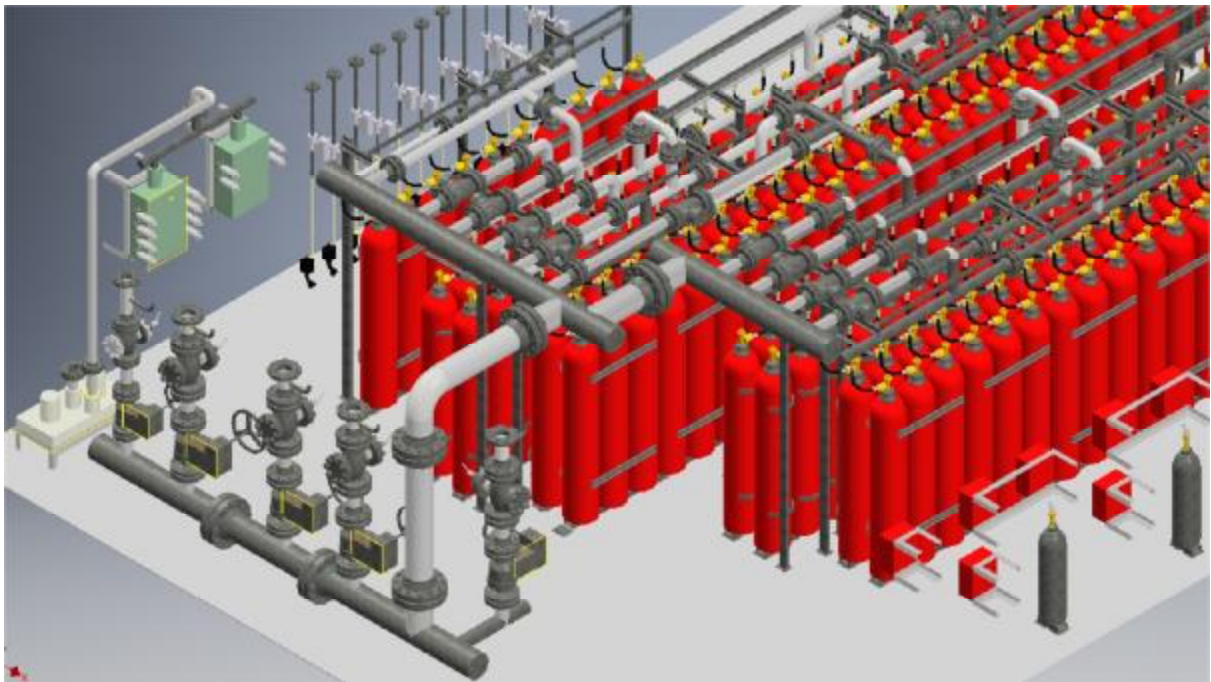


USER MANUAL

FOR CARBON DIOXIDES FIRE EXTINGUISHING SYSTEM.



High Pressure Carbon Dioxides Fire-Extinguishing System

USER MANUAL

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CHAPTER 1. GENERAL INFORMATION

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 1. GENERAL INFORMATION

1.1 Introduction

- a. This manual is provided for the use and guidance of those charged with the purchasing, designing, installing, testing inspecting, operating or maintaining of carbon dioxide fire-extinguishing systems.
- b. The NK " High pressure co2 system is to be designed to comply with the international convention for the safety Of life at sea (SOLAS) 1974, as amended, chapter II-2, Regulation 10 and the FSS(Fire safety systems) Code Chapter 5.

1.2 Agent Characteristics

Fixed Carbon dioxides fire-extinguishing systems typically suppress fires by reducing the available oxygen in the atmosphere to a point where combustion can no longer take place or by interrupting the chemical reaction necessary for the progression of the fire. Also, care should be taken to avoid the possibility of a fire being restarted due to dissipation of the fire-extinguishing gas and the introduction of fresh air from protected compartments being prematurely opened after a fire.

CO₂ is a compound of carbon and oxygen. At atmospheric pressures and temperatures, CO₂ is a colorless, odorless and electrically non-conductive gas. It is approximately 50% heavier than air. CO₂ provides a desirable (although very limited) cooling effect. The gas dissipates into the atmosphere after its discharge and leaves no residue. Because CO₂ reduces the available oxygen in the atmosphere, it will not support life. A concentration of 6% to 7% is considered the threshold level at which harmful effects become noticeable in humans, at concentrations below 10%, most people lose consciousness within a short time. Because of the hazard involved, particular care must be taken to ensure that all personnel are evacuated from the protected space prior to discharging the system.

1.3 Effectiveness

CO₂ gas is an effective agent for class "A" (wood, paper, etc.), class "B" (flammable liquids and gases) and class "C" (electrical equipment) hazards as it displaces the oxygen necessary for combustion. The CO₂ concentration must be maintained for a sufficient period to allow the maximum temperature to be reduced below the auto-ignition temperature of the burning material. Reduction of oxygen content to 15% is sufficient to extinguish most fires. Developing a CO₂ concentration of 28.5% in the atmosphere will reduce the oxygen content to about 15%. However, the concentrations required normally exceed this amount in order to allow for possible escape of gas or infiltration of air, as well as to provide an adequate margin of safety.

Carbon dioxide cannot be used on Class "D" (reactive metals, metal hydrides and chemicals containing their own oxygen supply) hazards, such as magnesium, potassium, sodium and cellulose nitrate. These Class "D" fires can only be controlled by special extinguishing agents and procedures.

1.4 System Applications

CO₂ systems are "total flooding" systems and must displace sufficient amounts of air to reduce the oxygen concentration to a level which will not support combustion.

1.4.1 Machinery Space System

As indicated above, fires in machinery spaces, cargo pump rooms and similar spaces are generally Class "B" (flammable liquids) type fires. In this type of fire, ignition of flammable sources can spread quickly. Accordingly, the heat build-up is rapid. It is important to introduce the required quantities of CO₂ quickly in order to minimize the growth of the fire. This prevents the build-up of heat from possibly causing failure of the structural integrity of the space, making it impossible to maintain the CO₂ concentration and also prevents heat updraft created by the fire from carrying away the carbon dioxide, as well as allowing for quicker cool-down periods.

1.4.2 Cargo Holder System

Fires in ordinary cargo holds normally involve class "A" combustibles and generally start with some smoldering and production of large quantities of smoke. Only when sufficient heat is developed to reach the "flash-over" or ignition

temperature (temperature at which solid combustibles give off sufficient gases to support continued rapid burning) will rapid burning occur. Extinguishing a class "A" fire is difficult due to the thermal insulating properties of the material. Typically, the hold is kept closed until the vessel reaches a port where the cargo is removed from adjacent spaces not involved in the fire. The cargo hold involved in the fire is then opened, with charged fire main nozzles at the ready and the cargo is unloaded, cooled with water or broken open if necessary to extinguish any remaining fire.

1.4.3 Warning

CO₂ reduces the available oxygen in the atmosphere, it will not support life. Care must be taken to ensure All personnel are evacuated from the protected space prior to discharging the system. A suitable warning notice must be prominently displayed in clear view at the point of entry into the protected area to alert personnel of the asphyxiation properties of CO₂.

1.4.4 Caution

The carbon dioxide and nitrogen gases used in these systems are stored in cylinders at extremely high pressures. An uncontrolled release of this high pressure gas from an accidental discharge, improper handling, or damage to parts can result in a violent and rapid propulsion of the cylinder(s), capable of causing severe property damage, personal injury, or death. All the warnings and instructions noted in this manual must be followed for the safe handling, installation, transportation, service and inspection of the cylinders.

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 1. GENERAL INFORMATION

1.5 Actute health effects of high concentrations of carbon.

Concentration (% carbon dioxide/air)	Time	Effects
2%	Several hours	Headache, dyspnea* upon mild exertion
3%	1 hour	Dilation of cerebral blood vessels, increased pulmonary ventilation, and increased oxygen delivery to the tissues.
4-5%	Within a few minutes	Mild headache, sweating and dyspnea at rest.
6%	1-2 minutes < 16 minutes Several hours	Hearing and visual disturbances Headache and dyspnea Tremors
7-10%	Few minutes 1.5 minutes – 1 hour	Unconsciousness or near unconsciousness. Headache, increased heart rate, shortness of breath, dizziness, sweating, rapid breathing.
10-15%	1+ minute	Dizziness, drowsiness, severe muscle twitching and unconsciousness.
17-30%	< 1 minute	Loss of controlled and purposeful activity, unconsciousness, convulsions, coma and death.

1.6 Advantages Of Fixed Gas Systems Over Water Base System.

- Damage to sensitive equipment can be avoided, especially in the case of electronic equipment.
- Clean up time and equipment down time is substantially reduced.

1.7 Disadvantages

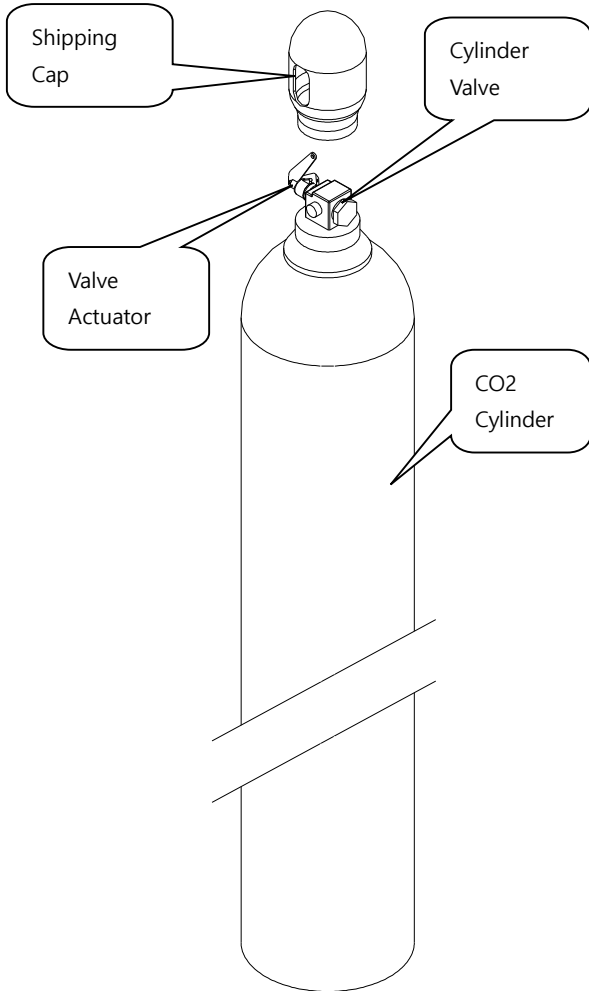
- CO₂ gaseous agents are hazardous to personnel.
- Cooling effect of gas systems is significantly less than water-based systems.

CHAPERT 2. SYSTEM COMPONENT

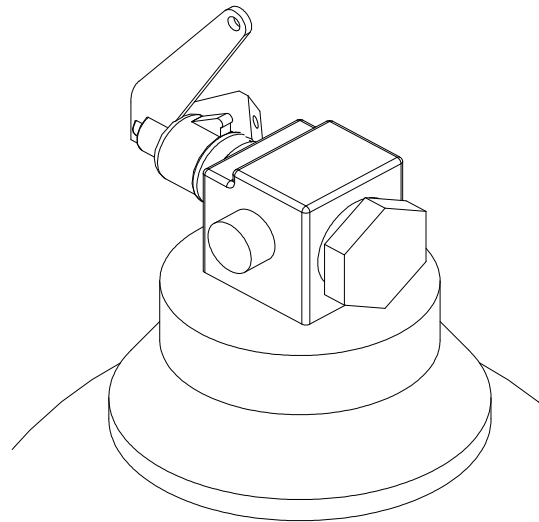
High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

2.1 Cylinder Assembly



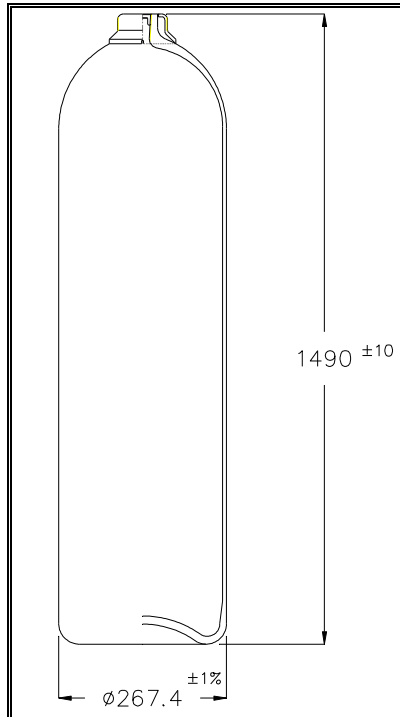
The cylinder is factory filled with carbon dioxide. A single cylinder may be used or multiple cylinders can be manifold together to obtain the required quantity of agent for total flooding or local application methods. NK co2 valve can be actuated pneumatically and/or manually. Co2 is stored in steel cylinders as a liquid under its own vapor pressure. The cylinder valve assembly is manufactured from forged brass and is equipped with a safety burst disc as protection against over pressurization



Component	Material
Cylinder	Inter-Mn steel or Cr-Mo steel
Cylinder Valve	Brass
Cylinder Valve Actuator	Forged Brass
Shipping cap	Steel

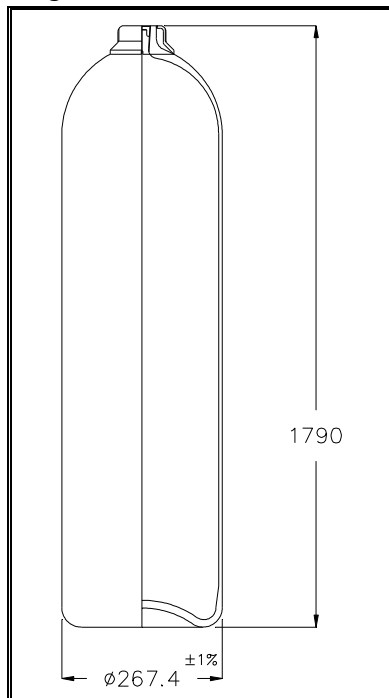
2.2 Cylinder

45 kg CO2 CYLINDER



- STANDARD : ISO 9809-2 or US-DOT-3AA
- WATER VOLUME : 68L
- AGENT CAPACITY : App. 45kg
- MATERIAL : : Inter-Mn steel or Cr-Mo Steel
- AMBIENT TEMPERATURE : : Max. 55 °C
- TEST PRESSURE : : 250 bar (25 Mpa)
- STORAGE PRESSURE : : 58 bar (5.8 Mpa) at 21 °C
- STD. COLOR : RED / GRAY / BALCK / GREEN
- WEIGHT(TOTAL) : : Approx. 115~130 kg

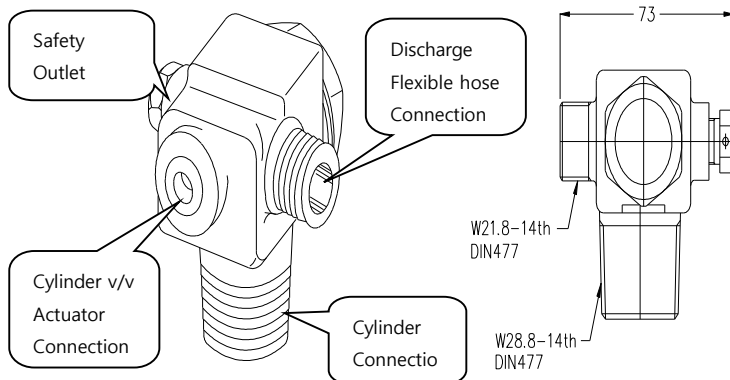
55 kg CO2 CYLINDER



- STANDARD : ISO 9809-2 or US-DOT-3AA
- WATER VOLUME : 82.5L
- AGENT CAPACITY : App. 55kg
- MATERIAL : : Inter-Mn steel
- AMBIENT TEMPERATURE : : Max. 55 °C
- TEST PRESSURE : : 250 bar (25 Mpa)
- STORAGE PRESSURE : : 58 bar (5.8 Mpa) at 21 °C
- STD. COLOR : RED / GRAY / BALCK / GREEN
- WEIGHT(TOTAL) : : Approx. 148 kg

2.3 Cylinder Valve

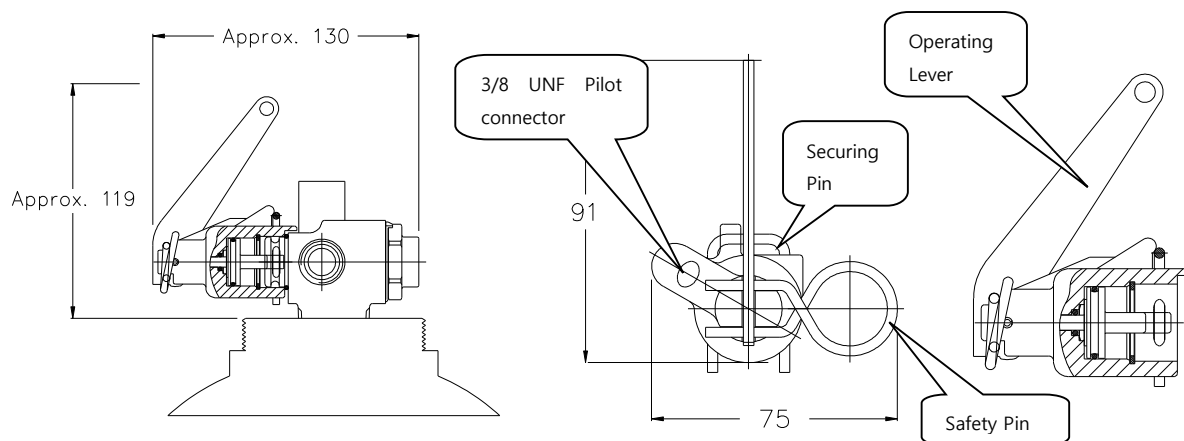
Each cylinder is fitted with a valve can be opened pneumatically (by pilot gas pressure) or manually when the appropriate actuator is fitted to it. The valve is opened by depressing an actuator rod, the end of which is recessed into the valve body. The actuator rod is recessed into the body so that the valve cannot be accidentally operated while the cylinder is being handled during installation and maintenance.



- MATERIAL : FORGED BRASS
- AMBIENT TEMPERATURE : : Max. 55 °C
- TEST PRESSURE : : 250 bar (25 Mpa)
- STORAGE PRESSURE : : 58 bar (5.8 Mpa) at 21 °C
- WEIGHT(TOTAL) : : Approx. 1.1 kg
- BURST DISC RANGE : 180~200bar
185~215bar

2.4 Cylinder Valve Actuator

When the system is to be operated automatically or when number of cylinders are to be manually operated, the cylinder valves are fitted with pressure actuators. The fitting of pressure actuators allows the simultaneous operation of cylinder valves by using pilot gas pressure. The pressure actuator is a small piston device which, when pilot gas pressure is applied, depresses the cylinder valve actuator rod and opens the cylinder valve. Each pressure actuator is fitted with a small lever which is secured by a removable safety pin. This lever is provided for emergency use and the operation of the lever will discharge co2 agent from that cylinder only.



Caution!!!

if the pressure test perform in the co2 distribution line(include all pipe network), actuator shall be remove from cylinder valve.

Safety pin is always locked except the case of manual release.

Safety pin should be removed only in case of emergency operation by manual.

Page 2-4

2.5 Main Valve

Where several spaces are protected from one control bank of CO₂ cylinders, a distribution valve for each protected space is installed on a common CO₂ feed pipe from the cylinder bank. For a fire in one of the spaces the appropriate valve is opened to direct the CO₂ to that space.

The distribution valve is normally operated by using pilot CO₂ gas pressure.

Pilot CO₂ (operating CO₂) is applied to the valve actuator inlet port. Pilot CO₂ depresses the piston, opens the valve and it then flows from an outlet port to the cylinder valve pressure actuators to discharge the main fire fighting CO₂.

When the pilot CO₂ pressure is removed from the valve actuator, the valve will automatically close.

The valve is provided with a manual operating handwheel (3",4" & 6"valves have a handwheel).

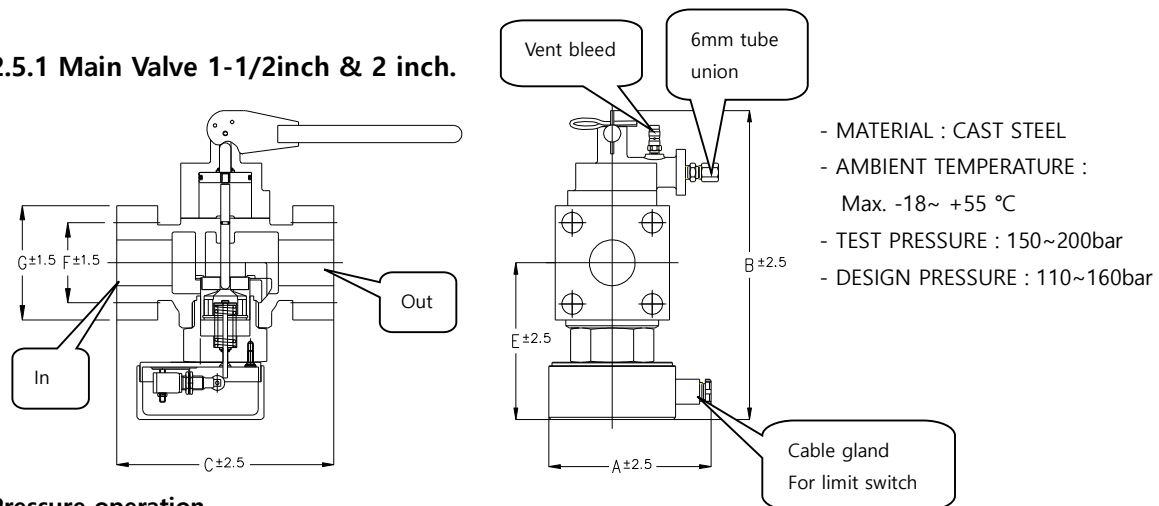
This manual facility is for emergency use.

If the manual handwheel is operated while pilot CO₂ pressure is applied to the valve actuator, the valve will not close until the manual handwheel is restored to its original(valve shut) position.

Note) For 3/4" POD V/V, please don't lose the adaptor of 3/4" POD V/V at your side to avoid any problem.

If you need to replace the pipe line, please contact to NK CO., LTD.

2.5.1 Main Valve 1-1/2inch & 2 inch.



Pressure operation

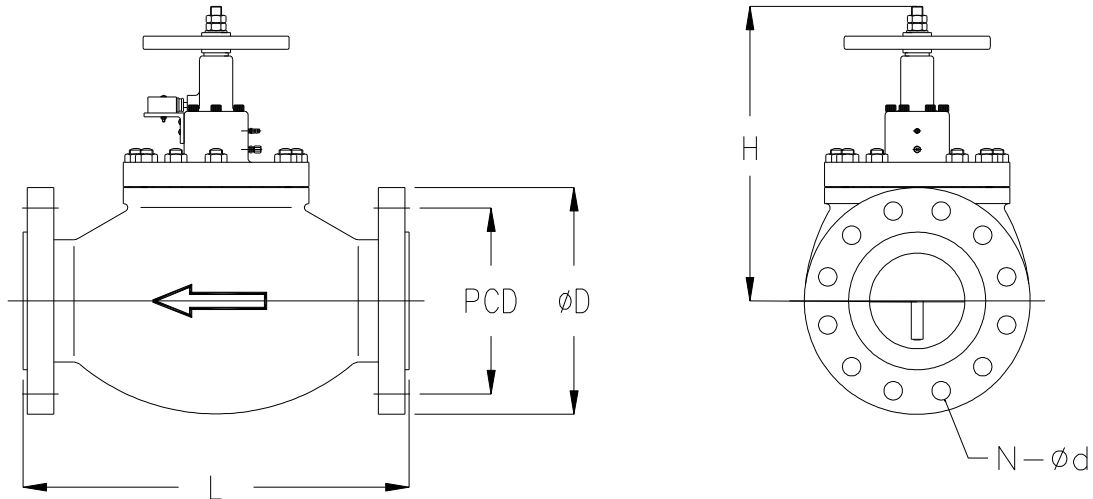
The valve opens when pilot gas is applied to the pilot Inlet port. Pilot gas entering the inlet port depresses the actuating piston and the valve is opened. When the piston is at the bottom of its stroke an outlet port is uncovered and the pilot gas can be conveyed to the cylinder valve pressure actuators which then discharge main CO₂ agent from the cylinder bank. The valve remains open until pilot gas pressure is removed.

Manual operation

The valve can be opened manually by operating the lever. The manual lever is secured in its normal position(valve shut) by a safety pin, which must be removed before operating the lever. The valve can be opened while the valve is subjected to main pilot pressure.

Valve size	A	B	C	D	E	F	G	H	Weight
1-1/2"	145	253	190	215	135	70	102	18	13.8
2"	145	343	240	197	170	80	113	18	23.8

2.5.2 Main Valve 3 & 4 & 6 inch.



Pressure operation

The valve opens when pilot gas is applied to the pilot inlet port. Pilot gas entering the inlet port lifts the actuating piston and the valve is opened. The valve remains open until pilot gas pressure is removed.

