of the gas.		
d) Check that all pipes and nozzles are adequately braced against the reaction to discharge.		
e) Check that the pipe work has been properly painted or identified.		
f) If any doubt exists concerning the integrity of the pipework, arrange for it to be purged.		
g) Remove nozzles to check that they are free of debri following the purge.		
h) Steps f) and g) may be omitted from the commisioning procedure if written evidence is available that the pipe work was purged at an appropriate stage during installation.		

Containers

a) Check that the containers are safe from mechanical damage, corrosion or unathorised interference.		
b) Check that the container brackets are fitted and that all bolts are tight.		
c) Check that all containers are fitted with instructions plates.		

Record C02 Container Details Below

Area Protected	Containers		Liquid Level (mm)	Temp. deg.C	Corrections Required Yes/No
	Size Kg.	Serial No.			

Record Pilot Container Details

Area Protected	Containers				
	Size Kg.	Serial No.	Liquid Level (mm)	Temp. deg.C	Corrections Required Yes/No

Ancillary Equipment

a) Check that all 'extinguishant released' pressure switches are fitted and are securely fixed to the wall or pipe work.		
b) Check that all pressure trips are fitted in the correct plane and are securely fixed.		
c) Check that the pneumatic actuation tubing is securely fixed.		
d) Check that the pneumatic actuation tubing connections are tight.		
e) Check that the pressure switch operates at 4 bar or lower using a regulated nitrogen supply.		
f) Check that any dampers close or curtains drop to fully cover openings.		
g) Check that the supervisory pressure switch is fitted to the pilot cylinder.		
h) Check that a pilot line vent device is fitted into ant pilot lines.		
i) On system utilising a remote mechanical manual release check the satisfactory operation of the T528 unit. Check that the frangible washers are in place.		
j) Check that the solenoid flexible lead is correctly fitted and secured.		
k) Upon completion of all checks ensure that the solenoid actuator is reset. Fit the solenoid actuator to the master container or pilot cylinder as required.		
l) Check that the safety pin is fitted to the manual actuator.		
m) Ensure that the manual actuator is reset and fit it to the master container or pilot cylinder as required.		
n) Ensure that the pneumatic actuators are reset and fit them to the slave containers.		
o) Check that the door caution plates are fitted to all doors into the protected area.		
p) Check that the manual release plates are fitted to all manual release control points.		
q) Check that the odourisers are fitted.		

Enclosure Integrity

a) Record whether a satisfactory Room Integrity Test has been performed on the protected area.		
b) If not, visually inspect the room and record any leakage areas.		
c) If so, record the retention time.		

8. RELATED PUBLICATIONS

14A-01-S1 GASEOUS FIXED FIRE FIGHTING SYSTEMS - GENERAL SERVICE AND MAINTENANCE

14A-01-G1 GASEOUS FIXED FIRE FIGHTING SYSTEMS - REQUIREMENTS FOR PERIODIC INSPECTION OF TRANSPORTABLE GAS CONTAINERS

14A-01-G2 GAS DISCHARGE TESTS

14A-02-C1 COMMISSIONING SCHEDULE

14A-02-S1 SERVICE AND MAINTENANCE SCHEDULE