Manual operation

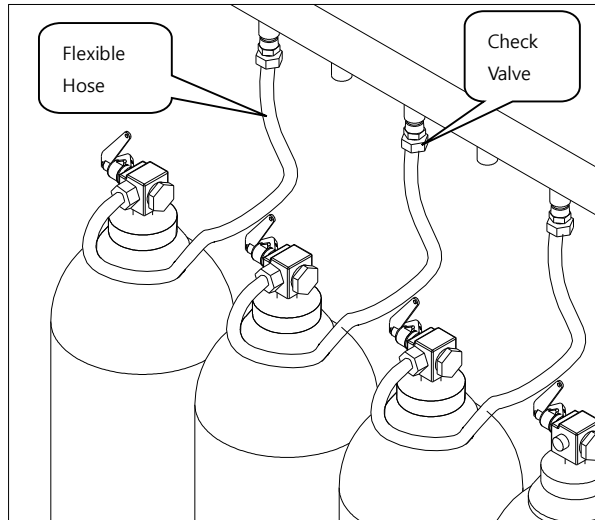
The valve can be opened manually by turning the handwheel fully anti-clockwise.
The valve can be opened while the valve is subjected to main pilot pressure.

Specification

- Material : Cast steel
- Environment(ambient temperature) : -18 ~ +55°C
- Test pressure : body at hydro pressure - 150~200bar
- Design pressure : 110~160bar
- Actuation pressure at unpressurized valve : 7 bar (0.7 mpa)
- Actuation pressure at pressurized valve: Approx. 30 bar (3 MPa)
- Standard Finish : electric galvanized (Other Finish is optional)
- Connection Rate : BS 10

Valve size	L	H(OPEN)	H(SHUT)	ØD	PCD	N	Ød	Weight
3"	330	335	313	203	165	8	21	43.5
4"	406	381	360	241	197	8	25	66.5
6"	508	501	460	305	260	12	25	147.2

2.6 Flexible Hose With Check Valve



Description

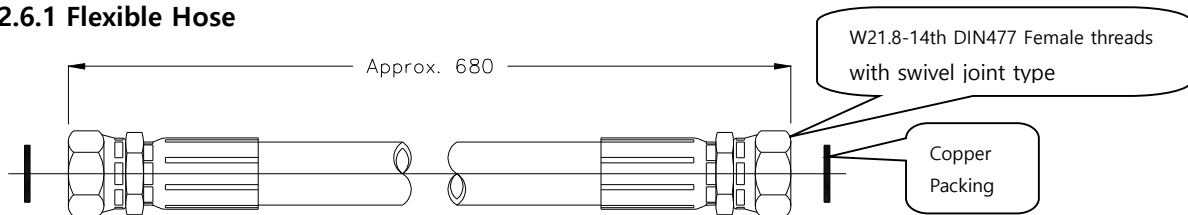
Flexible hose

Each cylinder co2 agent outlet is connected to the manifold pipe by a flexible hose.

Check valve

The check valve is installed between the flexible connection and the discharge manifold. check valve prevents any back flow of the gas into the other cylinder when the gas was discharged into the manifold pipe.

2.6.1 Flexible Hose



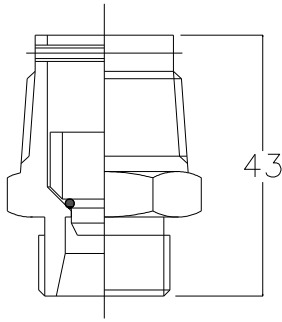
Specification

- Type designation : G119-8K - Standard : SAE 100R1
- Material : Tube - NBR(Nitrile Butadiene Rubber) // Reinforcement - One bride steel wire
Outer cover - Oil and weather resistant rubber.
Fitting – End nuts (Mild steel with electric galvanized)
- Design pressure : 130~175 kg/cm²
- Hydro test pressure : : 260~350 kg/cm²
- Weight : App. 0.55 KG

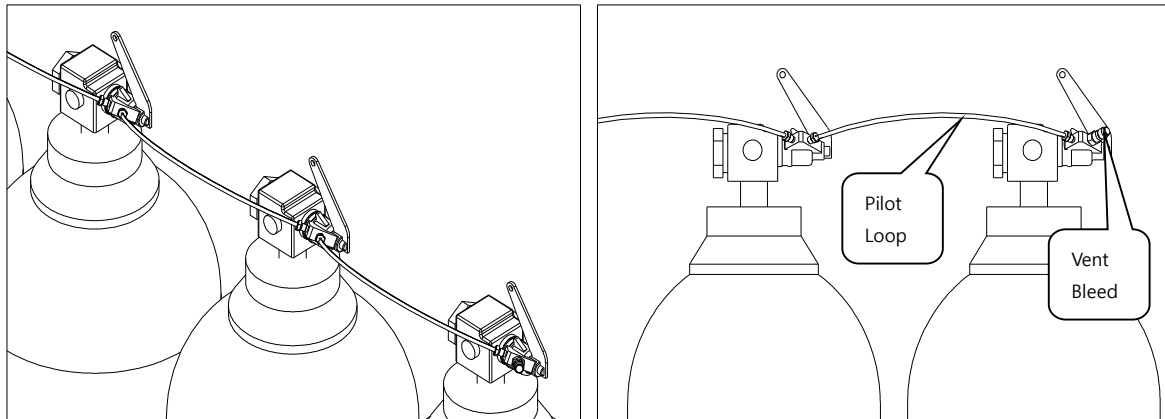
2.6.2 Check Valve For Manifold

Specification

- Material : Brass or Maker standard
- Finish : Natural
- Weight : App. 0.11kg
- Test pressure : 190 kg/cm²



2.7 Pilot Loop & Vent Bleed



Pilot loop

The pressure actuators are interconnected by small bore, pilot loop connected to the gas inlet ports of the pressure actuators. Operating pilot gas can therefore be applied simultaneously to a all cylinder valve pressure actuators.

** Short type : The short pilot gas loop is used to interconnect the inlet ports of the pressure actuators. This allows pilot gas pressure to be applied to the pressure actuators and operate the cylinder Valves simultaneously.

** long type : The long pilot gas loop is used to interconnect two rows of pressure actuators. Where the cylinders are installed in two rows. It is also used to convey pilot gas from a system actuator to the inlet port of the nearest pressure actuator.

Vent bleed

On pressure operated fire extinguishing systems the pilot gas is conveyed to the actuators through the pilot gas hose. To permit the pilot gas in the hose to safely vent to atmosphere once the discharge is complete the vent assembly is screwed into an unused pilot gas port in a pressure actuator, or, if necessary, connected into the pilot gas pipe line. When fitted the vent provides a very small leak(Bleed) in the pilot gas system.

High Pressure Carbon Dioxides Fire-Extinguishing System

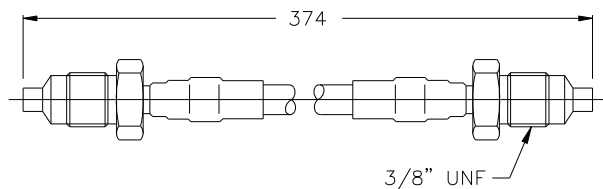
CHAPTER 2. SYSTEM COMPONENT

When the fire extinguishing system is operated pilot gas commences to bleed away to atmosphere immediately.

The rate at which the pilot gas is vented is slow enough to maintain adequate operating pressure in the pilot line far in excess of the duration of the main extinguishant discharge for normal flooding systems. To achieve the above purpose, the set screw in the valve shall be positioned in the marked set position or open 1/8 turn to anti clockwise from the closed position and to be secured with loctite.

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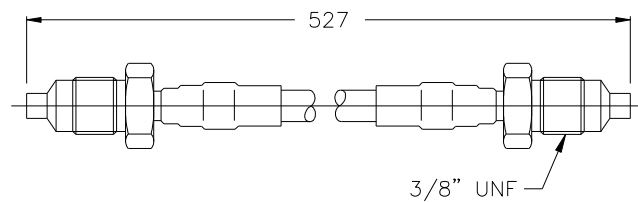
2.7.1 Pilot Loop Short



** short loop Specification

- Material : hose – Polyamide inner tube
End fitting – Brass
- Min. bending radius : 50mm
- Test pressure : : 150 kg/cm² (14.7 MPa)
- Bursting pressure : 400 kg/cm² (39.2 MPa)
- Weight : App. 0.4 kg

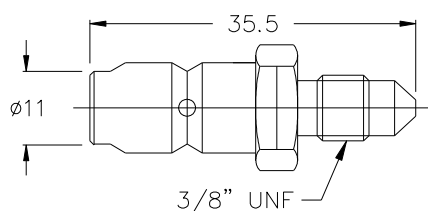
2.7.2 Pilot Loop Long



** Long loop Specification

- Material : hose – Polyamide inner tube
End fitting – Brass
- Min. bending radius : 50mm
- Test pressure : : 150 kg/cm² (14.7 MPa)
- Bursting pressure : 400 kg/cm² (39.2 MPa)
- Weight : App. 0.5kg

2.7.3 Vent Bleed



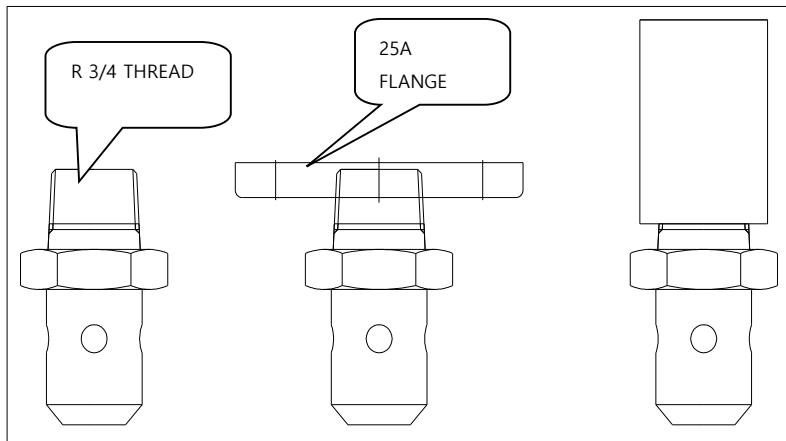
Specification

- Weight : App. 0.1 kg
- Material : Brass
-

2.8 Co2 Discharge Nozzle

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT



Description

CO2 Gas discharged to the protected area through nozzle. For machinery spaces the fixed piping system shall be such that 85% of the gas can be discharged into the space within 2 min.

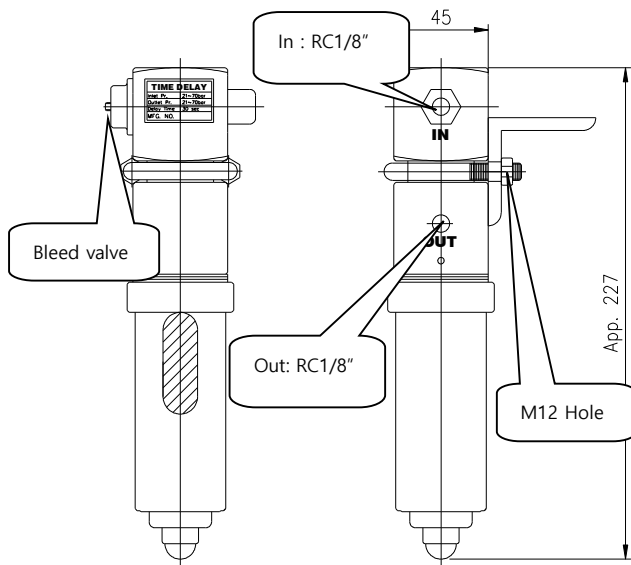
Specification

- Material : Nozzle – Bronze(Melting point 940 °C)
- Flange or boss – Steel with Electric galvanize

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2.9 Time Delay

2.9.1 Pneumatic Type



Description

The time delay device allows additional time for personal evacuation after warning alarm for released.

Specification

- Material : Brass
- Inlet pressure : : 21~70bar
- Outlet pressure : : 21~70bar
- Delay time range : 30 second(+/- 10sec)
- Operating Temp. : 0 - 55 °C
- Weight : App. 2kg

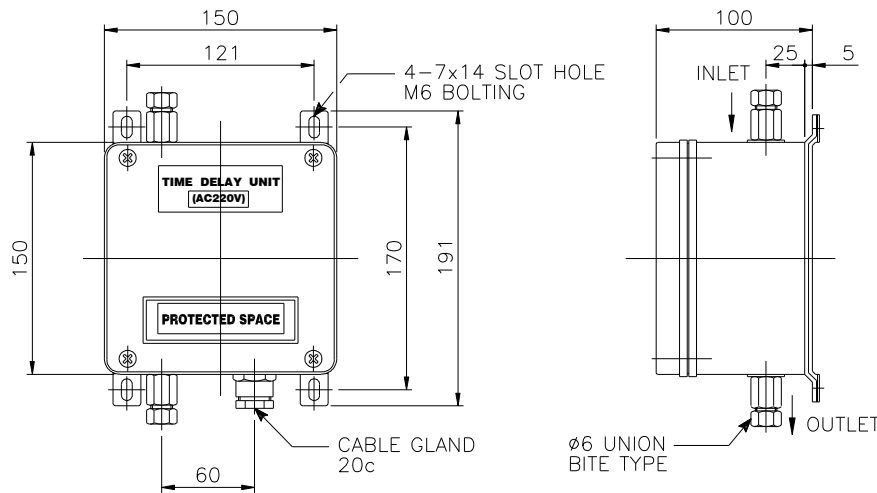
****Note**

1. During test of time delay unit, if the venting of pilot gas plug to make quick vent and retight it.
2. To avoid inadvertent actuation of cylinder valve actuator during the test, or reset of pneumatic time delay unit, the vent bleed fitted at end of cylinder group may be opened one-eighth to anti-clockwise from closed position.

2.9.2 Electric Type

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

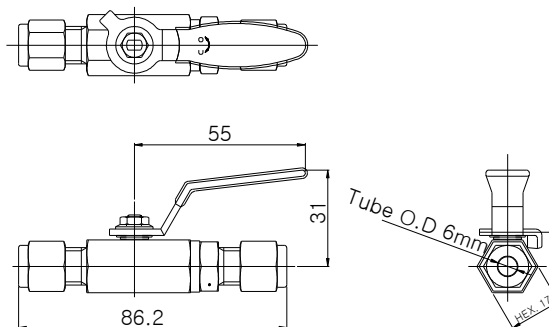


Specification

- Material : ABS
- Voltage : DV24V / AC 220V / AC 110V
- Weighy : 1.8kg
- Color : Beige
- Operating range : 15~120bar
- Delay time : 0~60 sec. adjustable.

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2.9.3 By-pass Valve For Time Delay



**DELAY UNIT
BY - PASS VALVE
NORMALLY CLOSED
PROTECTED SPACE**

CAUTION

IF THE CO2 IS NOT DISCHARGED EVEN AFTER 40 seconds DUE TO MALFUNCTION OF TIME DELAY UNIT, OPEN BY - PASS VALVE OF THE UNIT.

BY PASS VALVE NORMAL CONDITION	BY PASS VALVE OPERATING CONDITION
<p>CLOSE</p>	<p>OPEN</p>

NK CO., LTD
497, Shinyong-Dong, Saha-Gu, Busan, Korea
 TEL: 82-51-204-2211~3, FAX: 82-51-204-2215
www.nk.com

2.10 Release Control Component

CCC => CONTROL CYLINDER CABINET

CVC=> CONTROL VALVE CABINET

Description

Each cabinet is operated the main cylinder valve and the operated main(distribution) valve and fire alarm is actuated or the fans, fire damper can be stopped/closed by limit switch in the cabinet door.

The system is initiated by a supply of pilot gas, which is stored in a small cylinder.

This small cylinder contains the operating pilot gas (CO2 gas, or N2 gas) and located in the Release Control cabinet or Combination type.

Co2 cylinder can be also equipped with manual cylinder valve and N2 Cylinder can be electric remote operated by solenoid valve or(and) manual operated by manual lever.

The small pilot cylinder is connected to pilot tube and the pilot gas pressure will operate the main cylinder valve and the pressure operated main valve. For this reason, the pilot cylinder should be storage to cabinet to ensure the safety and security.

This component is placed at each protected entrance of the space, or fire control station, or co2 room.

When release control cabinet door or Control valve cabinet(Combination type) opened the fire alarm is actuated and the fans, fire damper can be stopped/closed. This kind of logic system can be designed according to the rule requirements, or(and) in accordance with the customer's requirements.

****Caution**

Two separate controls are to be provided for releasing CO2 into a protected space and to ensure the activation of the alarm. One control is to be used to discharge the gas from its storage containers. A second control is to be used to open the valve of the piping that conveys the gas into the protected

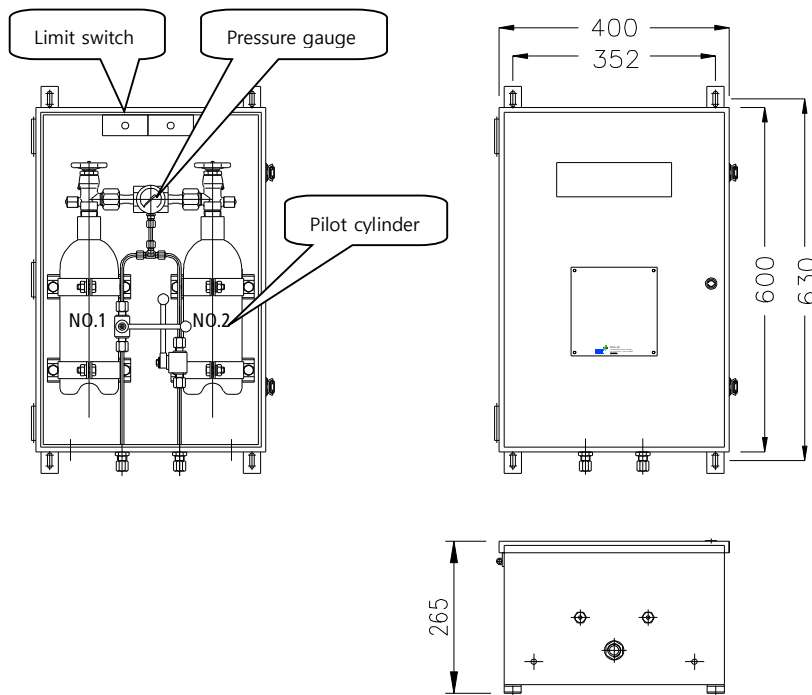
High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

space.

The two controls are to be located inside a release box clearly identified for the particular space. If the box containing the controls is locked, a key to the box is to be in a break-glass type enclosure conspicuously located adjacent to the box.

2.10.1 Manual Release Control Cabinet (Pilot gas : Co2)



Specification

Material	Poly carbonate	GI Steel, 2.3t
Paint	Natural	Red
Weight	App. 25kg	App. 28kg

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

Pilot line	6mm copper	6mm copper
Storage Pressure	56~58 kg/cm ²	

Description

Release control cabinet is operate the main cylinder valve & main(distribution) valve and Fire alarm or vent fan or damper can operate by limit switch in the cabinet door.

Recommended

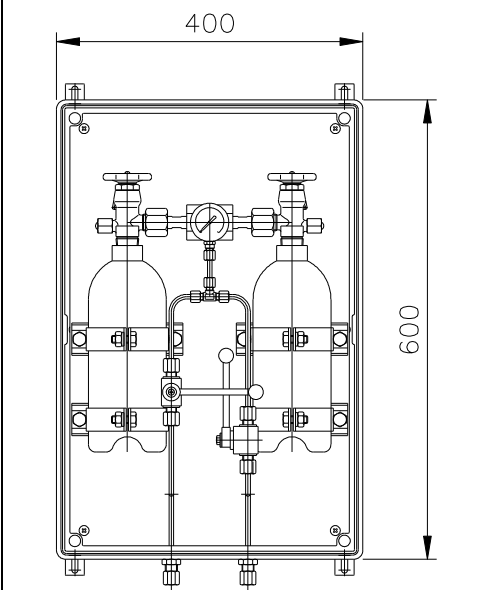
Recommended zone Quantity is 5 zone or less zone for effective arrangement. If six or more zone is applied, recommended control concept is Control cylinder cabinet + Control valve Cabinet.

Max. Pilot line(OD.6mm * 1t tube) length is 300m.

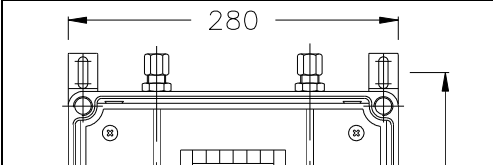
If pilot line exceed 300m it is recommended to use the Start cylinder.

2.10.2 Manual Combination Type CC+CVC (Pilot gas : Co₂)

CCC => Control Cabinet

	Material	Poly carbonate	GI Steel, 2.3t
	Paint	Natural	Red
	Weight	App. 25kg	App. 30kg
	Pilot line	6mm copper	6mm copper
	Storage Pressure	56~58 kg/cm ²	56~58 kg/cm ²

CVC => Control Cylinder Cabinet

	Material	Poly carbonate	GI Steel, 2.3t
	Paint	Natural	Red
	Weight	App. 4kg	App. 6kg
	Pilot line	6mm copper	6mm copper

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

	Storage Pressure	56~58 kg/cm ²	56~58 kg/cm ²

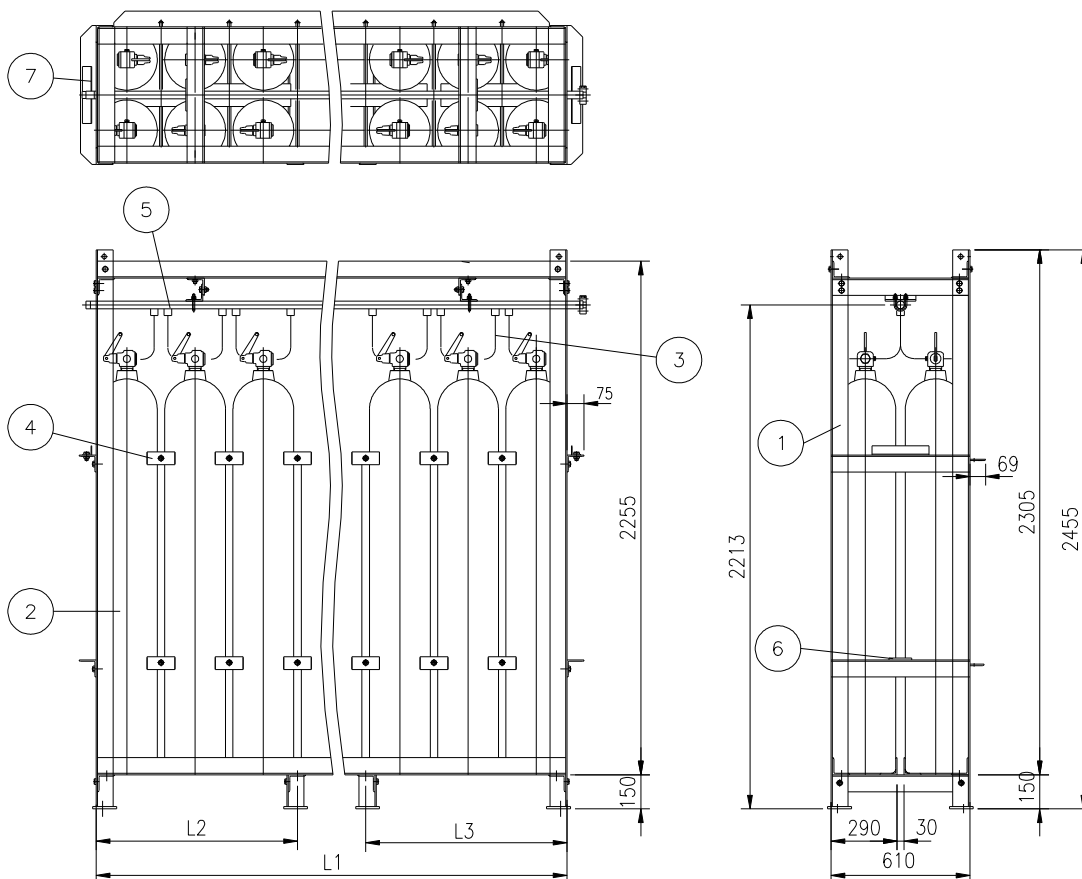
Description

Applying the RCC if there are many protected areas is not good design. So cylinder function & valve function is separated, CCC have pilot cylinder function and CVC have control valve function..

Release control cabinet is operate the main cylinder valve & main(distribution) valve and Fire alarm or vent fan or damper can operate by limit switch in the cabinet door.

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2.11 Cylinder Rack Unit Type



Model	Cyl. Q'ty	L1	L2	L3
NKR208	8	1170	-	-
NKR210	10	1470	581	-

NO.	Description	Specification	Material	Q'ty
1	Cylinder rack	Angle 75*6t	SS400	1
2	Rack assembly	83liter	-	-

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

NKR212	12	1770	881	-
NKR214	14	2070	881	-
NKR216	16	2370	1181	-
NKR218	18	2670	881	881
NKR220	20	2970	881	881

3	Flexible hose	630L	NBR	-
4	Clamp	M10	SS400	-
5	Manifold	25A	STPG370	1
6	Wooden rack	100*40B	WOOD	-
7	Rack support	Angle 40*3t	SS400	2

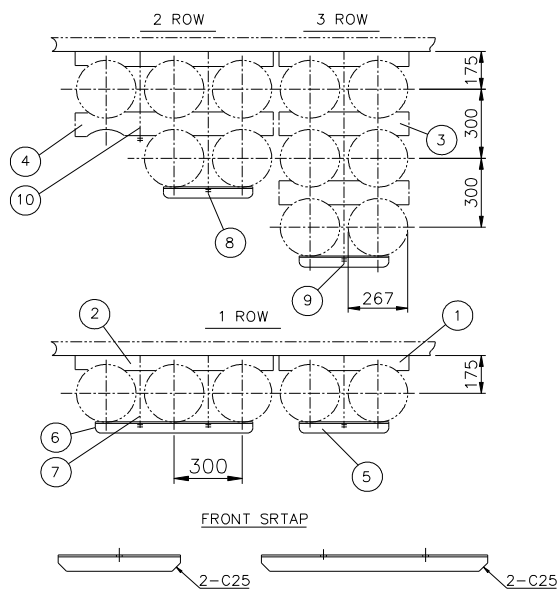
Specification

-Finish : Cylinder rack – Hot dip gal'v

****Rack painting : Contact the manufacture, Painting is not manufacture standard.**

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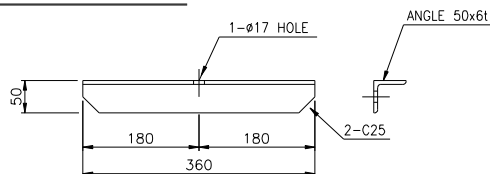
2.12 Cylinder Rack Angle Type



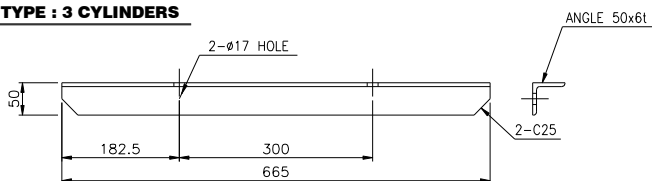
NO.	DESCRIPTION	MATERIAL	REMARK
1	WOODEN RACK (1x2)	WOOD	PINE TREE
2	WOODEN RACK (1x3)	WOOD	PINE TREE
3	WOODEN RACK (2x2)	WOOD	PINE TREE
4	WOODEN RACK (2x3)	WOOD	PINE TREE
5	FRONT STRAP 360L	SS 400	GAL'V
6	FRONT STRAP 665L	SS400	GAL'V
7	STAY B/N/W (SHORT) M16x395L	SS400	GAL'V
8	STAY B/N/W (MIDDLE) M16x695L	SS400	GAL'V
9	STAY B/N/W (LONG) M16x995L	SS400	GAL'V
10	STAY B/N/W (LONG) M16x450L	SS400	GAL'V

2.12.1 Front Strap

TYPE : 2 CYLINDERS



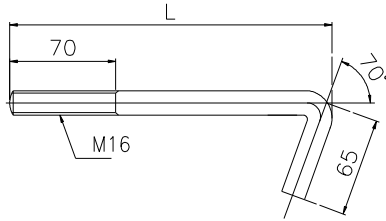
TYPE : 3 CYLINDERS



High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

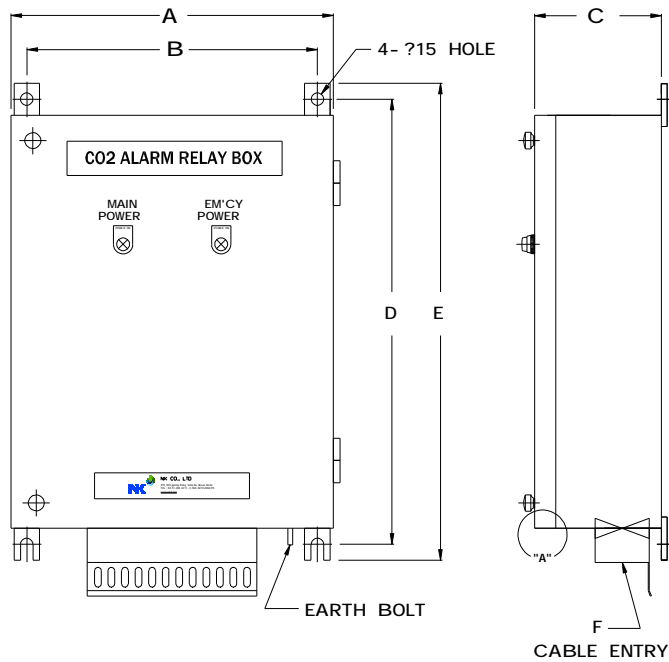
2.12.2 Stay bolt



NO.	DESCRIPTION	L	REMARK
1	STAY B/N/W (SHORT) M16 x 395L	395	SS400, GAL;V
2	STAY B/N/W (MIDDLE) M16 x 695L	695	SS400, GAL;V
3	STAY B/N/W (LONG) M16 x 995L	995	SS400, GAL;V
4	STAY B/N/W M16 x 440L	440	SS400, GAL;V
5	STAY B/N/W M16 x 360L	360	SS400, GAL;V
6	STAY B/N/W M16 x 660L	660	SS400,0 GAL;V
7	STAY B/N/W M16 x 960L	960	SS400, GAL;V

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2.12 Alarm Relay Box



Type	A	B	C	D	E	F	WEIGHT
TB1~40	380	300	200	450	500	200*100	App. 20 kg
TB40~100	500	450	200	600	650	200*100	App. 25 kg
TB100~200	640	590	200	750	800	200*100	App. 30 kg
TB200~300	800	750	200	1100	1150	500*100	App. 45 kg

Specification

High Pressure Carbon Dioxides Fire-Extinguishing System

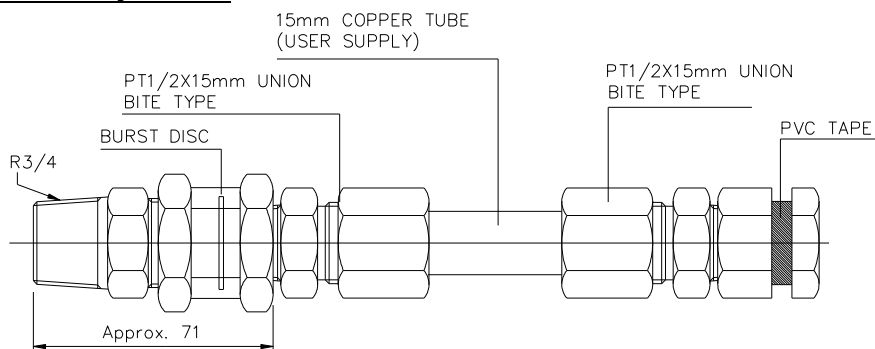
CHAPTER 2. SYSTEM COMPONENT

-MATERIAL : MILD STEEL, 2.3T

-PAINTING : 7.5BG 7/2

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2.13 Safety Outlet



Description

A safety out is provided in the event the cylinders have discharged and the stop valve does not operate.

If pressure build up in the manifold becomes excessive, the safety relief will rupture, venting the pressure to the atmosphere.

PVC tape for indicator is blown off when disc bursts giving a visual indicator of operation.

End of line direction shall be installed avoid direct attack to person.

Specification

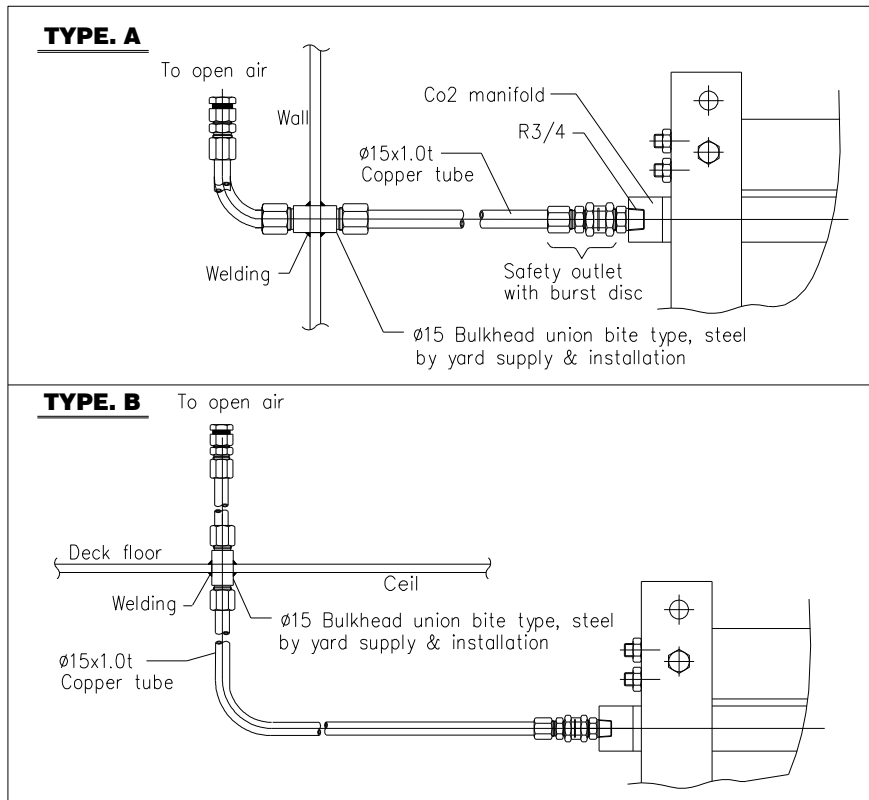
-Material : Brass

-Burst pressure of safety disc : 110bar

Installation

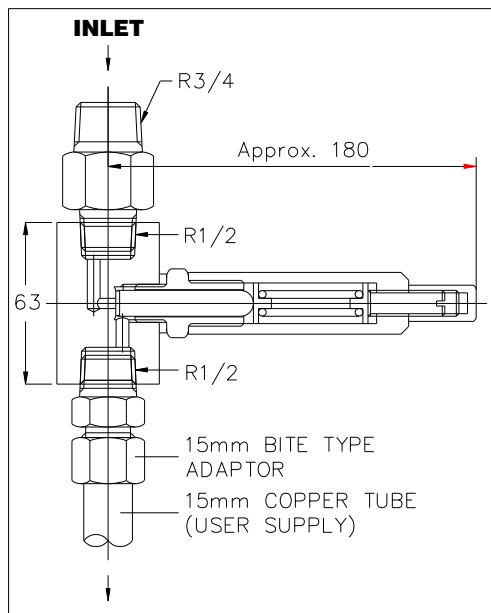
High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT



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2.14 Safety Relief Valve



Description

A safety relief is provided in the event the cylinders have discharged and the stop valve does not operate. If pressure build up in the manifold becomes excessive, the safety relief will rupture, venting the pressure to the atmosphere. End of line direction shall be installed avoid direct attack to person.

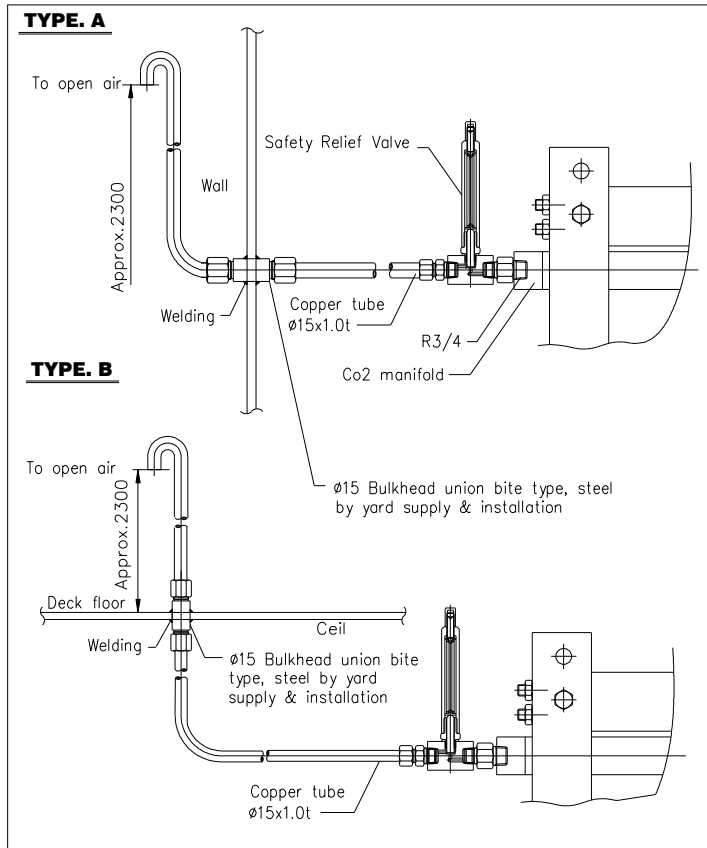
Specification

- Material : Brass
- Design pressure : 160~218bar
- Setting pressure : 126~180bar
- Test pressure : 242~328bar

Installation

High Pressure Carbon Dioxides Fire-Extinguishing System

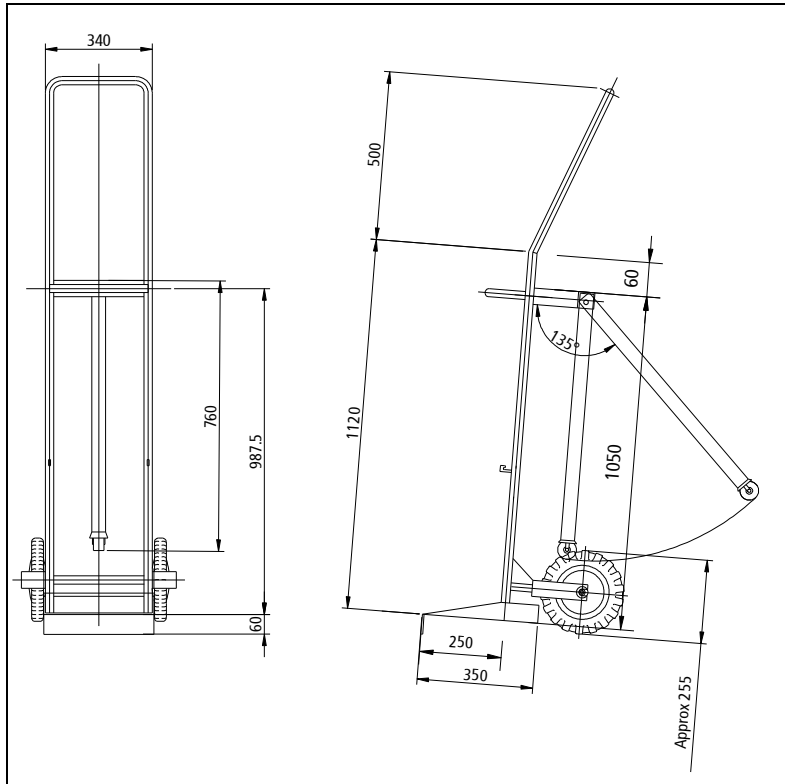
CHAPTER 2. SYSTEM COMPONENT



2.15 Trolley

High Pressure Carbon Dioxides Fire-Extinguishing System

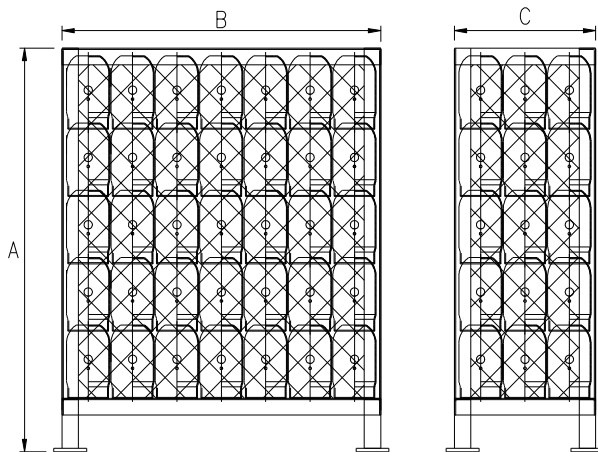
CHAPTER 2. SYSTEM COMPONENT



Specification

- Material : Trolley - SS400
- Wheel - NBR
- Weight : App. 17 kg
- Paint : Black

2.16 Cap Box



Specification

- Material : SS400
- Finish : Hop dip gal'v

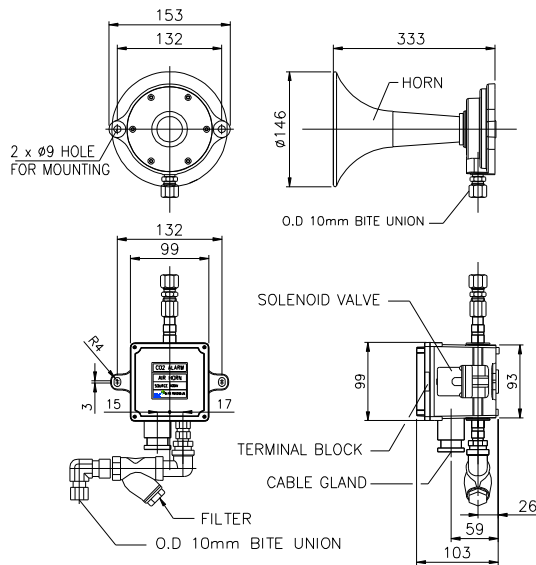
A	B	C	Cap Storage q'ty
350	520	330	1~45EA
350	610	520	45~90
500	710	520	91~140
650	800	520	141~220
800	900	520	221~315

2.17 Alarm Device (Non Explosion Type)

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

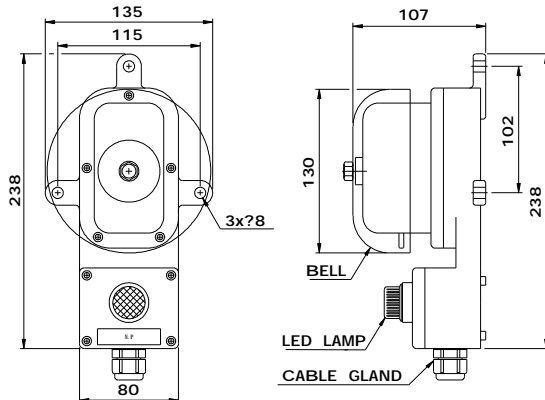
1) AIR HORN WITH SOL. V/V AND FILTER



Specification

- MATERIAL : ABS
- SOUND LEVEL : 130dB(+/- 3dB) at 1M
- COLOR : MAKER STASNARD
- VOLTAGE : AC220V / AC110V / DC24V
- OPERATING AIR PRESSURE : 5~7kg/cm2

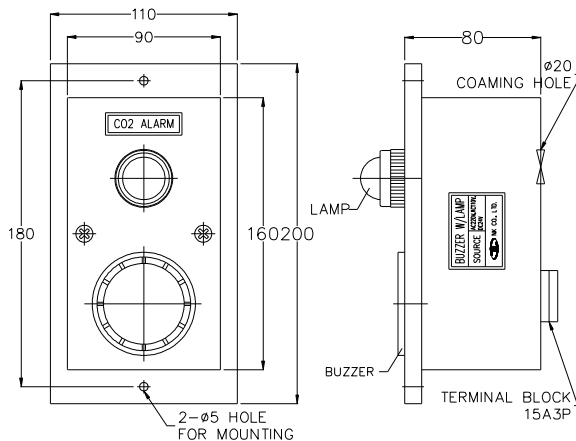
2) ALARM BELL WITH LAMP



Specification

- MATERIAL : BODY – ABS
BELL - STEEL
- SOUND LEVEL : 90dB(+/- 3dB) at 1M
- COLOR : BODY – MAKER STANDARD
BELL - RED
- VOLTAGE : AC220V / AC110V / DC24V

3) BUZZER WITH LAMP



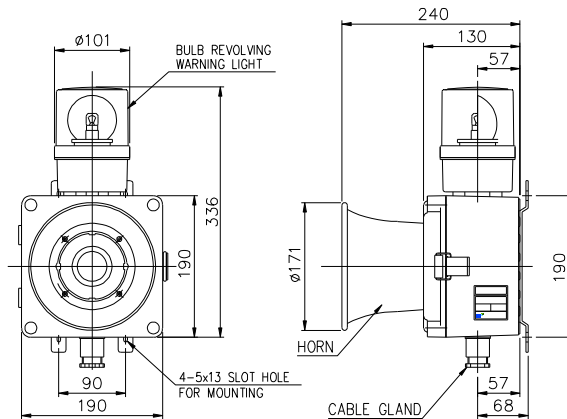
Specification

- MATERIAL : STEEL
- SOUND LEVEL : 92dB(+/- 3dB) at 1M
- COLOR : BODY – RED
BELL - RED
- VOLTAGE : AC220V / AC110V / DC24V

4) BUZZER WITH LAMP

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

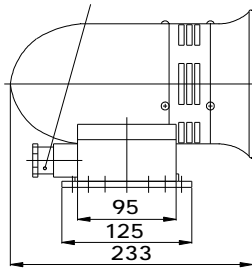


Specification

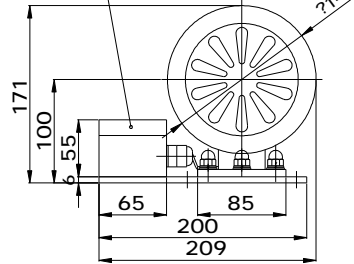
- MATERIAL: HOUSING- PC
HORN - SUS
- SOUND LEVEL : 118dB(+/- 3dB) at 1M
- COLOR : HOUSING – MAKER STANDARD
LENS - RED
- VOLTAGE : AC220V / AC110V / DC24V

5) MOTOR SIREN

20C CABLE GRAND



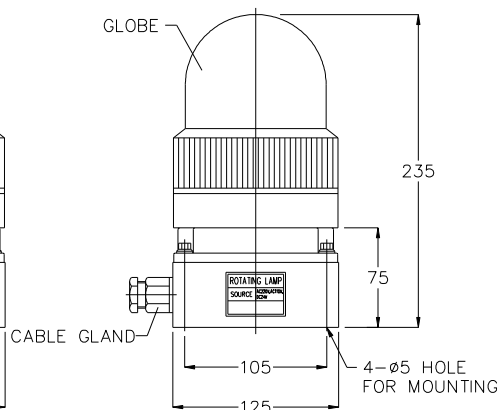
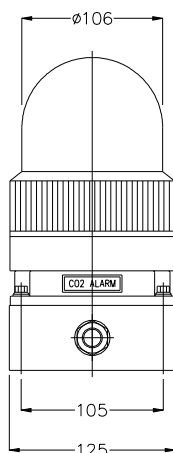
65x95x55BOX



Specification

- MATERIAL : HOUSING- DIECAST AL
- SOUND LEVEL : 120dB(+/- 3dB) at 1M
- COLOR : RED
- VOLTAGE : AC110V

6) ROTATING LAMP

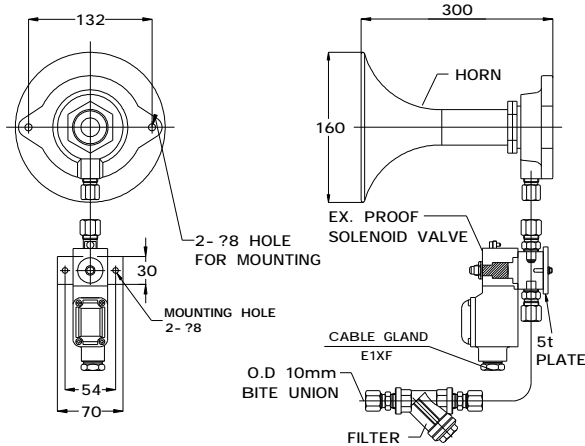


Specification

- MATERIAL: PC/PLASTIC
- GLOBE COLOR : RED / BLUE / GREEN
- VOLTAGE : AC220V / AC110V / DC24V

2.18 Alarm Device (Explosion Type)

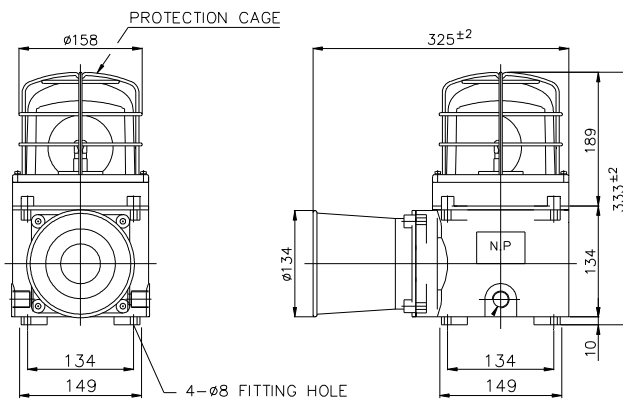
1) AIR HORN WITH SOL. V/V AND FILTER (EX. TYPE)



Specification

- MATERIAL : ABS
- SOUND LEVEL : 130dB(+/- 3dB) at 1M
- COLOR : MAKER STASNARD
- VOLTAGE : AC220V / AC110V / DC24V
- OPERATING AIR PRESSURE : 5~7kg/cm²
- ENCLOSURE : Ex d mb IIC T4,T5 and T6 / IP67 (ATEX CERTIFICATE)

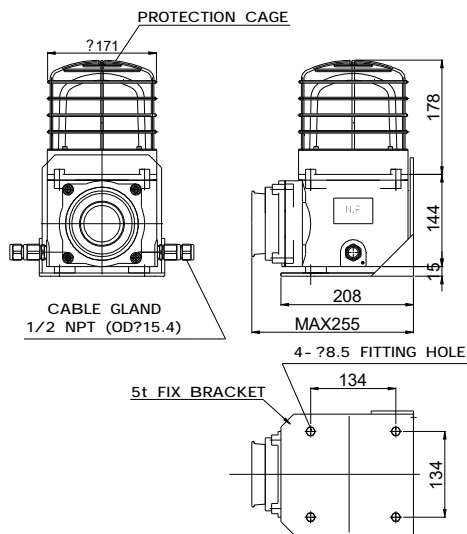
2)ELECTRIC HORN WITH ROTATING LAMP (EX. TYPE)



Specification

- MATERIAL: HOUSING – DIECAST AL
- LENS- EXPLOSION-PROOF
- TEMPERED GLASS
- REFLECTOR : HEAT RESISTING ABS
- SOUND LEVEL : 118dB(+/- 3dB) at 1M
- COLOR : HORN – RED
- LENS – RED
- HOUSING : MUNSELL 7.5BG 7/2
- VOLTAGE : AC220V / AC110V / DC24V
- ENCLOSURE : Exd IIC T6 IP66 ATEX

3) ELECTRIC HORN WITH WARNING LIGHT (EX. TYPE)



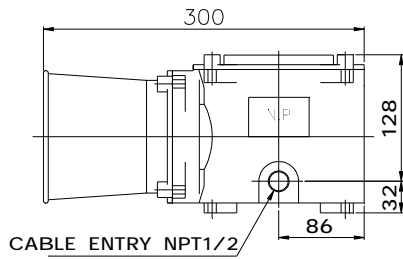
Specification

- MATERIAL: HOUSING – MAKER STANDARD
- HORN : SUS316
- LAMP : GLASS
- SOUND LEVEL : 105dB(+/- 3dB) at 1M
- COLOR : HOUSING - MUNSELL 7.5BG 7/2
- GLOBE - BLUE
- VOLTAGE : AC220V
- ENCLOSURE : Ex d IIC T6 / IP66 / ATEX,IECEX
- LIGHT TYPE : LED FLASH LIGHT

High Pressure Carbon Dioxides Fire-Extinguishing System

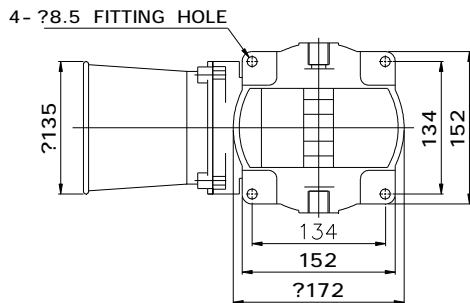
CHAPTER 2. SYSTEM COMPONENT

4) ELECTRIC HORN (EX. TYPE)

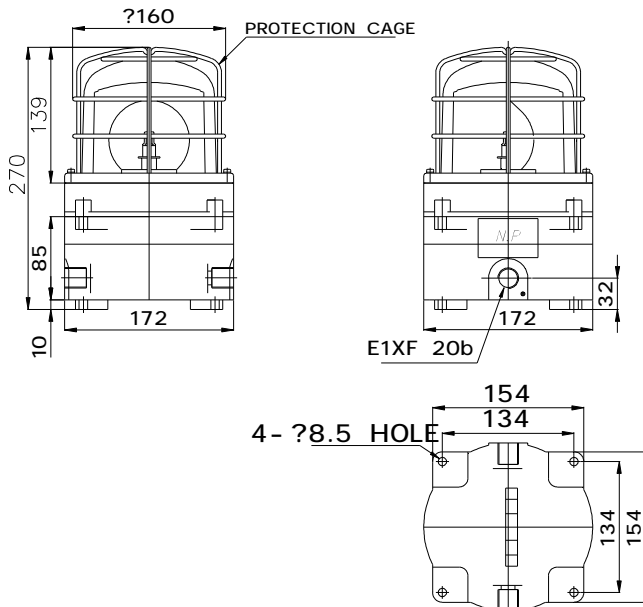


Specification

- MATERIAL: HOUSING – DIECAST AL
- SOUND LEVEL : 110~118dB at 1M
- COLOR : HOUSING - MUNSELL 7.5BG 7/2
- VOLTAGE : AC220V / AC110V / DC24V
- ENCLOSURE : Exd IIC T6 IP56 ATEX



5) ELECTRIC HORN (EX. TYPE)

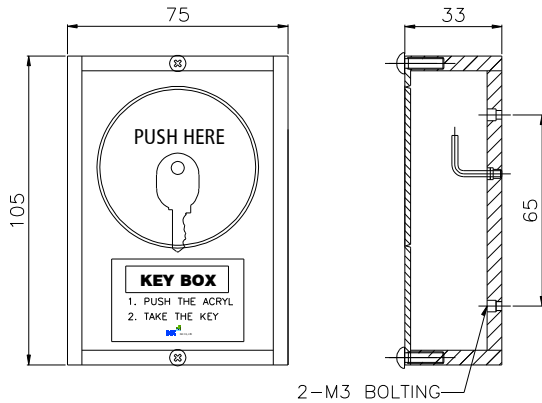


Specification

- MATERIAL: HOUSING – DIECAST AL
- LENS- EXPLOSION-PROOF
- TEMPERED GLASS
- REFLECTOR : HEAT RESISTING ABS
- COLOR : LENS – RED
- HOUSING : MUNSELL 7.5BG 7/2
- VOLTAGE : AC220V
- ENCLOSURE : Exd IIC T6 IP56 ATEX

2.19 Accessory

2.19.1 Key Box For Inside Area



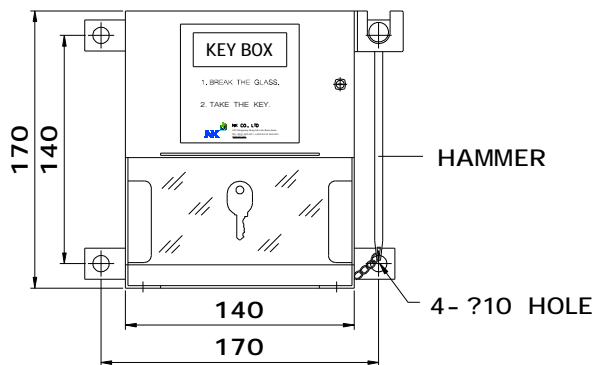
Description

Key box fitted on control cabinet door or other required place.

Specification

- Body : RED Acryl 5t.
- Cover : Transparent acryl 2t
- Location : inside area.

2.19.2 Key Box For Outside Area



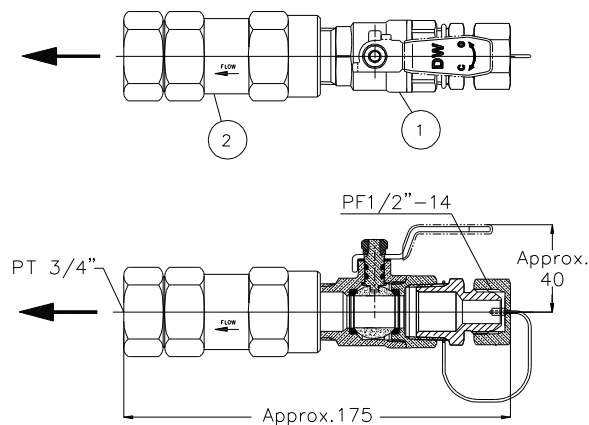
Description

Key box fitted on control cabinet door or other required place.

Specification

- Body : SUS316
- Color : RED

2.19.3 Air Connection Assembly



Description

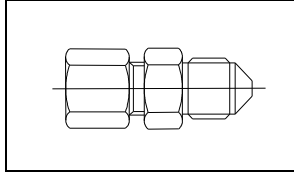
It fitted main valve upstream or downstream for discharge line tightness test & air blowing.

Specification

1. 3/4" Ball valve
 - Material : Forging brass
 - Working pressure : 10kgf/cm²
 - Test pressure : 15kgf/cm²
2. 3/4" Non-return check valve
 - Material : Brass
 - Test pressure : 130~190kgf/cm²

2.19.4 Tube Fitting

Tube adaptor



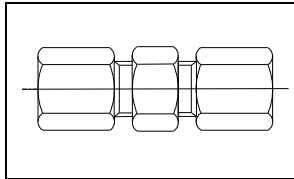
Description

It is used to connect the 6mm tube between the Control cabinet and the cylinder valve actuator.

Specification

- Material – Brass
- Connection : 6mm tube * 3/8 UNF(M) or R 1/8(M)

Union STRIGHT



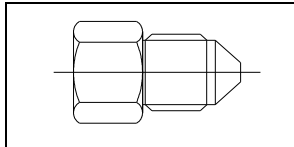
Description

It is used to connect the between of the tube and tube for long term distance or maintenance.

Specification

- Material – Brass

End plug



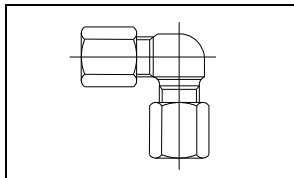
Description

It is used to connect the end point.

Specification

- Material – Brass
- Connection : 3/8 UNF(M)

Union Elbow



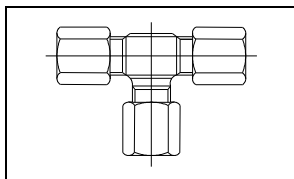
Description

Normally pilot tube elbow point there are applied tube bending. As per on the field work condition will consider apply.

Specification

- Material – Brass
- Connection : 6mm tube bite

Union tee



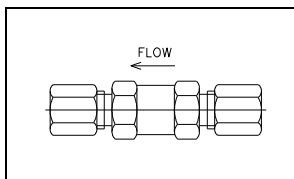
Description

It use at the three direction point of pilot line.

Specification

- Material – Brass
- Connection : 6mm tube bite

Check valve



Description

It use at the three direction point of pilot line.

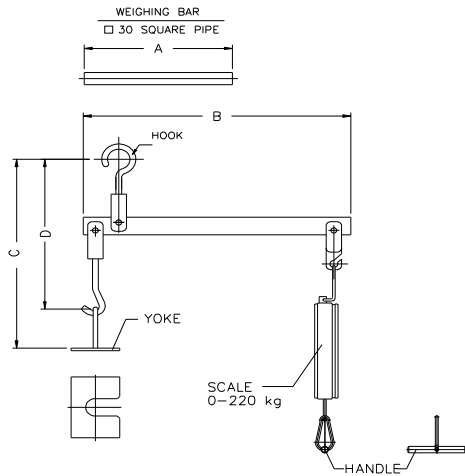
Specification

- Material – Brass
- Connection : 6mm tube bite

High Pressure Carbon Dioxides Fire-Extinguishing System

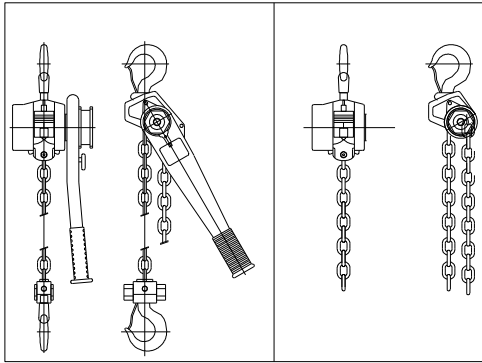
CHAPTER 2. SYSTEM COMPONENT

2.19.5 Beam Scale



	Rack unit type		Wooden rack type	
	45kg	55kg	45kg	55kg
A	800	800	775	775
B	560	560	775	775
C	350~475 (Adjustable)	310~475 (Adjustable)	350~475 (Adjustable)	350~475 (Adjustable)
D	355	225	355	225

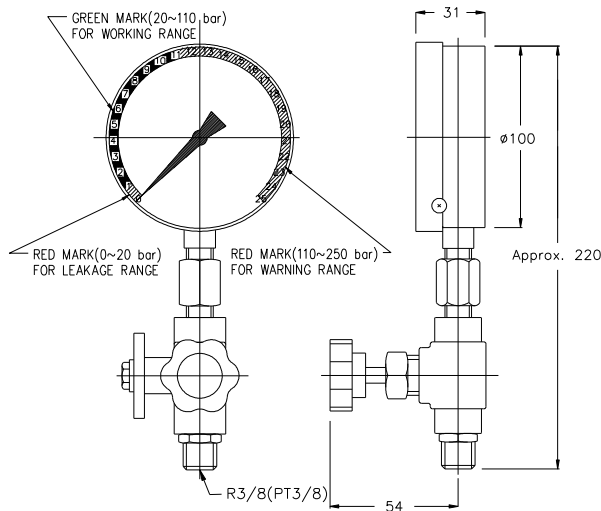
2.19.6 Lever & Chain Type Block



Specification

- CAPACITY : 3/4 ton
- STANDARD LIFT : 1.5m

2.19.7 Pressure Gauge



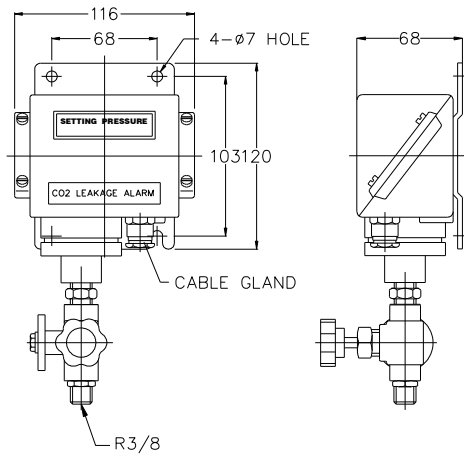
Specification

- MATERIAL : GAUGE - SUS
3-WAY COCK – FORGED BRASS
- FINISH : NATURAL
- SCALE : 0~250BAR
- TYPE : OIL FILLED TYPE

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

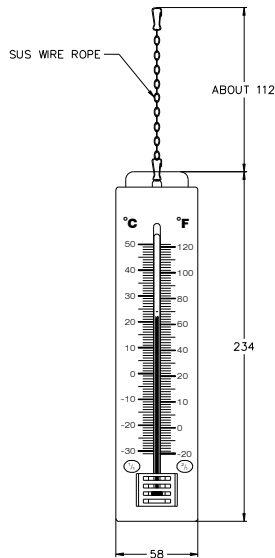
2.19.8 Pressure Switch



Specification

- MATERIAL : SWITCH – MILD STEEL
STOP VALVE – FORGED BRASS
- FINISH : NATURAL
- SETTING RANGE : 1~10kg/cm²
- MAX. TEST PRESSURE : 180kg/cm²
- SETTING PRESSURE : 4kg/cm²

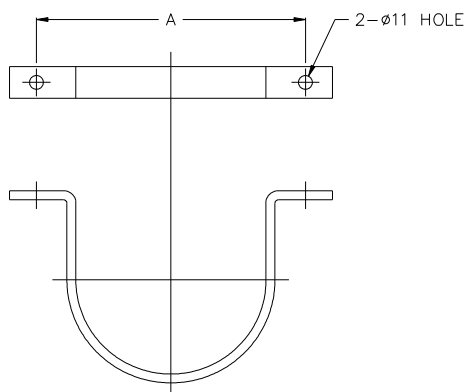
2.19.9 Thermometer



Specification

- MEDIUM : ALCOHOL(RED)
- TEMP. RANGE : -30°C ~ 50°C

2.19.10 Cylinder Strap



CYLINDER DIA(mm)	A (mm)
141.3	193
178	240
232	292
267	320
376	428

Specification

- MATERIAL : MILD STEEL
- FINISH : GALVANIZED

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

2.20 Smoke detection system For Cargo Holders onboard Ships

**Over view

The smoke detection system SDS-48 is used for continuous smoke monitoring in up to 48 cargo holds. For this a network of pipes simultaneously draws air samples from all cargo spaces, which are then fed to the smoke detection panel. In most cases, the pipes for the CO2 fire extinguishing system are used for this. The fire extinguishing equipment and the smoke detection system can both be connected to the same network by means of 3-way valves or 2-way valves.

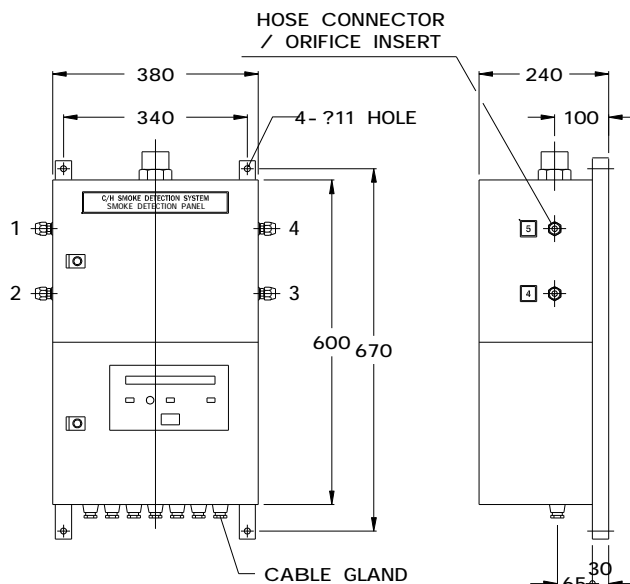
The interpretation of the lines is continuous, not sequential. All lines are evaluated anytime. Each line is connected to its own smoke detector to ensure a proper allocation of a fire event to its place of origin.

For remote display and handling of smoke alarms and fault warnings, the control panel is installed on the bridge and is connected to the smoke detection panel in the CO2 room.

The system in its layout complies with the requirements of FSS Code Chapter 10 (sample extraction smoke detection systems), furthermore EN 54-2, -4 and -20 as well as IEC 60092-504 (control panel). The system is designed to safeguard against explosion according to IEC 60079. For the according standards the fan units fulfil, please refer to the operation manual DOK02.055, chapter 3 (Relevant Regulations).

2.20.1 Smoke Detection Panel

2.20.1.1 4Line



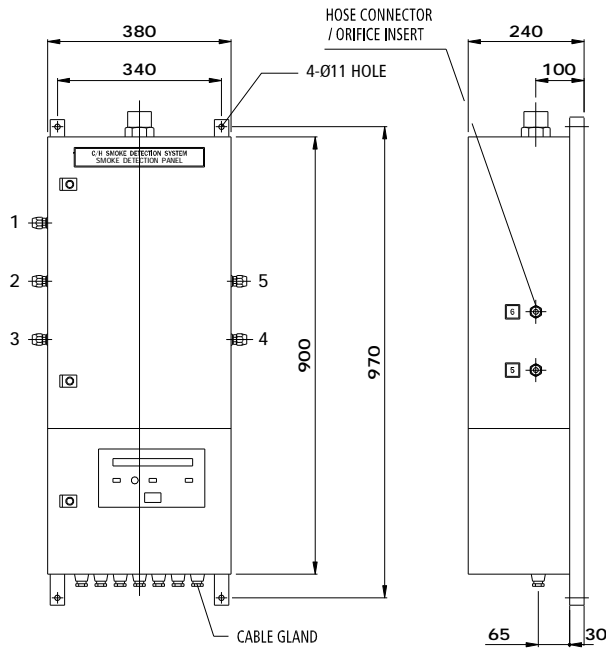
Material	Steel
Color	RAL 7035
Weight	Approx. 25kg
Operating Temperature	0°C ~ 55°C
Power	2 x 220/230V AC 50/60Hz 2 X 110V AC 60Hz
IP Grade	IP54

From 3 or 2-way valves to smoke detection panel	Pipe / Hose Type INSIDE \varnothing : 13 mm
From smoke Detection Panel to Fan Unit	Galvanized steel
	1~10 line : 65A
	11~18 lines : UP TO 5m : 65A OVER 5m : 80A
	19~24 line : 80A

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

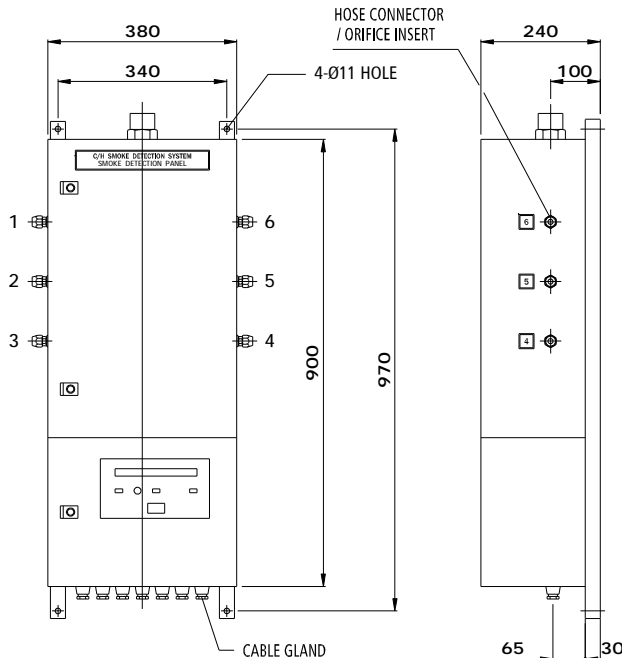
2.20.1.2 5Line



Material	Steel
Color	RAL 7035
Weight	Approx. 40kg
Operating Temperature	0°C ~ 55°C
Power	2 x 220/230V AC 50/60Hz 2 X 110V AC 60Hz
IP Grade	IP54

From 3 or 2-way valves to smoke detection panel	Pipe / Hose Type INSIDE Ø : 13 mm
From smoke Detection Panel to Fan Unit	Galvanized steel
	1~10 line : 65A
	11~18 lines : UP TO 5m : 65A OVER 5m : 80A
	19~24 line : 80A

2.20.1.3 6Line



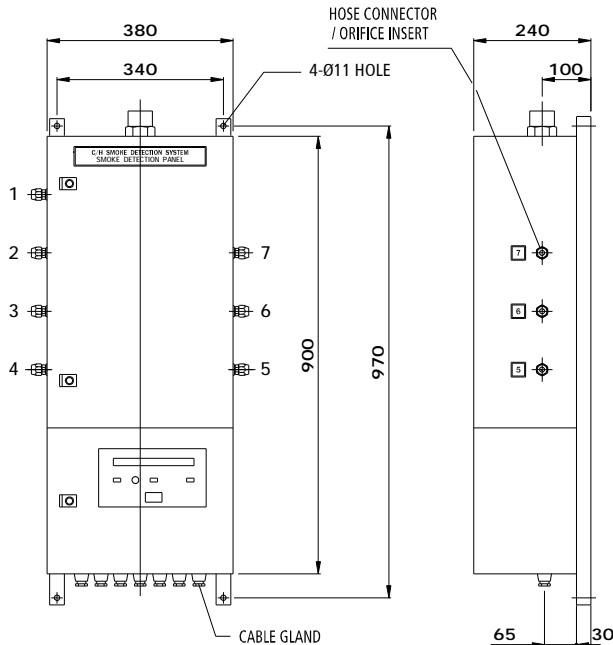
Material	Steel
Color	RAL 7035
Weight	Approx. 40kg
Operating Temperature	0°C ~ 55°C
Power	2 x 220/230V AC 50/60Hz 2 X 110V AC 60Hz
IP Grade	IP54

From 3 or 2-way valves to smoke detection panel	Pipe / Hose Type INSIDE Ø : 13 mm
From smoke Detection Panel to Fan Unit	Galvanized steel
	1~10 line : 65A
	11~18 lines : UP TO 5m : 65A OVER 5m : 80A
	19~24 line : 80A

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

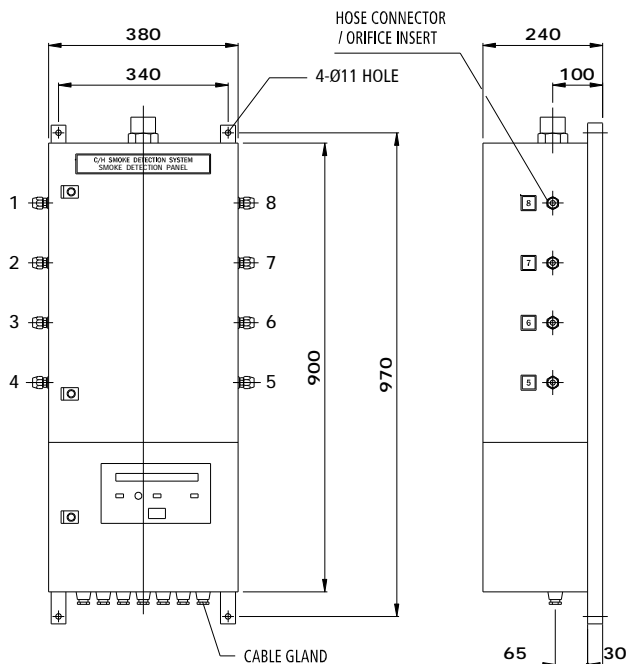
2.20.1.4 7Line



Material	Steel
Color	RAL 7035
Weight	Approx. 40kg
Operating Temperature	0°C ~ 55°C
Power	2 x 220/230V AC 50/60Hz 2 X 110V AC 60Hz
IP Grade	IP54

From 3 or 2-way valves to smoke detection panel	Pipe / Hose Type INSIDE Ø : 13 mm
From smoke Detection Panel to Fan Unit	Galvanized steel
	1~10 line : 65A
	11~18 lines : UP TO 5m : 65A OVER 5m : 80A
	19~24 line : 80A

2.20.1.5 8Line

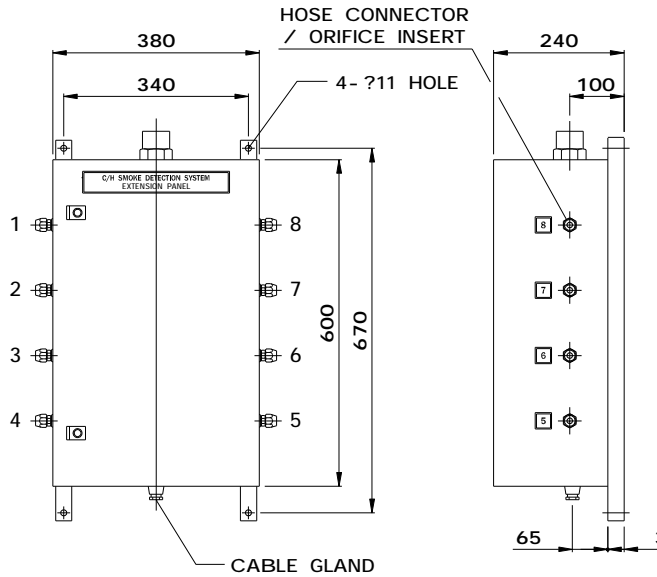


Material	Steel
Color	RAL 7035
Weight	Approx. 40kg
Operating Temperature	0°C ~ 55°C
Power	2 x 220/230V AC 50/60Hz 2 X 110V AC 60Hz
IP Grade	IP54

From 3 or 2-way valves to smoke detection panel	Pipe / Hose Type INSIDE Ø : 13 mm
From smoke Detection Panel to Fan Unit	Galvanized steel
	1~10 line : 65A
	11~18 lines : UP TO 5m : 65A OVER 5m : 80A
	19~24 line : 80A

2.20.2 Extension Panel

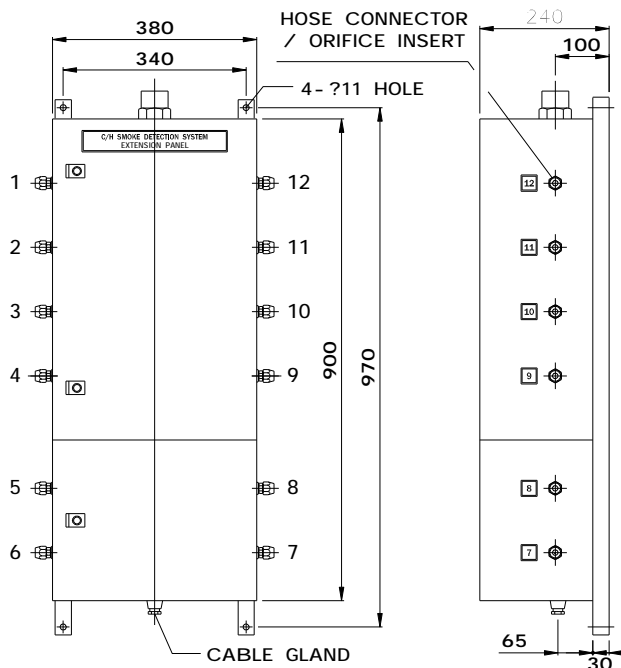
2.20.2.1 8Line



Material	Steel
Color	RAL 7035
Weight	Approx. 30kg
Operating Temperature	0°C ~ 55°C
IP Grade	IP54

From 3 or 2-way valves to smoke detection panel	Pipe / Hose Type INSIDE \varnothing : 13 mm
From smoke Detection Panel to Fan Unit	Galvanized steel
	1~10 line : 65A
	11~18 lines : UP TO 5m : 65A OVER 5m : 80A
	19~24 line : 80A

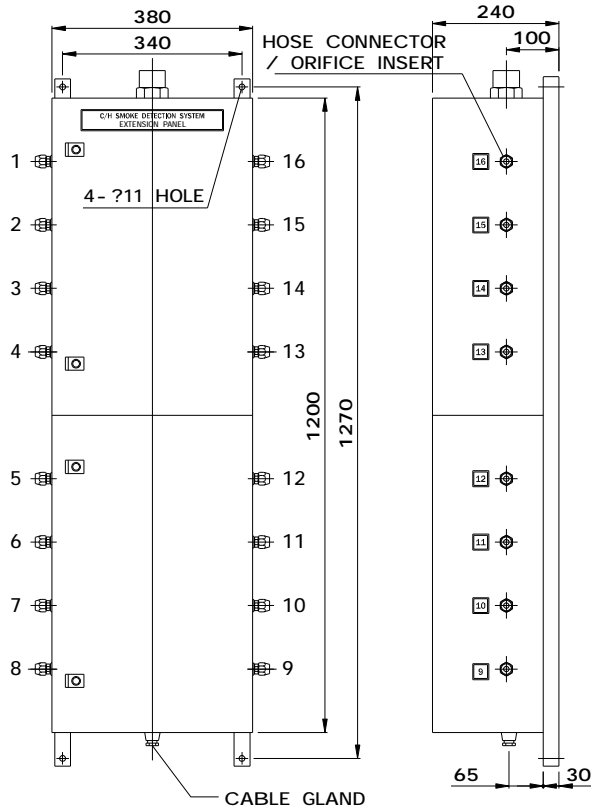
2.20.2.2 12Line



Material	Steel
Color	RAL 7035
Weight	Approx. 45kg
Operating Temperature	0°C ~ 55°C
IP Grade	IP54

From 3 or 2-way valves to smoke detection panel	Pipe / Hose Type INSIDE \varnothing : 13 mm
From smoke Detection Panel to Fan Unit	Galvanized steel
	1~10 line : 65A
	11~18 lines : UP TO 5m : 65A OVER 5m : 80A
	19~24 line : 80A

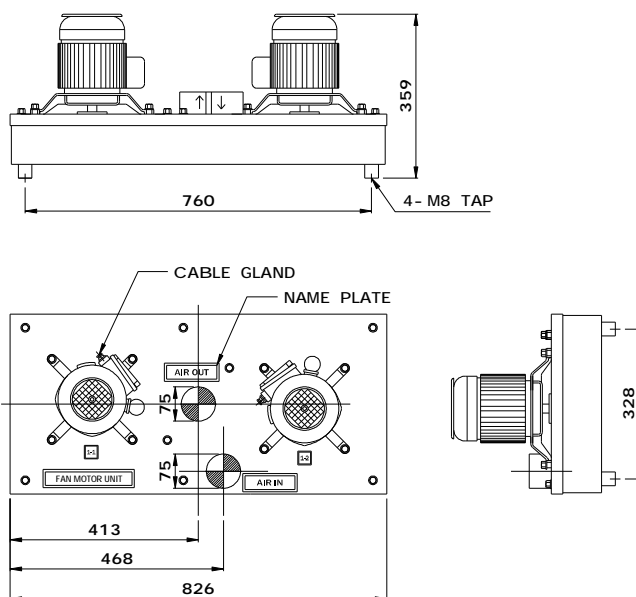
2.20.2.3 18Line



Material	Steel
Color	RAL 7035
Weight	Approx. 65kg
Operating Temperature	0°C ~ 55°C
IP Grade	IP54

From 3 or 2-way valves to smoke detection panel	Pipe / Hose Type INSIDE ∅ : 13 mm
From smoke Detection Panel to Fan Unit	Galvanized steel
	1~10 line : 65A
	11~18 lines : UP TO 5m : 65A OVER 5m : 80A
	19~24 line : 80A

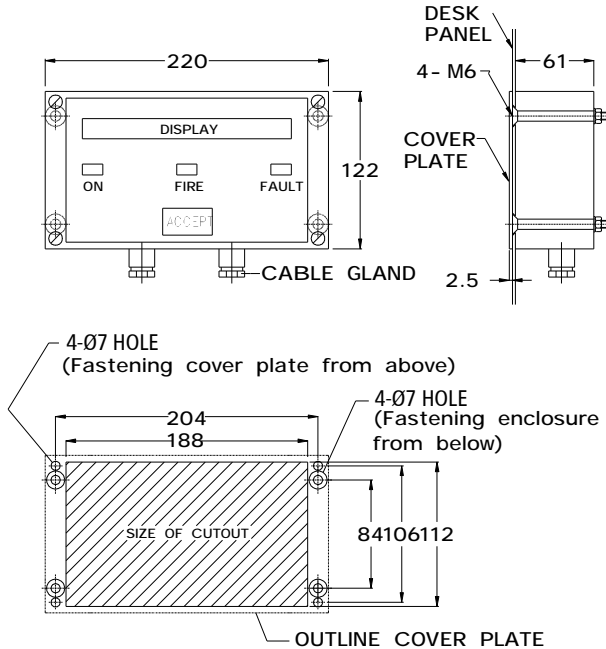
2.20.3 Fan Motor Unit



Material	Steel
Color	RAL 7035
Weight	Approx. 45kg
Power	220/230V AC 50/60Hz 110V/115V AC 60Hz
Operating Temperature	-20°C ~ 45°C
Kondensator Capacity	40 uF 240V
IP Grade	FAN MOTOR - IP 54
Bearing	6204-2RS1 TYPE

2.20.4 Repeater Panel

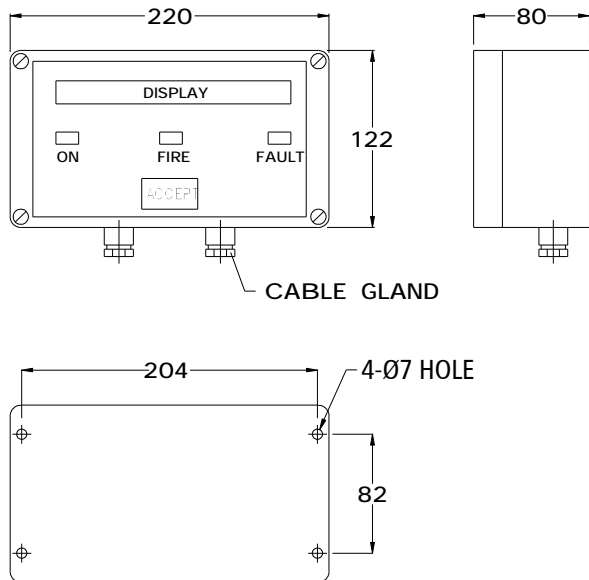
2.20.4.1 Flush Mounting Type



Specification

- Material : Die-cast aluminium
- Color : RAL 7035
- Weight : Approx. 1.8kg
- Operating Temperature : 0°C ~ 55°C
- IP Grade : IP54

2.20.4.2 Wall Mounting Type

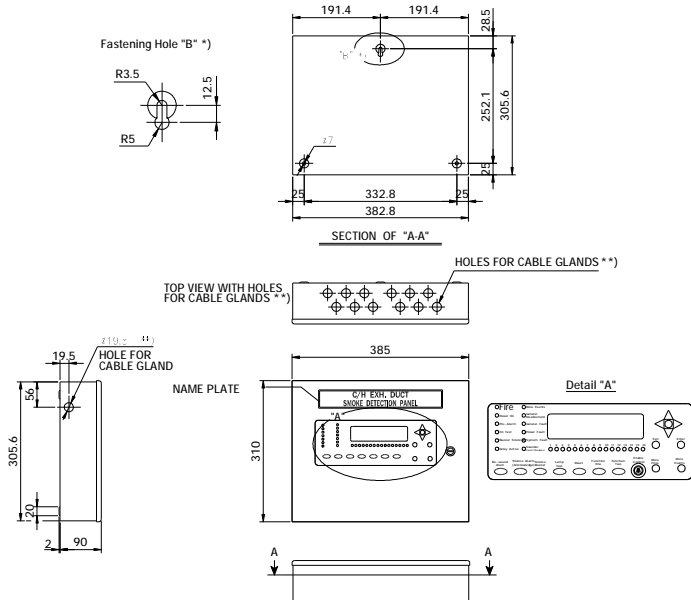


Specification

- Material : Die-cast aluminium
- Color : RAL 7035
- Weight : Approx. 1.8kg
- Operating Temperature : 0°C ~ 55°C
- IP Grade : IP66

2.20.5 Fire Detection Panel

2.20.5.1 Fire Detection Panel Syncro ASM



Specification

- Material : Phenol
- Color : White base. Black letter
- Weight : Approx. 9kg

Description

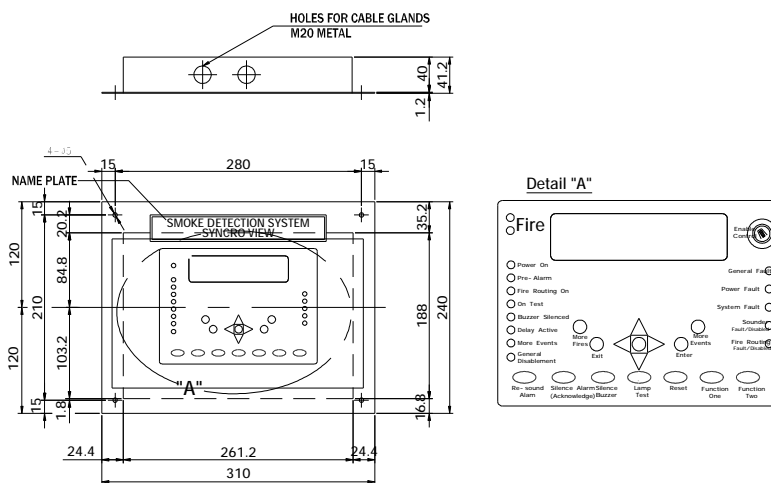
The Fire Detection Panel Syncro ASM powers up to 2 detection loops with up to 126 analogue addressable detectors per loop.

"CAUTION"

Battery is consumables. In order to extend the battery life, please follow the below conditions.

1. After the installation of syncro ASM panel, please disconnect the battery from the panel.
2. For the test and inspection, the battery can be connected before ship delivery.
3. If the test and inspection is completed, the battery should be disconnected again.
4. When the ship is delivered, please connect the battery. If you don't follow it, the battery life can be shortened.

2.20.5.2 Syncro View Repeater Panel (Flush Mounting Type)



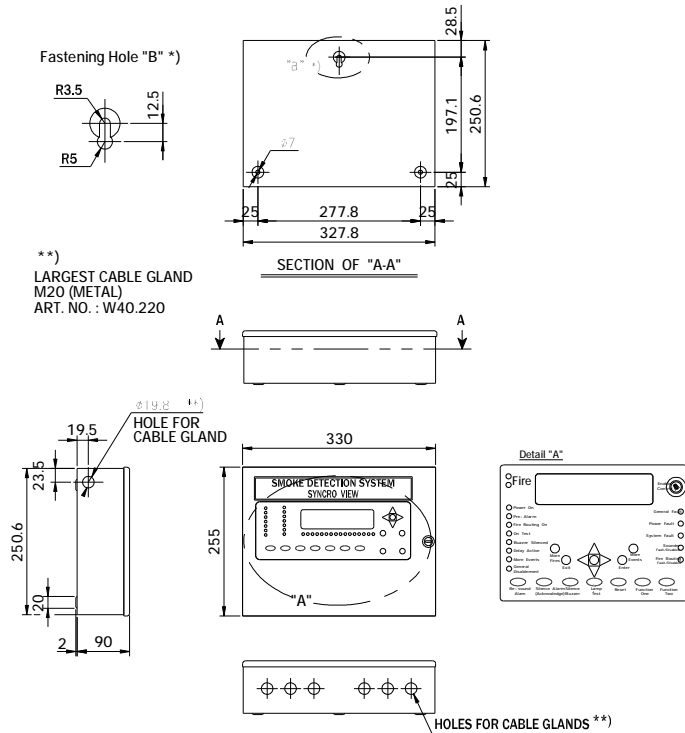
Specification

- Material : POLYCARBONATE
- Color : White base. Black letter
- Weight : Approx. 4kg

Description

The Repeater Panel Syncro View shows all messages from Fire detection Panel Syncro ASM. It allows the complete operation of the Syncro fire detection system. The connection takes place via the RS-485- Bus of the Syncro ASM Fire Detection-and Alarm Panel. Up to 2 Syncro View devices can be connected without additional power supply (24V=)to the Fire Detection Panel.

2.20.5.3 Syncro View Repeater Panel (Wall Mounting Type)



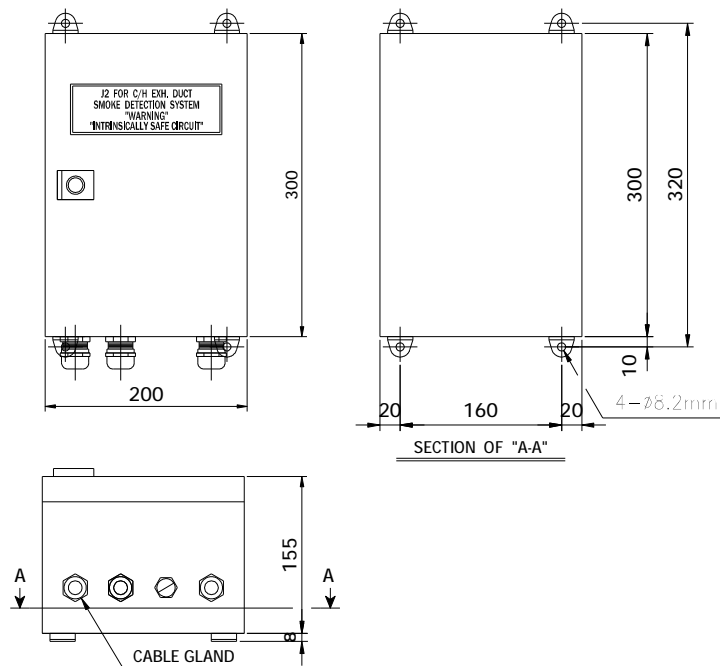
Specification

- Material : POLYCARBONATE
- Color : White base. Black letter
- Weight : Approx. 4kg

Description

The Repeater Panel Syncro View shows all messages from Fire detection Panel Syncro ASM. It allows the complete operation of the Syncro fire detection system. The connection takes place via the RS-485- Bus of the Syncro ASM Fire Detection-and Alarm Panel. Up to 2 Syncro View devices can be connected without additional power supply (24V=)to the Fire Detection Panel.

2.20.6 Junction Box



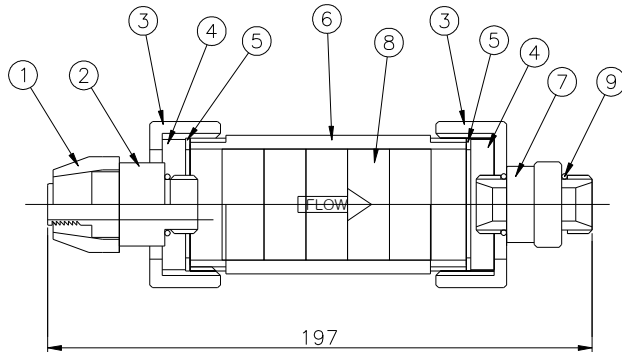
Specification

- Material : POLYCARBONATE
- Color : White base. Black letter
- Weight : Approx. 5kg

Description

The junction box comprises a 2-channel loop isolator, and one protocol translator and galvanic isolator per each channel. It connects intrinsically safe the exhaust duct smoke detectors of different cargo holds to the fire detector loop. The junction box must be mounted in a safe area.

2.20.7 Prefilter



NO.	DESCRIPTION	SPECIFICATION
1	END CAP	SUM24L, Zn GAL'V
2	NOPPLE	PF 1/2", ASTEL
3	END CAP	ASTEL
4	CAP	PVC (POLYVINYL CHLORIDE)
5	PACKING	NBR G45
6	FILTER HOUSING	ACRYLIC
7	NIPPLE	SUM24L, Zn GAL'V
8	FILTER ELEMENT	PLOYURETHANE SOFT FOAM
9	GASKET	BRASS, $\phi 31$, 2T

- WEIGHT : Approx. 400 g

Description

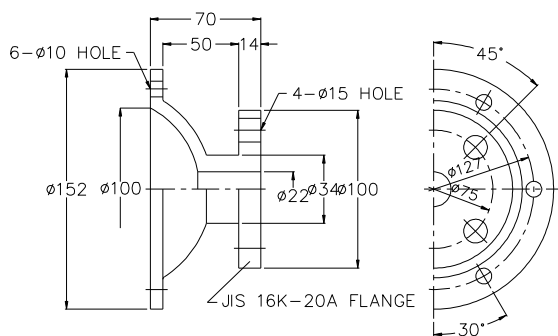
False alarms can be a frequent occurrence on freighters that are fitted with an extraction smoke detection system, especially when "dirty loads" are being transported. This is annoying for the crew, and involves tiresome cleaning work on the smoke detectors.

Assembly

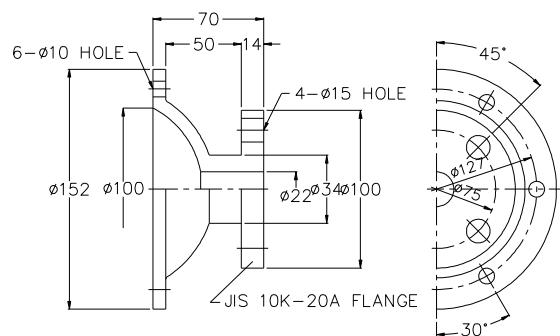
Prefilters are fitted in the suction pipelines (mostly hoses) before the three-way valves. The pipe connections are removed from the three-way valves and replaced by the prefilters. The pipes are then shortened appropriately and connected to the prefilters.

2.20.8 Smoke accumulator

JIS16K FL. TYPE



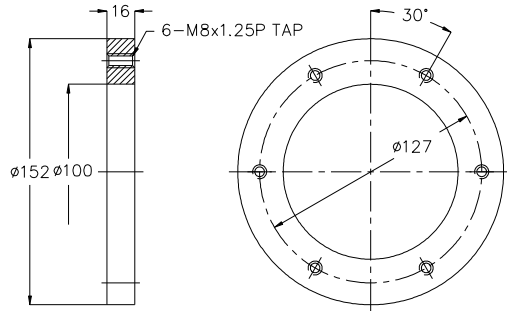
JIS10K FL. TYPE



-Specification

- Material : Cast Steel
- Finish : Electric Gal'v
- Weight : Approx. 3kg

2.20.9 Smoke Accumulator Seat For Cargo Holder

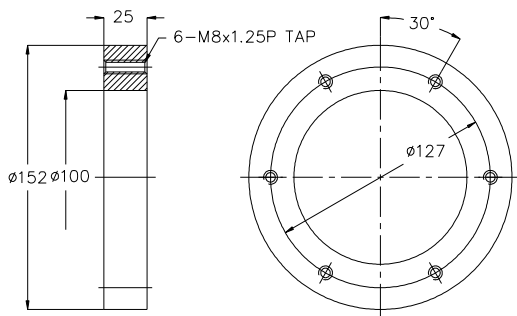


-Specification

- Material : Cast Steel
- Finish : Electric Gal'v
- Weight : Approx. 1kg

2.20.10 Smoke accumulator Seat For Duct

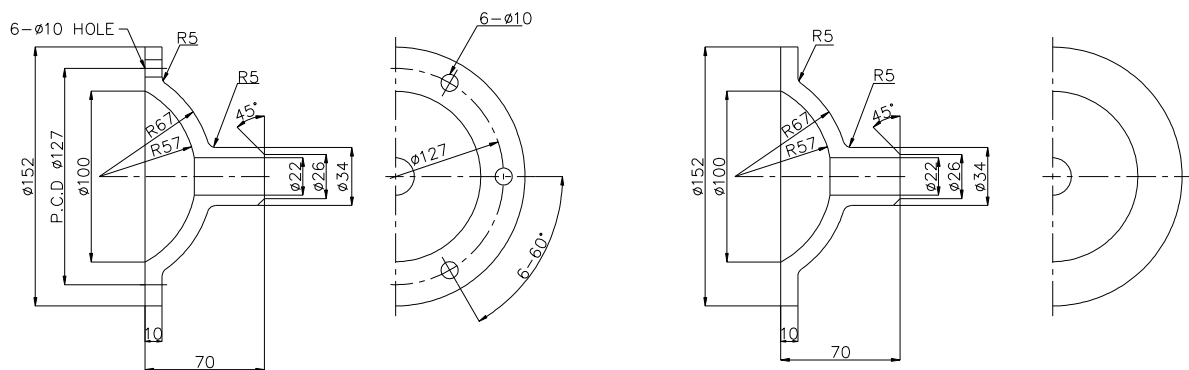
JIS10K & 16K FL.SEAT



-Specification

- Material : Cast Steel
- Finish : Electric Gal'v
- Weight : Approx. 1kg

2.20.11 Smoke accumulator (Welding Type)

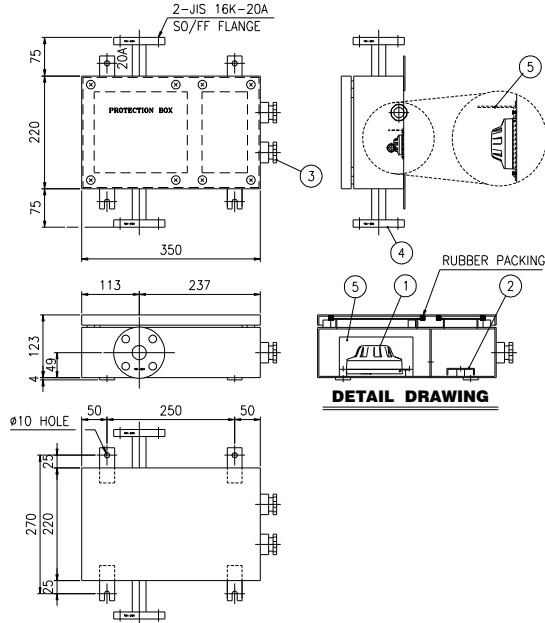


-Specification

- Material : FCD450
- Finish : Electric Gal'v
- Weight : Approx. 2kg

2.20.12 Protection Box For Duct

2.20.12.1 Protection Box



-Specification

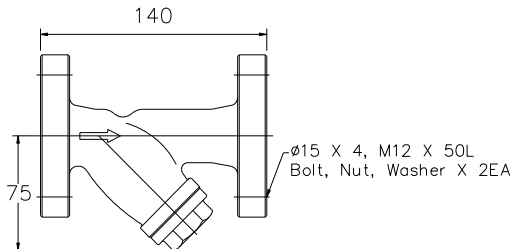
- Material : SS 2.6T
- Finish : 7.5 BG 7/2

1	Optical Smoke Detector
2	Terminal Block
3	Cable Gland
4	Pipe Piece With Flange, 20A
5	Protection Cover

-Description

It is used to detect smoke in the cargo ventilation duct.

2.20.12.2 Dust Filter

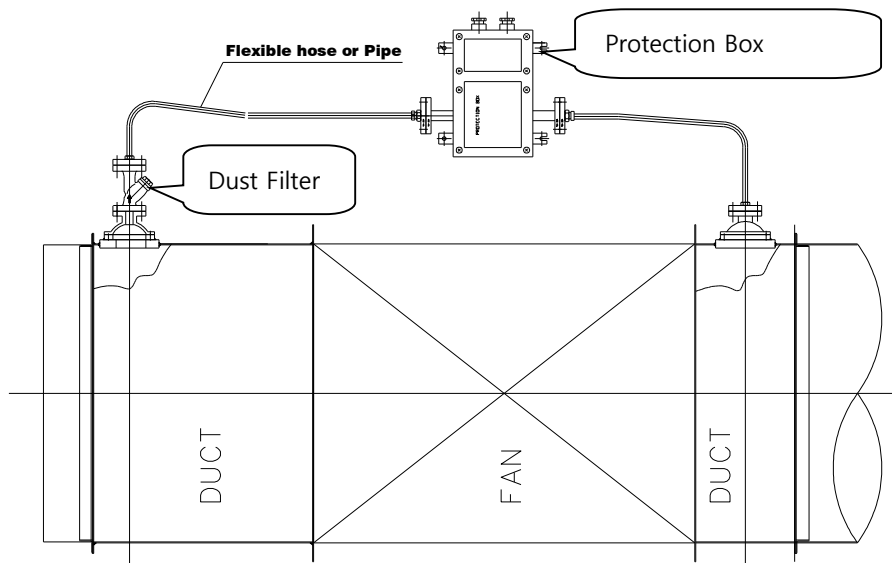


-Specification

- Material : GC200
- Mesh : 150 Mesh Filet + 15Mesh

-Description

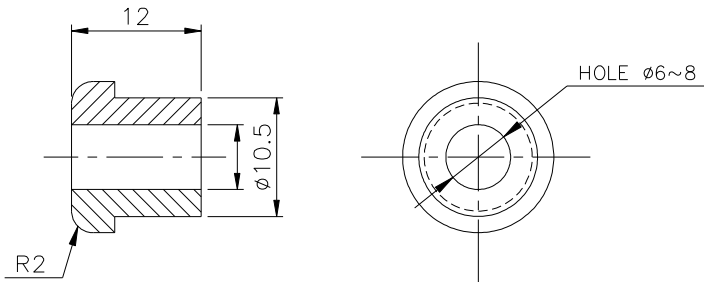
It is used to Prevent clogging in the sampling Line at protection box.



High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

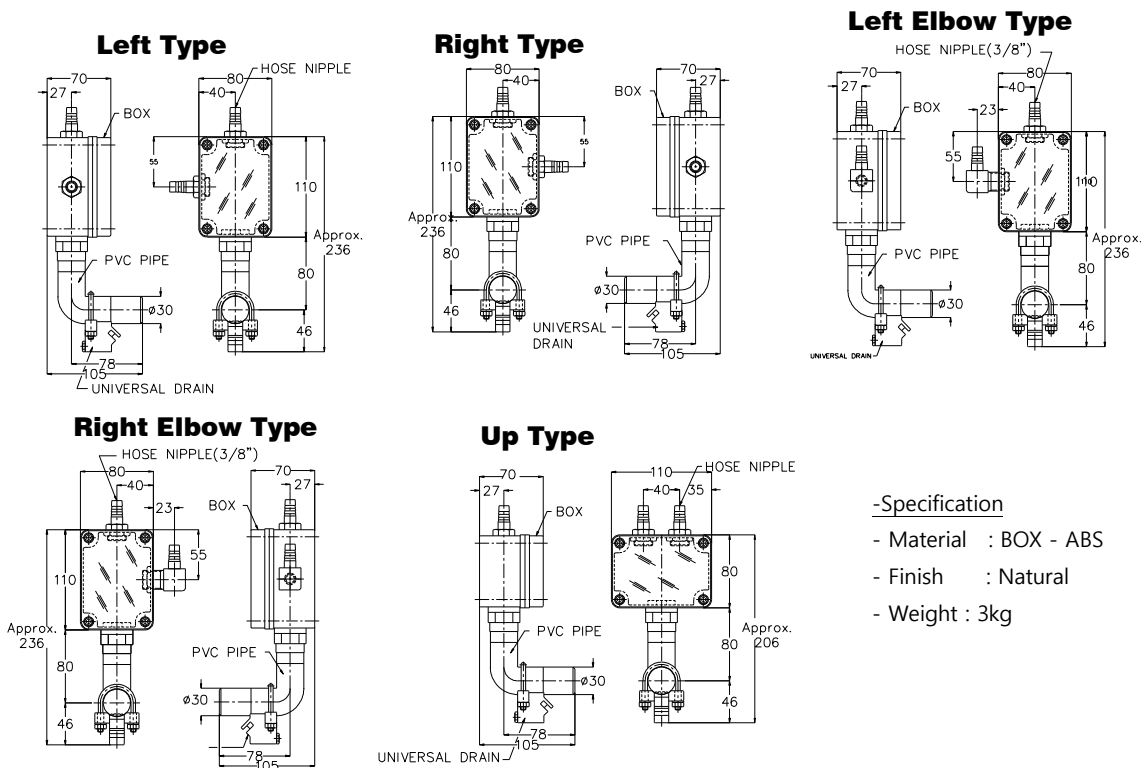
2.20.13 Orifice For Smoke Cabinet



SPECIFICATION

- MATERIAL : RUBER
- COLOR : BLACK
- Type. : $\phi 6$ / $\phi 7$ / $\phi 8$

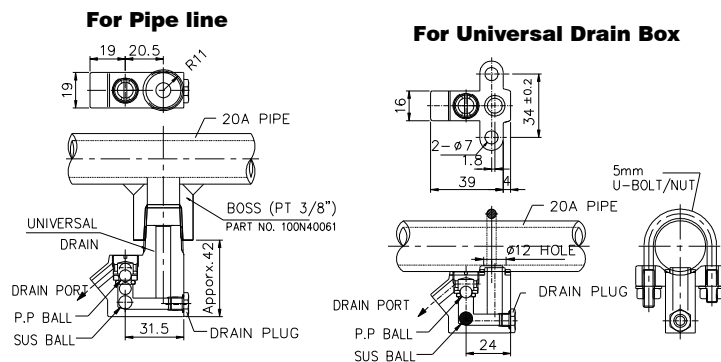
2.20.14 Universal Drain Box Assembly



-Specification

- Material : BOX - ABS
- Finish : Natural
- Weight : 3kg

2.20.15 Universal Drain



-Specification

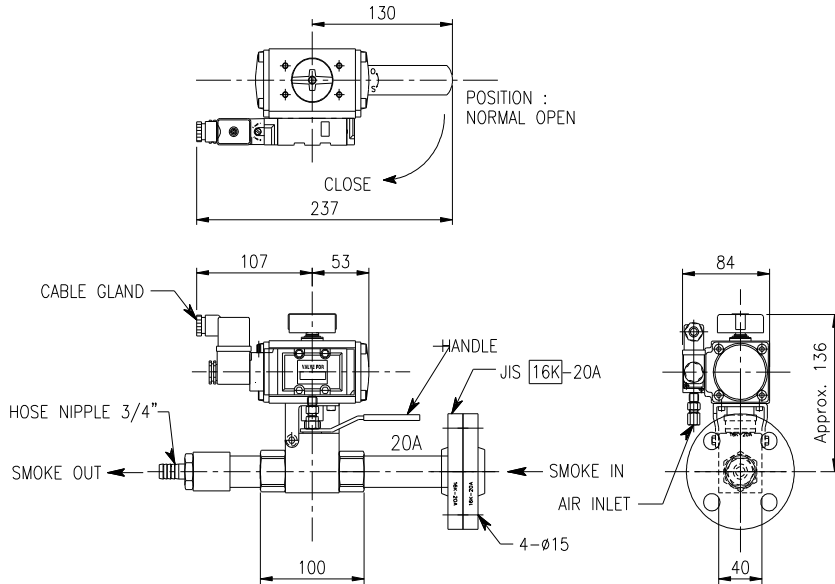
- Material : Body - Forged Brass & Brass
Ball - P.P & SUS
Packing - Teflon
- Finish : Natural
- Weight : 0.3kg

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

2.20.16 2-Way valve for Smoke sampling line

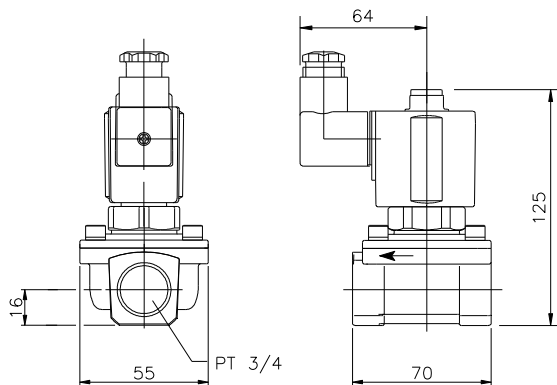
2.20.16.1 Pneumatic type



Specification

- Air Supply : 7~10kg/cm²
- Voltage : AC 220V, 60Hz
- Valve material : SUS304

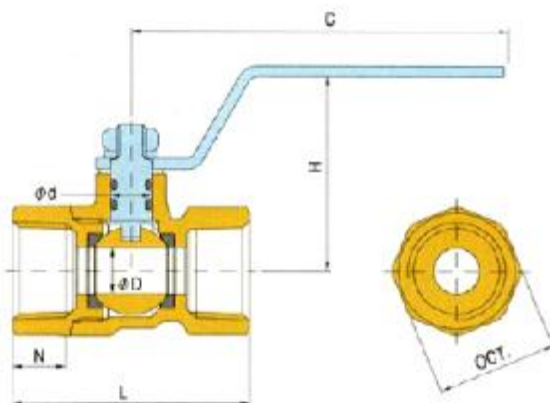
2.20.16.2 Electric type



Specification

- Type : Normally open
- Voltage : AC220V
- Operating pressure : Max. 1.5Mpa
- Material : C37

2.20.16.3 Manual type



Specification

- Material : Forged Brass
- Max. Pressure : 1.4Mpa

øD	ød	C	H	N	L
15	9	80	45	12.8	58

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 2. SYSTEM COMPONENT

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**CHAPTER 3 . INSTALLATION & INSPECTION
& MAINTENANCE**

High Pressure Carbon Dioxides Fire-Extinguishing System

CHAPTER 3. Installation & Inspection & Maintenance manual

3.1 General Information

This manual provide installation manual for High pressure carbon dioxides Fire extinguishing system.

3.2 Scope of Manual

This manual is guideline for the install the CO₂ agent system. All information contained in this manual does not mean to the work scope of the manufacturer. Work scope shall be confirmed in accordance with the contract.

**** Caution****

- Discharge of an Incomplete tuning & Incomplete pipe connection could be extremely dangerous and may result in Serious casualties.
- High pressure storage gas are applied on the installation of this system.
- Never complete all pneumatic connections between cylinder and the actuating system before Fully installing the other component.
- Never complete all electric line at the electric actuating system before fully installing the other Component.(if supplied electric component)

3.3 System Component Description

- Refer to chapter 2 for system component.

3.4 Safety

1) Safety Equipment

- Safety goggles / Gloves / Dust masks / Safety shoes / Ear plugs etc.
- All local shipyard or site safety regulations must be followed.

2) Ventilation

- Work in well ventilated area when using resins and all associated catalysts, acetone or toxic Gas etc.
- Never work in small confined spaces without the buddy system, and without the guidance of An authorized, qualified instructor or supervisor. Use air-purifying respirators if ventilation is Inadequate.

3) Flammable

- Fire - Use CO₂ , dry chemical, or foam to fight fire.
- Never torch-cut or weld empty cans/drums of resins, acetone,or other chemicals.
- SMOKING, WELDING, FLAME is not to be allow where adhesives, pastes, resins, acetone, or catalysts are being used.
- Never store resins, adhesives, pastes, promoters, catalysts, or acetone in areas having open flame, sparks or hot surfaces.

3.5 CO2 System Installation

3.5.1 Rack Unit Installation

a. System is supplied in the cylinder rack unit.

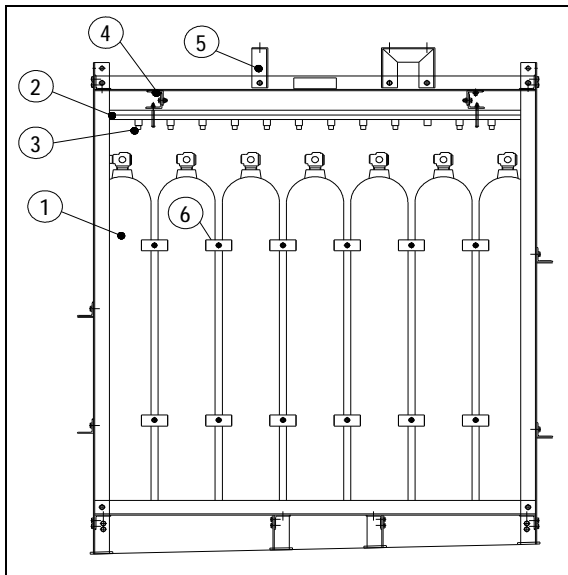
Just the welding of 4~8 point leg is required, It provided a simple mounting method than the individual cylinders mounted.

b. Check the rack location, Place the cylinder rack according to the final room arrangement.

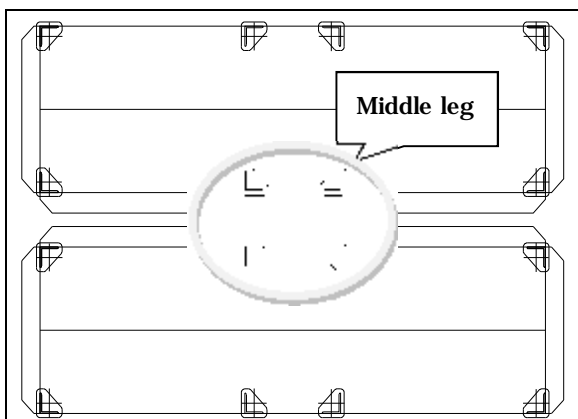
c. Manifold & Main manifold tentative assembly is required before cylinder rack leg full welding.

Leg to be full welding if there any assembly problem is not found.

d. Cylinder cap must be disassembly on cylinder after completed the installation of the rack & manifold & Main manifold



1. CYLINDER
2. MAIFOLD
3. MANIFOLD CHECK VALVE
4. SUPPORT FOR MAINFOLD
5. SUPPORT FOR MAINMANIFOLD



e. All the surfaces of the leg triangular pad to be welded.

f. Middle leg of the NKR 2 type rack for use in a narrow space can not be welded, therefore It may be welded after removing the few cylinder in order to adequate working space.

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3.5.2 Manifold Installation

- The manifold is used to convey the co2 agene in cylinders to the main manifold.
- Manifold is supplied be assembled on the rack.
- Make sure the check valve is assembled on a manifold and Check valve quantity shall be same with Cylinder quantity.
- Dust cap & Dust taping must be removed before flange connection.

**** DO NOT modify or site repair the provided manifold.**

The modify would make useless the tests carried out by NK and the class certification.

3.5.3 Main Manifold Installation.

- Manifold & Main manifold tentative assembly is required before cylinder rack leg welding.
- Dust cap & Dust taping must be removed before flange connection.
- Check the between quantity & dimension and product drawing.

**** DO NOT modify or site repair the provided Main manifold.**

The modify would make useless the tests carried out by NK and the class certification.

3.5.4 Main Valve Installation.

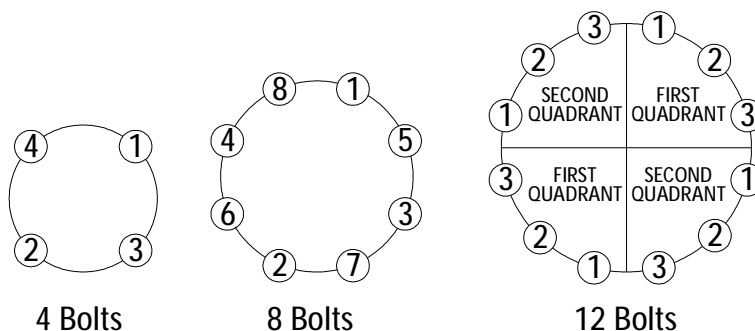
- Valve must be in the close position for installation
- Be careful not to change the flow direction of valve.
- Dust cap & Dust taping must be removed before flange connection.
- Use hex bolts & nuts to secure valve to flange.
- Ensure proper gaskets are used between the valve flange and pipe flange.
- Tighten bolts & nuts in alternating opposite sides until completely tightened.
3~6 inch main valve tighten method as per section 2-5

**** DO NOT modify or site repair.**

The modify would make useless the tests carried out by NK and the class certification.

3.5.5 Bolting Tightening Sequence & Torque.

4.5.5.1 Bolting Tightening Sequence



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3.5.5.2 Bolting Tightening Torque.

As per ISO 898/1

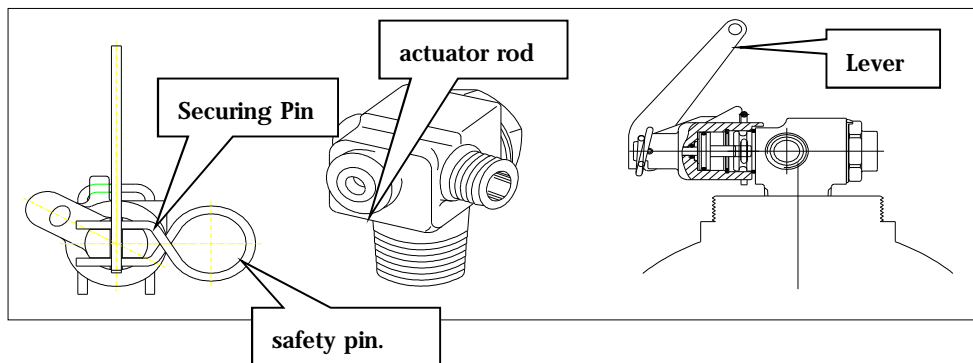
Material	Grade	Size	Max. Allowable Torque of Bolt (N.m)	BS10 Flange Tightening Torque(N.m)	Jis210k Flange Tightening Torque(N.m)
S45C (Heat Treatment) Torque k : 0.125	10.9	M8	34		25~
		M10	67		51~
		M12	117		90~
		M14	185		140~
		M16	385	210~	210~
		M18	390	300~	300~
		M20	550	420~	420~
		M22	745	550~	
M24	950	700~			

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3.5.6 Cylinder Valve Actuator Installation.

- a. Separate Securing Pin at actuator. Not to be confused with the safety pin.
- b. Connect the actuator to the actuator rod of cylinder valve and Fixed the security pin.
- d. The gas is released when the lever operating. Therefore Pin must be always fixed in order to prevent a malfunction.



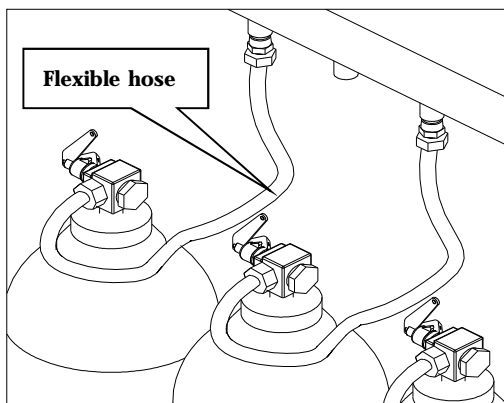
Caution!!

- a. Do not allow foot walk on the reducer, or cylinder valve, which is so dangerous.
- b. If Performing a pressure test at section valve upstream or downstream or pilot loop test, Cylinder valve actuate must be disconnect from cylinder valve.
- c. **Safety pin is always locked except the case of manual release.**
Safety pin should be removed only in case of emergency operation by manual.

3.5.7 Discharge Flexible Hose Installation.

- a. Be careful not to contact between Cylinder & Pipe etc. and hose tension point.
- b. Place correctly the Fixed swivel nut, and then screw the nut until the connection is locked properly.
- c. Excessive wrinkled is not allowable at bending or round point.

****Do not missing the copper packing between check valve and swivel nut connection point.**

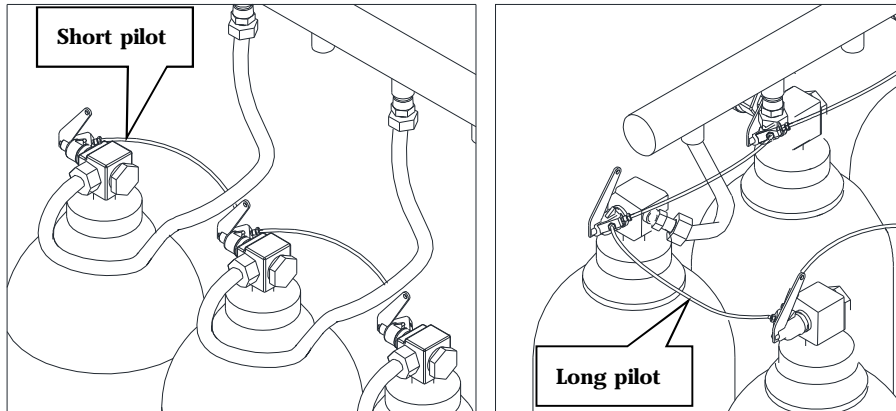


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3.5.8 Tube & Fitting Installation

3.5.8.1 Pilot Tube



- The short pilot gas loop is used to interconnect the inlet ports of the pressure actuators. This allows pilot gas pressure to be applied to the pressure actuators and operate the cylinder valves
- The long pilot gas loop is used to interconnect two rows of pressure actuators. Where the cylinders are installed in two rows. It is also used to convey pilot gas from a system actuator to the inlet port of the nearest pressure actuator.

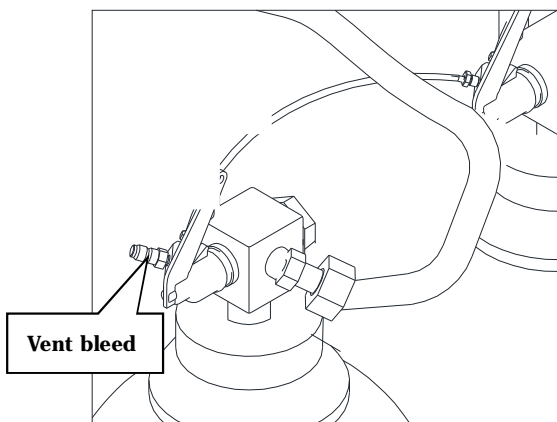
3.5.8.2 Recommended Tube Bending Radius (Copper & stainless steel)

it is not mandatory and can be change on the tube manufacturer or tool.

ISO TUBING		
OD (mm)	Approx. Radius(mm)	Thickness (mm)
3	15	~0.8
6	15	~1.5
8	24	~1.5
10	24	~2
12	38	~2

METRIC TUBING		
OD (mm)	Approx. Radius(mm)	Thickness (mm)
3	15	~0.8
6	15	~1.5
8	24	~1.5
10	24	~2
12	38	~2

3.5.8.3 Vent bleed



- Install the vent bleed at the end of the actuator pilot tube line.
- Not included fittings in this manual must be completed in accordance with the schematic & chapter 1 system component data.

** CAUTION!!

Tubing lines or other operation method shall not be connected to the control panel Untill finished of all relation system work scope with system installation.

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3.5.9 Pressure Gauge or Pressure Switch Installation on Main Manifold.

- a. Remove the protection cap or tape of the gauge port.
- b. Gauge port thread & gauge thread shall be clean.
- c. Place correctly the connection point, and then screw the thread until the connection is locked properly.
- d. check the pressure gauge indication glass direction and check the pressure switch cable way direction.

Caution !! If a long period of time to remove the cap There have a possibility of dust enters.

3.5.10 Pipe Line & Nozzle Installation

- a. Before installing nozzles check that the nozzle Number stamped on nozzle. and the nozzle installation numbering shall be according to the drawings.
- b. Thoroughly clean pipe before installation to remove foreign matter and oil from pipe.
- c. The tightness between Thread connection must be done with teflon or other proper material.
- d. The tightness between flange connection must be done with gasket or o-ring.
- e. Each discharge nozzle has a orifice hole by calculated.

Each nozzle must be placed as correct on the design documentation during the installation.

3.5.11 Safety Outlet or Relief Valve Installation

- a. safety valve outlet point shall be installation to weather part from manifold or main manifold.
- b. The safety valve connection point shall not be installed downstream of main valve.
- c. End of line direction shall be installed avoid direct attack to person.

3.5.12 Air Connection Assembly Installation

- a. Connection port thread on pipe & air connection assembly thread shall be clean.
- b. Place correctly the connection point, and then screw the thread until the connection is locked properly.
- c. Check the proper direction of the check valve.

3.5.13 Control Cabinet Installation

- a. Do not impact Release control cabinet, There is high pressure storage cylinder.
- b. Fixing by welding is not allowed, only bolting is allowable by bolt hole at the cabinet.

3.6 Smoke Sampling System Installation

3.6.1 Smoke Detection unit

The smoke detection panels and any extension panels are generally installed in the CO₂ room. However they can also be affixed on the bridge. When installing the smoke detection system outside the bridge, a control panel, available either for mounting on a wall or in a console, will be installed on the bridge to report fire alarms and fault warnings.

To be able to easily read and service the smoke detection panel, the bottom of the housing should be situated approx. 1.10 - 1.20 m above the floor. Any extension panels are installed normally next to the smoke detection panel at the same height. Equally the required minimal distance for laying out the hoses must be taken into account. When using hose brackets, the minimal distance between two panels is 40 cm. When the hoses are tied into a bundle without using brackets, the minimal distance between two panels shall be 25 cm.

The fan units are installed in the vicinity of the smoke detection panel in upright position standing on the shock mounts. For servicing purposes a clearance of 300 mm above and 50 mm beside the fan unit must be observed.

3.6.2 Smoke Accumulators, Pipes and Hose Connections

Provided that a CO₂ fire extinguishing system is installed, the air samples will be fed via steel pipes to the 3-way switching valve. The connection between 3-way valves and smoke detection panel is usually made with flexible hoses (see following table). The minimum inner diameter of the pipes and hoses must be not less than 12mm. The pipes which connect fan unit with smoke detection panel, extension panels and air out must be of conductive material. The pipes must have conductive connections and must be connected to conductive earth.

To prevent water buildup, the steel pipes must be installed with slight inclination. Automatic drain valves must be provided at all low points. For the steel pipes bends should be used instead of elbows.

The array of smoke accumulators must be chosen according FSS-Code Chapter10, Rule 2.3.1.2.

Construction measures must ensure that all smoke accumulators and all lines draw approximately the same amount of air. This can be achieved e.g. by a symmetrical layout of the detection pipes and their smoke accumulators. The number of smoke accumulators arranged in a line one after another should be kept as small as possible.

If smoke accumulators are arranged in a line their orifice sizes must be adapted in a way that they all will suck in an even amount of air volume.

For proper airflow it also is vital to determine the correct air pipe size. Total number of detection lines and length of air pipe must be considered.

The proper layout of the piping shall be tested according FSS Code Chapter 10, Rule 2.4.2.2: when smoke is fed into the most remote smoke accumulator the alarm shall go off not more than 300 s later (180 s at vehicle decks).

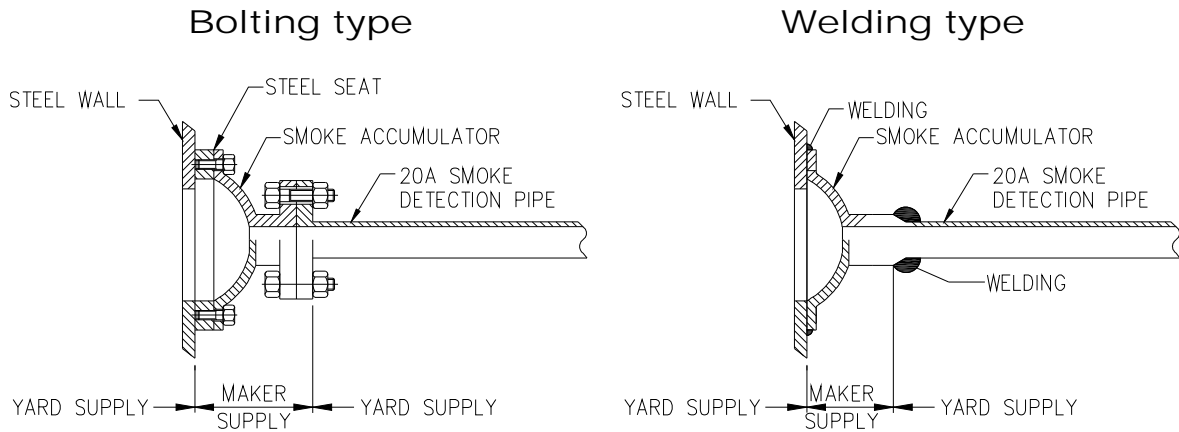
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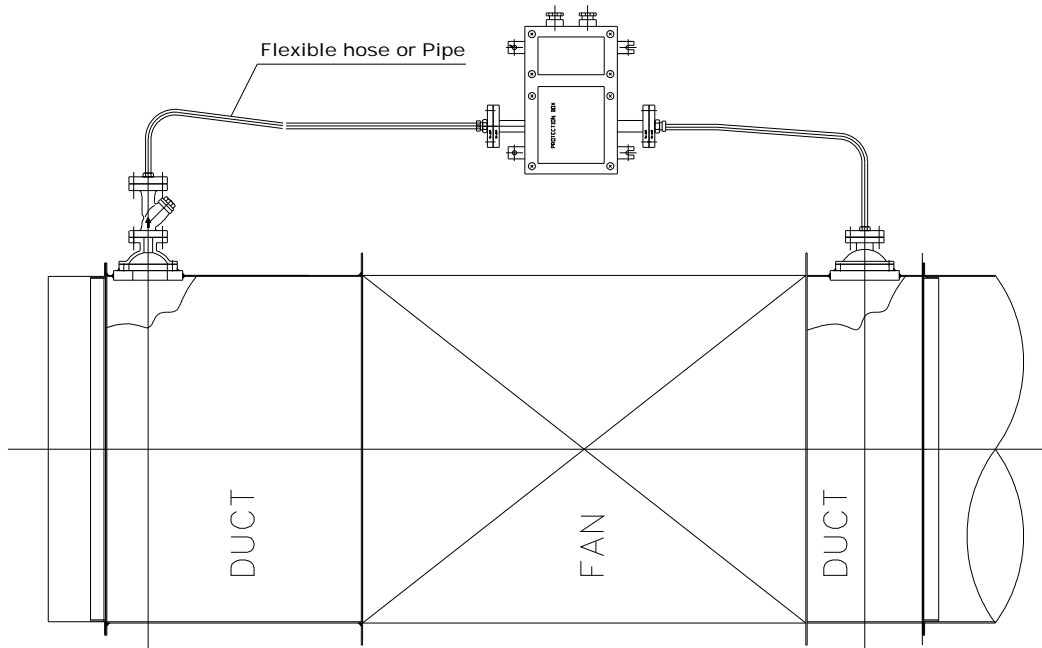
3.6.3 Prefilter Installation

Prefilters are fitted in the suction pipelines (mostly hoses) before the three-way valves. The pipe connections are removed from the Two or three-way valves and replaced by the prefilters. The pipes are then shortened appropriately and connected to the prefilters.

3.6.4 Smoke Accumulator for Cargo Holder



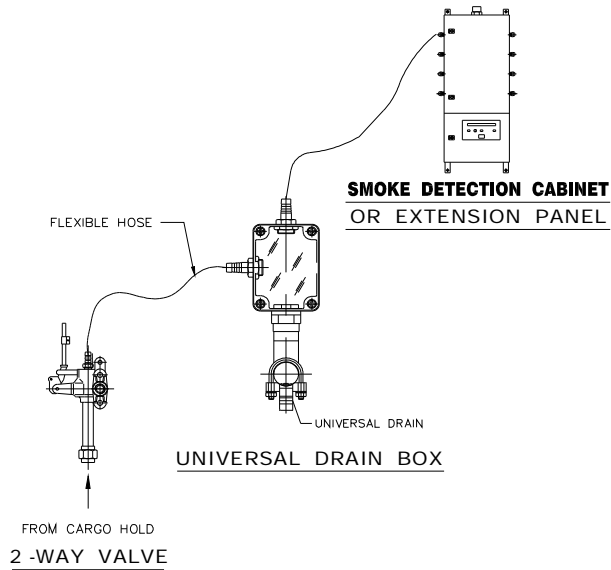
3.6.5 Smoke accumulator for Vent Duct



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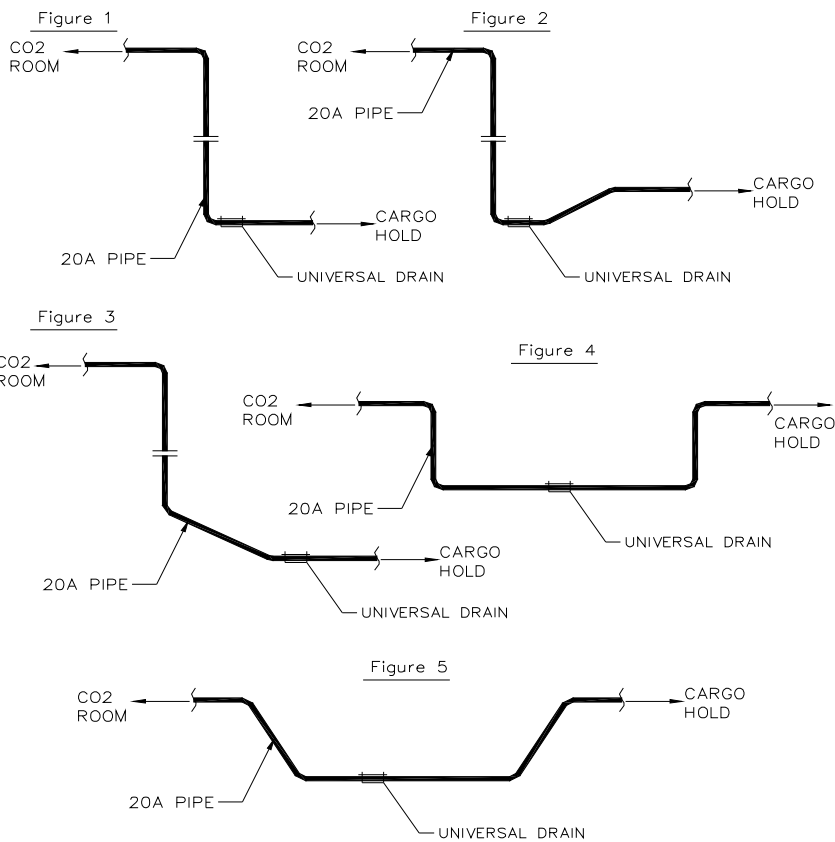
3.6.6 Universal Drain Box



3.6.7 Universal Drain

NOTE :

When the install an universal drain in cargo hold pipe by yard, please refer to one of below installation sketch.



3.7 CO2 Discharge System Inspection & Maintenance

3.7.1 General Information

- 1) This manual is a guideline containing the recommendations and procedures to maintain of NK Carbon dioxides Fire extinguishing system.
- 2) The purpose of the inspection & maintenance is to check the normal state of the system.
- 3) The user shall perform a inspection & maintenance program according to the instructions of this manual.
- 4) Inspector shall be read all supplied system manual with drawing and understand the system logic.
- 5) At least annually, all systems shall be thoroughly inspected and tested for proper operation by Competent personnel. Discharge tests are not required.

3.7.2 Inspection & Maintenance

3.7.2.1 Weekly

- 1) Verify all fixed fire-extinguishing system control panel indicators are functional by operating the lamp/indicator test switch
- 2) Verify all control/section valves are in the correct position.
- 3) Atmospheric Corrosion

Equipment designed for outdoor use and/or harsh, marine environment are normally completely weather tight and have several layers of protective coating to withstand surface corrosion attacks. Seals around doors and hatches should be inspected at regular intervals. Make sure that draining holes and channel are not clogged. Whenever the protective coating of the equipment is scratched deep enough to leave bare metal exposed, it must be fixed. Immediate repair is important to prevent the imminent corrosion attack from spreading beyond damaged parts of the surface coating.

3.7.2.2 Monthly

- 1) Make a general inspection survey of all cylinders and equipment for damaged or missing parts.
- 2) Ensure access to hazard areas, release control panel, discharge nozzles, and cylinders is unobstructed and that there are no obstructions to the operation of the equipment or distribution of CO2.
- 3) Inspect flexible discharge hose for loose fittings, damaged threads, cracks, distortion, cuts, dirt and frayed hose rubber. Tighten loose fittings, replace hoses with stripped threads or other damage. Replace damaged adaptors, inspect couplings and tees for tightness. Tighten coupling if necessary. Replace damaged parts.
- 4) Inspect CO2 cylinder valve actuator for physical damage, deterioration, corrosion, distortion, cracks, dirt. Replace valve actuator if damage is found.
- 5) Inspect CO2 cylinder valve for physical damage, deterioration, corrosion, distortion, cracks, dirt. Replace valve if damage is found.
When replacing the disc of cylinder valve from copper plate to nickel plate, plug also shall be replaced to match the exact burst pressure for cylinder valve.
- 6) Inspect cylinder stay bolt & strap etc. , cradles and attaching hardware for loose, damaged, or broken parts, corrosion, oil, grease, grime, etc. Tighten loose hardware, replace damaged parts.
- 7) Inspect discharge manifold for physical damage, corrosion and dirt. Inspect manifold support brackets and clamps for looseness and damage. Inspect connections to manifold for tightness.

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Inspect check valves where applicable for deformation, leakage, cracks, wear, corrosion, and dirt.

Secure loose parts; replace damaged parts.

- 8) Inspect discharge nozzles for dirt and physical damage. Replace damaged nozzles. If nozzles are dirty or clogged.
- 9) Inspect pressure S/W for deformation, cracks, dirt or other damage. Replace switch if damage is found.

**** If Performing a pressure test at section valve upstream or downstream or pilot loop test, Cylinder valve actuate must be disconnect from cylinder valve,**

*** As per MSC.1/Circ.1318/Rev.1 (25 May 2021) requirement**

4. Monthly inspections

4.1 At least every 30 days a general visual inspection should be made of the overall system condition for obvious signs of damage, and should include verification that:

- .1 all stop valves are in the closed position;
- .2 all releasing controls are in the proper position and readily accessible for immediate use;
- .3 all discharge piping and pneumatic tubing is intact and has not been damaged;
- .4 all high pressure cylinders are in place and properly secured; and
- .5 the alarm devices are in place and do not appear damaged.

3.7.2.3 Semi-annual

- 1) Check the connection between alarm station and visible & audible alarm.
And the activation of the alarm operating.
- 2) Check the manual activation devices are immediately usable and without obstacle.
- 3) Check the presence and proper function of the ventilation stop system.
- 4) Check the proper function of doors, damper and related closing device.
- 5) Check the charge state of the batteries. If applicable.
- 6) Check that the nozzles are free of obstructions or obstructed by materials which can reduce the proper distribution of gas

3.7.2.4 Annual

All system component & connection & states shall be thoroughly inspected.

- 1) Checked the cylinder quantity matching with the system design.
In case that cylinder installation state changes are ascertained, it is restore the original conditions.
- 2) Checked the correct cylinders installation location & direction.
- 3) Checked the safety pins & locking pins& flexible hose etc... It shall be securely fitted.
- 4) Checked the noticeable damage to the cylinders and pipe network.
- 5) Checked the cylinder rack storage area temperature. Recommended Temperature rang is 0°~+55°.
- 6) Checked the correct installation of the cylinders and of the manifold (fixation, stability, corrosion and damage)
- 8) Checked the bolt & nut of flanges fitted securely.

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- 9) Checked the good state of all circuits subject to supervision to ensure proper reporting of failure on The electric composition.
- 10) All system hose shall be examined annually for damage. If visual examination show any deficiency, The hose shall be immediately replaced or tested as per 3.7.2.6.4
- 11) Checked the hydrostatic test date of all storage containers.

* As per MSC.1/Circ.1318/Rev.1 (25 May 2021) requirement

5. Annual inspections

The following minimum level of maintenance and inspections should be carried out in accordance with the system manufacturer's instructions and safety precautions:

- .1 the boundaries of the protected space should be visually inspected to confirm that no modifications have been made to the enclosure that have created uncloseable openings that would render the system ineffective;
- .2 all storage containers should be visually inspected for any signs of damage, rust or loose mounting hardware. Cylinders that are leaking, corroded, dented or bulging should be hydrostatically retested or replaced;
- .3 system piping should be visually inspected to check for damage, loose supports and corrosion. Nozzles should be inspected to ensure they have not been obstructed by the storage of spare parts or a new installation of structure or machinery;
- .4 the manifold should be inspected to verify that all flexible discharge hoses and fittings are properly tightened; and
- .5 all entrance doors to the protected space should close properly and should have warning signs, which indicate that the space is protected by a fixed carbon dioxide system and that personnel should evacuate immediately if the alarms sound. All remote releasing controls should be checked for clear operating instructions and indication as to the space served.

3.7.2.5 Two Year Inspection

DISTRIBUTION PIPING

- 1) Blow out all distribution piping with air to make sure that it is not obstructed.
- 2) Remove valve actuator on the cylinder valve.
- 3) Remove valve discharge hose on the cylinder valve.
- 4) Remove end plug on manifold and main manifold in co2 room
- 5) Open main valve.
- 6) Discharge test cylinder or compressor air into distribution piping by test Connection at main valve downstream test connection or other point.
- 7) After blowing completed, reconnect all disconnected point.

Actuator for cylinder valve

**Where possible, all activating heads should be removed from the cylinder valves and tested for correct functioning by applying full working pressure through the pilot lines.

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3.7.2.6 Two Year Weighing of Carbon Dioxide Cylinders

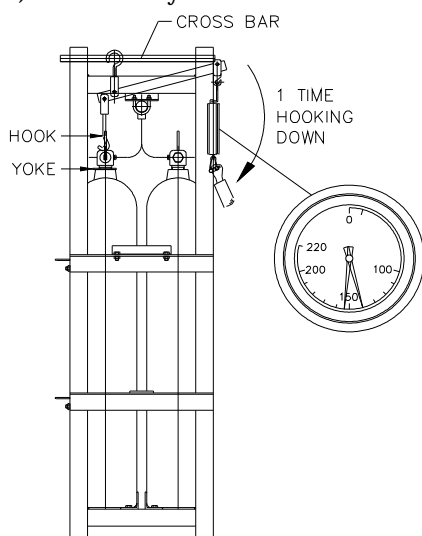
(Intermediate or periodical or renewal survey in cargo ships)

- 1) Remove valve actuator & discharge hose on the cylinder valve
- 2) Loosen cylinder framing so that cylinders can move freely..
- 3) Hook scale on weighing angle and slip yoke under discharge head.
- 4) Pull down until cylinder is just clear of floor and lever is horizontal.

Read weight directly off scale. : 45 kg cylinder Normally the scale shall be between 118 ~ 127 kg .

55 kg cylinder Normally the scale shall be between 140 ~ 154 kg .

- 5) Acceptance range for annual survey: it shall be kept more than 95 % of required amount of co2 always. 45kg cylinder Acceptable range (more than 95 %) : heavier than 116 ~ 124.5 kg
55kg cylinder Acceptable range (more than 95 %) : heavier than 137.5 ~ 151.5 kg
- 6) If charge weight loss exceeds 10%, proceed as follows
 - A. Remove valve actuator & discharge hose on the cylinder valve and Install the valve protection cap
 - B. Forward charged cylinder WITH DISCHARGE HOSE AND ACTUATOR REMOVED AND PROTECTION CAP INSTALLED to a recognized NK Fire Systems distributor.
- 7) After all carbon dioxide cylinders have been weighed, tighten clamps.
- 8) Reinstall Cylinder actuator & discharge hose.



* As per MSC.1/Circ.1318/Rev.1 (25 May 2021) requirement

6. Minimum recommended maintenance

6.1 At least biennially (intervals of 2 years \pm 3 months) in passenger ships or at each intermediate, periodical or renewal survey* in cargo ships, the following maintenance should be carried out :

- .1 all high pressure cylinders and pilot cylinders should be weighed or have their contents verified by other reliable means to confirm that the available charge in each is above 90% of the nominal charge. Cylinders containing less than 90% of the nominal charge should be refilled.

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.2 the hydrostatic test date of all storage containers should be checked. High pressure cylinders should be subjected to periodical tests at intervals not exceeding 10 years. At the 10-year inspection, at least 10% of the total number provided should be subjected to an internal inspection and hydrostatic test**.

If one or more cylinders fail, a total of 50% of the onboard cylinders should be tested. If further cylinders fail, all cylinders should be tested. Flexible hoses should be replaced at the intervals recommended by the manufacturer and not exceeding every 10 years; and

.3 the discharge piping and nozzles should be tested to verify that they are not blocked.

The test should be performed by isolating the discharge piping from the system and flowing dry air or nitrogen from test cylinders or suitable means through the piping.

6.2 At least biennially (intervals of 2 years \pm 3 months) in passenger ships or at each renewal survey* in cargo ships, the following maintenance should be carried out by service technicians/specialists trained to standards accepted by the Administration:

.1 where possible, all activating heads should be removed from the cylinder valves and tested for correct functioning by applying full working pressure through the pilot lines.

In cases where this is not possible, pilot lines should be disconnected from the cylinder valves and blanked off or connected together and tested with full working pressure from the release station and checked for leakage.

In both cases this should be carried out from one or more release stations when installed.

.2 all cable components should be cleaned and adjusted as necessary, and the cable connectors should be properly tightened. If the remote release controls are operated by pneumatic pressure, the tubing should be checked for leakage, and the proper charge of the remote releasing station pilot gas cylinders should be verified. All controls and warning devices should function normally, and the time delay, if fitted should prevent the discharge of gas for the required time period; and

.3 after completion of the work, the system should be returned to service. All releasing controls should be verified in the proper position and connected to the correct control valves. All pressure switch interlocks should be reset and returned to service. All stop valves should be in the closed position.

3.7.2.7 Five Years Inspection & Maintenance

1) DOT & CTC Shall not be recharged without retesting if more than 5 years have elapsed since the date Of the last test and inspection. Transporting charged containers that have not been tested within 5 years could be illegal. Other regulation cylinder is Federal and local regulations should be consulted.

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2) Cylinders continuously in service without discharging shall be given a complete external visual inspection every 5 year or more frequently if required. Inspection shall be made only by competent personnel and the results recorded on both of the following.

- a. A record tag permanently attached to each cylinder.
- b. A suitable inspection report

A completed copy of the inspection report shall be furnished to the owner of the system or an Authorized representative.

These records shall be retained by the owner for the life of the system.

3) Where external visual inspection indicates that the container has been damaged, additional strength Tests shall be required.

4) All hose shall be tested at 1.5 times the maximum discharge pressure.

And test temperature range is 0~55°C

- a. Hose assembly passing the test must be completely dried internally. If heat is used for drying the temperature must not exceed 55°C.
- b. Hose assembly failing a hydrostatic test must be marked and destroyed and be replaced with new assemblies.
- c. Each hose assembly passing the hydrostatic test is marked to show the date of test.

5) Check that the enclosure dimensions or volume have not been modified.

6) Performed internal inspection of all **Main/POD valves &** control valves.

* As per MSC.1/Circ.1318/Rev.1 (25 May 2021) requirement

7. Five-year service

At least once every five years, internal inspection of all control valves should be performed.

3.7.2.8 Ten Years Inspection & Maintenance

1) Perform a hydrostatic test and internal examination of 10 per cent of the system's extinguishing agent and pilot cylinders. If one or more cylinders fail, a total of 50 per cent of the onboard cylinders should be tested. If further cylinders fail, all cylinders should be tested.

****The remaining 90 per cent of CO2 cylinder hydrostatic test shall be performed before 20 years.**

For cylinder to test, cylinder & cylinder valve should be replaced by manufacture recommendation.

2) Flexible hoses, **pilot loop short & long** should be replaced at the intervals recommended by the manufacturer and not exceeding every 10 years

NOTE.

****When replacing the 10-year flexible hose, it is recommended to replace the actuator for CO2 cylinder as well.**

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****All inspection in the manual shall be inspected by NK's certified inspectors.**

3.8 CO2 Smoke Detection System Inspection & Maintenance

3.8.1 Rules applied

Observe MSC.1/Circ. 1318 and the rules of the responsible flag states / authorities regarding sample extraction smoke detection systems and the piping of gas extinguishing systems using CO2.

3.8.2 Function Test

3.8.2.1 Daily Routine Tests

- Operation: Check whether the green lamp at the control panel or at the smoke detection panel is on.
- Fault Indications: Check the smoke detection panel or the control panel for any fault warnings.
- Lamp Test: Check the buzzer, the lamps and the LCD by pressing the ACCEPT button at the control Panel

3.8.2.2 Tests at least Every 30 Days

- Section Valves: Check whether all three-way section valves (stop valves) are in the correct position.
- Hoses: Check whether the PVC-hoses between the Smoke Detection System and the three-way section valves (stop valves) are properly fastened and undamaged.
- Pipework: Thoroughly clean all pipes with compressed air. The pipes must be free of rust, dirt and other particles.

WARNING: Before doing this, ensure that the flexible hoses are disconnected from the smoke detection panel and extension, because otherwise the pressure switches which monitor the air flow could be damaged.

3.8.2.3 Tests Every 3 Months

• Fan Unit:

Check whether the active fan is drawing air. Then check the second fan by activating the special function "Switch Fans". To test the automatic switch over function open upper doors of all SDS-panels to reduce air pressure which simulates a fan failure.

WARNING: Do not remove fuses F2 – F5 while fans are running.

• Airflow Detection: Air Flow Monitoring

Close each sampling valve one at a time. After a few seconds a corresponding fault WARNING "FAULT: Airflow Line -x-" must appear for each line.

- Smoke Detectors: Carry out a smoke test for each smoke accumulator. For this, bring a smoke generator in the vicinity of each point in the cargo spaces where air is drawn. A suitable smoke generator is available on request. Check the fire alarm at the smoke detection panel and at the repeater panel(s). The fire alarm has to go off 180 s (vehicle decks) resp. 300 s (container- and general cargo holds) after the insertion of the smoke even for the most remote smoke accumulator.

- **Final Test** : Reset the fire alarm and ensure that no fault warnings are indicated. When no fault and no fire alarms are showed any more, the smoke detection system is ready for operation.

WARNING: In case of any spray paint or welding works in cargo holds the SDS-system shall be switched off to avoid soiling of optical components. Removing the transformer fuse F1 from the power supply module can take the system out of operation.

3.8.3 Cleaning a Smoke Detector

1. Undo both Cross-Slot - screws on the lower part of the smoke detector and lift off the white cover of the smoke detector. You are now looking at the black optical chamber with the insect guard.
2. Hold the smoke detector firmly in one hand, turn the optical chamber anticlockwise with the other hand and lift it from the lower part of the detector. Under no circumstances is the optical chamber to be switched with that of another smoke detector !
3. Clean the optical chamber in- and outside with a vacuum cleaner or with compressed air. The labyrinth can be cleaned with a brush. Be sure that the insect guard does not get damaged in the process.
4. Insert the optical chamber back onto the lower part of the detector and turn it clockwise until it engages.
5. Screw the white cover tight again and set the smoke detector in its socket.
6. Perform a function test. The diagnostic value of the smoke detector should lie between 15 and 35.
7. If the diagnostic value lies outside of this range after cleaning, it must be replaced with a new smoke detector. The old one can be sent to the manufacturer for cleaning and later reuse.

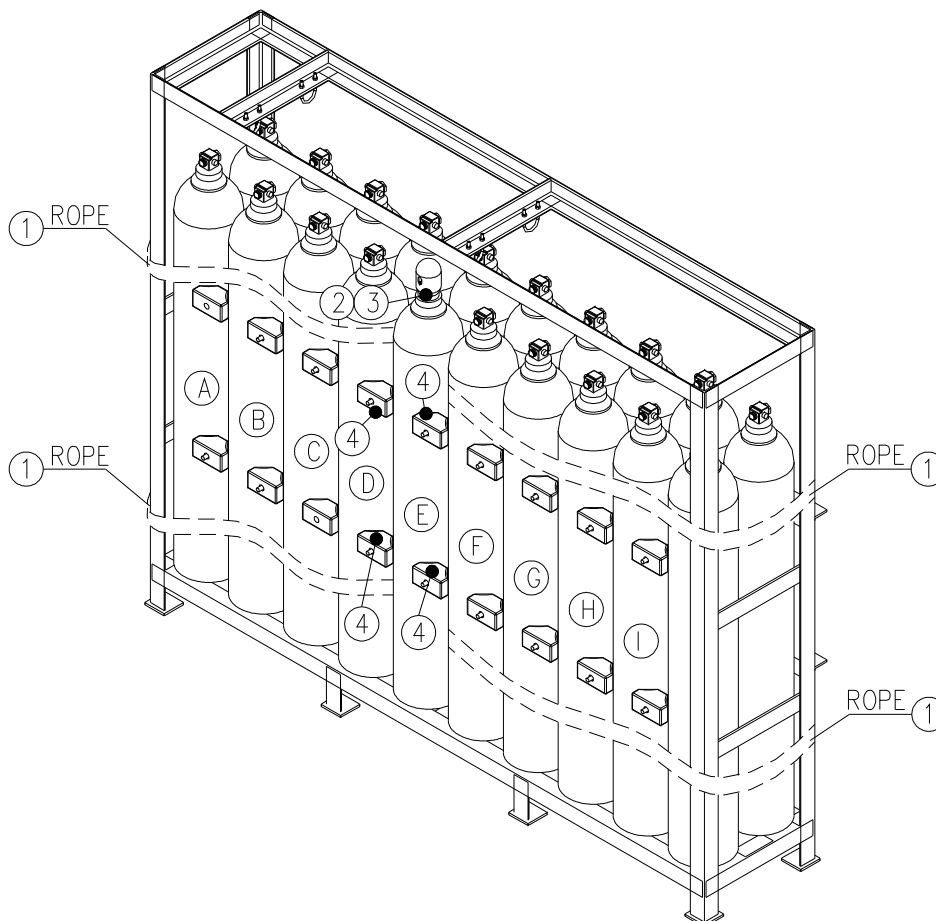
3.8.4 Cleaning the Suction Pipelines

1. Open the lower door of the smoke detection panel and turn the smoke detection system off by removing transformer fuse F1 on the power supply module.
2. Loosen the hose fitting and pull off the hose from the smoke detection panel to the detection line to be cleaned. (Note: Removing the hoses shall prevent residual air pressure, which can build up inside the 3-way valve due to the cleaning, from damaging the sensitive pressure switches for monitoring air pressure when the valves are reset. As long as the connection to the smoke detection panel is closed off with a shut-off valve and it can be ensured that the shut-off valve will remain closed until after the 3-way valves have been reset, the hoses need not be pulled off).
3. Bring the 3-way valve to the position "CO₂-extinguishing system".
4. Connect a compressed air source to the connections provided for it.
5. Clean the pipeline with compressed air.
6. When the pipeline has been cleaned, put the smoke detection panel back into its operational state in the reverse order. Only reconnect the detection line hose at the smoke detection panel after the 3-way valve has been brought to the position "smoke detection system".

--ANNEX 1.1 (Cylinder replacement)

1. CYLINDER LIFTING PROCEDURE FOR REPLACEMENT.

- 1) Case of Cylinder repair or replace Shall be fixed for safety.
Ex.) Case of No.E Cylinder replace.
 A~D Cylinder shall be fixed by rope or other method.
 F~I Cylinder shall be fixed by rope or other method.
- 2) Disassembly flexible hose & actuator.
 -Hose disassembly tool is M10~50 Adjustable monkey spanner.
 -Actuator disassembly shall be detail "A"
 **** Separate Securing Pin at actuator . Not to be confused with the lever safety pin.**
- 3) Assembly cylinder cap.
 Cap Assembly or disassembly shall be careful for prevent damage of pressure gauge.
- 4) Disassembly cylinder clamp.
 -Clamp disassembly tool is M10~50 Adjustable monkey spanner.

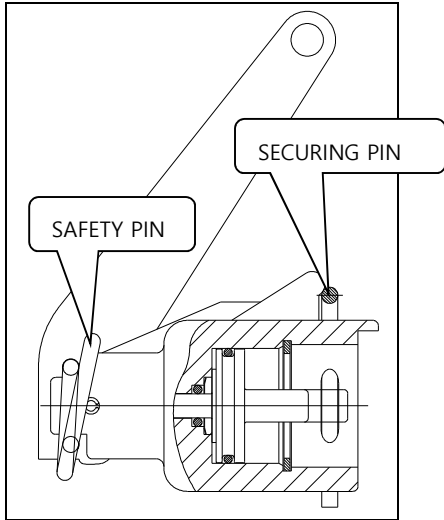


High Pressure Carbon Dioxides Fire-Extinguishing System

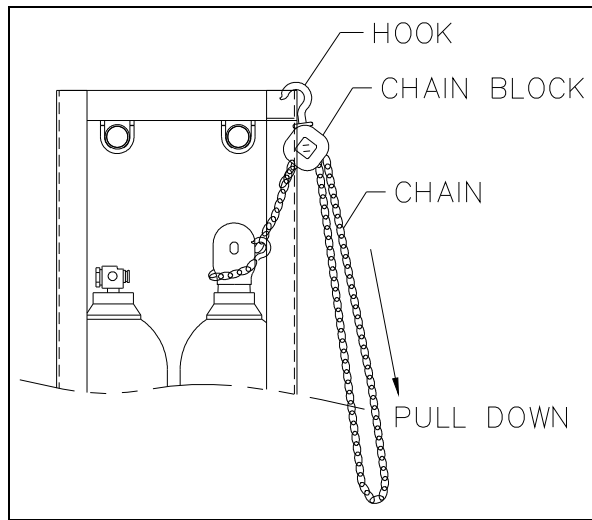
CHAPTER 5. ANNEX1

- 5) hang a chain block on top angle of rack unit and Tie the chain on the cylinder neck and
PULL DOWN THE CHAIN. SEE DETAIL "B"
- 6) Move to the trolley. SEE DETAIL "C"

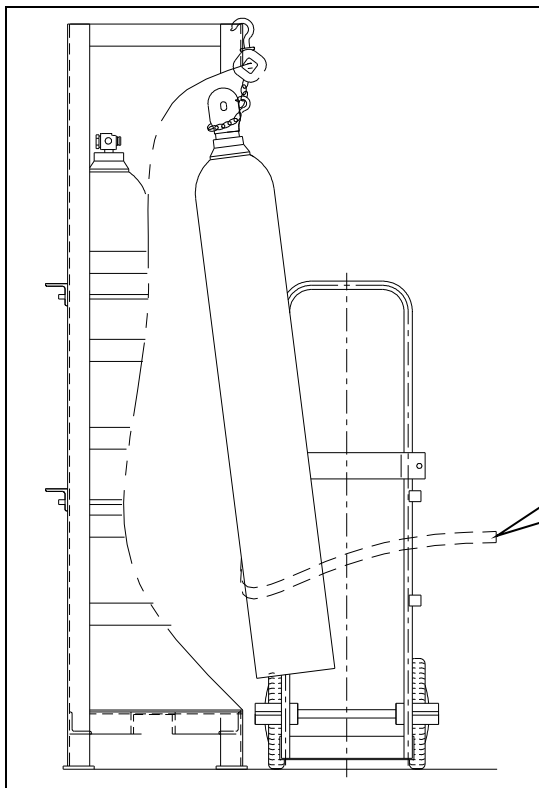
DETAIL "A"



DETAIL "B"



DETAIL "C"



Required handling by a rope or other method in order to the cylinder move to the trolley.

--ANNEX 1.2 (Preservation procedure)

1. Introduction

The purpose of this document is to describe the preservation, packing practices to be employed when the equipment is being placed in storage pending installation. The instructions outline specific precautions and necessary tasks to maintain the integrity of the equipment.

2. Safety Notice

The responsible personnel must always ensure that work and handling of the equipment described herein satisfy all requirements for safety.

As a minimum when performing work on any large machinery, the personal protective equipment should be; Protective clothing /Safety shoes with protective tip /Safety goggles /Helmet Etc.

3. Packing

All equipment dispatched from NK AS will be suitable packed for transport and initial storage;

- All flanges are to be blinded.
- Electrical conduits and other interfaces are to be sealed properly.
- When packing on pallets, if there are parts outside the pallet it shall have installed extra protection.

NOTE: Transport and protective items should remain on the equipment until all lifting is done and equipment is safely bolted or welded to its foundation.

4. Preservation

Preventative measures are essential when equipment is kept in storage for longer periods. The ideal conditions for storage are controlled indoor environments; however this could not always be expected, either due to limited space in the ware house or package size and quantity. This section will identify some of the factors that could potentially cause a reduction in longevity of the equipment.

4.1 Humidity

Humidity is especially harmful towards electrical equipment. Ensure that devices and terminal box have been fitted with vapor inhibitors and that they are replaced on regular basis, based on type and brand.

4.2 Temperature

The system should generally not be stored in sub-zero temperatures. If this cannot be avoided, extra caution should be taken to ensure that all piping/tubing and other parts containing fluids are properly drained.

4.3 Atmospheric Corrosion

Equipment designed for outdoor use and/or harsh, marine environment are normally completely weather tight and have several layers of protective coating to withstand surface corrosion attacks. When storing the equipment, ensure that water is not able to accumulate in such way could potentially enter enclosures through seals or wall penetrations. Seals around doors and hatches should be inspected at regular intervals. Make sure that draining holes and channel are not clogged. Whenever the protective coating of the equipment is scratched deep enough to leave bare metal exposed, it must be fixed. Immediate repair is important to prevent the imminent corrosion attack from spreading beyond damaged parts of the surface coating.

4.4 Dust

Sensitive components of the equipment are normally sealed off to prevent intrusion of dust and small particles. Tears and rip in the sealing should be repaired or should be replaced altogether immediately as they are detected.

Unpainted, surface treated stainless steels normally have good corrosion resistance, but could become stained if subject to carbon steel dust from welding and steel cutting processes. Proper cover is required whenever such work is to take place in the close vicinity of the stored equipment.

5. Preservation Plan

5.1 Initial preservation

This should be carried out whenever the equipment is awaiting installation.

- Cleaning shall be done before preservation can start, all installed pipe work and equipment must be cleaned.
- Open pipes / flanges shall all be blinded with plywood plates. Blinding shall be done right after testing in order to prevent dust and dirt. All open pipe flanges to be blinded with plywood plate to prevent dust and dirt.
- All electrical and electronic equipment exposed to any humidity shall be protected with corrosion inhibitor.

5.2 Short term storage preservation

This should be carried out when equipment is expected to be in storage for less than 12 months.

- All equipment must be kept in its original packing during storage period.
- If any protection frame etc. must this under no circumstances be removed before final installation.
- If equipment has a protective layer of paint. It is important that the painting is not damaged. The equipment must therefore be handled with care. Any surface damage (paint) discovered during inspection should be repaired before the equipment is installed. The package should not be exposed to carbon steel dust.

- The cylinders filled with Co2 gas shall be well stored in operating temperature range of 0°C~ 54°C.
- The cylinders shall be vertically stand.
- The cylinders shall be tightly strapped in place for safe storage.
- The safety cap must be installed on the valve outlet at all times except when the Cylinders are connected to the system piping, or are being filled.
- Cylinder actuator shall be fitted after all system completed and just before enter into service.
- Do not allow foot walk on the cylinder, or cylinder valve, which is so dangerous.
- Grease, or lubrication are not required for the Co2 system.

5.3 Long term storage preservation

In addition, this should be carried out when equipment is expected to be in storage for more than 12 months.

- The original packing must be inspected, if damaged it must be changed/repaired.
- The maintenance procedure must be checked if any special requirements, etc. lubricating, operating of manual valves.

--ANNEX 1.3 (Handling & shipping procedure)

1. Introduction

The purpose of this document is to describe the logistics, handling and shipping practices to be employed when the equipment is being moved, lifted or placed in storage pending installation. instructions outline specific precautions and necessary tasks to maintain the integrity of the equipment.

2. Safety

The responsible personnel must always ensure that work and handling of the equipment described herein satisfy all requirements for safety, including relevant laws, regulations, guidelines and standards, which may or may not be covered by this document.

As a minimum when performing work on any large machinery, the personal protective equipment should be; Protective clothing /Safety shoes with protective tip /Safety goggles /Helmet Etc.

3. Packing

All equipment dispatched from NK AS will be suitable packed for transport and initial storage;

- 3.1 All flanges are to be blinded.
- 3.2 Electrical conduits and other interfaces are to be sealed properly.
- 3.3 When packing on pallets, if there are parts outside the pallet it shall have installed extra protection.
- 3.4 Item packed on pallets will have.

NOTE: Transport and protective items should remain on the equipment until all lifting is done and equipment is safely bolted to its foundation.

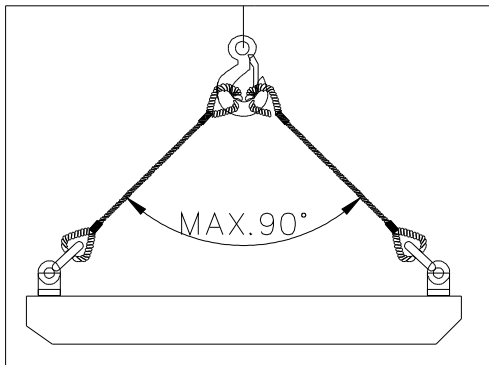
4. Transportation

- 4.1 Package unit(cylinder rack & Valve etc.) is heavy item, So must always be moved with caution.
- 4.2 All Package unit must be secured by straps to the vehicle and this should be done in both The horizontal and vertical plane.
- 4.3 When pass through a narrow space, the safety officer shall be placed.

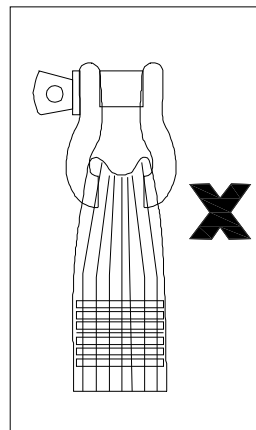
5. Loading & unloading

- 5.1 Do not put lifts equipment, straps or bars through the piping holes and cable tray & pipe support etc. in package. This will damage the package unit and void the warranty.
- 5.2 All package unit must never be placed on their " weak floor"
- 5.3 All package unit deliveries usually require two or three safety officer people on site to assist with off loading.
- 5.4 Do not drag a unit or pipe or instrument to deck or wall etc..it will cause damage the system
- 5.5 lifting of cylinder rack by crane

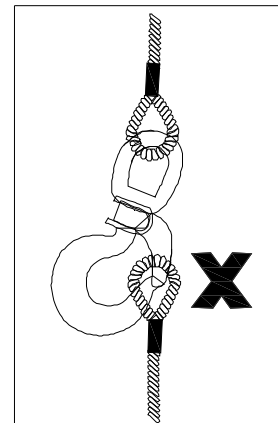
Skids equipped with lifting lugs for crane lifts. During lifting make sure that no personnel are standing directly under the skid / equipment being lifted. Be sure that the strap doesn't destroy any equipment on the skid; check closely before and during the lift that no damage can be done to the skid. The angel between vertical axis on the lifting lug or slings shall not be more than 45 degrees in any directions.



For rigging configurations with two-legged slings, the included angle should not exceed 90° due to loss of lifting capacity of slings.



. Use a shackle that is large enough to prevent pinching of the synthetic slings.

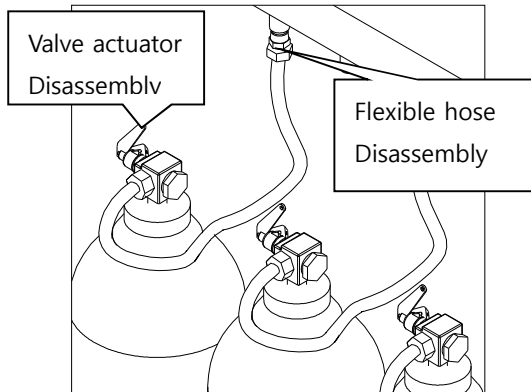


Sling fouled on latch.

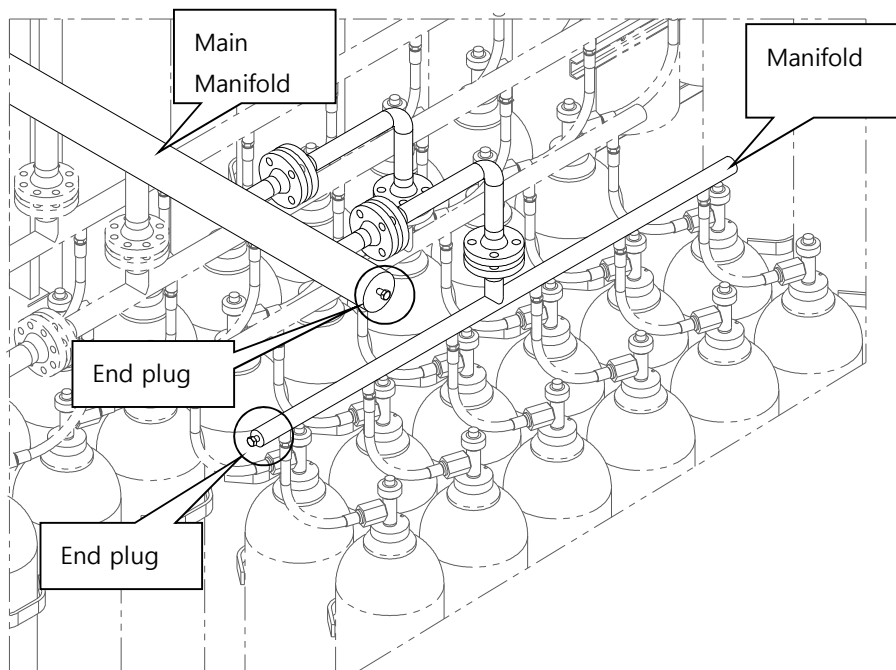
--ANNEX 1.4 (On-board function test)

1. Read carefully the instruction plate fitted on board.
2. First of all, ensure the release control cabinet and the cylinders relevant to the space to be tested.
3. Prepare the spare pilot cylinder, or 7kg/㎥ dry air on board to use for the test and connect it to the inlet pilot line of ball valve in the release control cabinet. When open the door of release control cabinet the CO2 alarm is activated and the vent fan is stopped. Therefore this function test is recommended to be carried out when the vessel is situated at the port, or anchored.
4. Remove the valve actuator from the cylinder valve by pulling off the securing pin on the relevant cylinders in the CO2 room and push the actuator pin by hand to return its original position.
5. Open the spare pilot cylinder valve, or put the 7kg/㎥ dry air, which connected in the release control cabinet, and open ball valve No.1/No.2.
6. Check if the valve stem of relevant main valve and internal pin of valve actuator were protruded. If so, the system is in order.
7. If not, it's not in order and check the leakage point on the pilot line, time delay unit, valve actuator etc and correct it if there is any leakage point.
8. Repeat above procedure to check the function of the relevant release control cabinet, main valve, cylinder valve actuator etc.
9. After completion of function test for all the space, close No.1/No.2 ball valve in the release control cabinet and open the vent bleed on the main valve and at end of cylinder valve actuator to vent the pilot gas pressure. Then, the main valve stem will be returned to original position by itself and the actuator pin will be returned to its position by push it by hand. Close the vent bleed to its original position and couple the cylinder valve actuator with its cylinder valve. Also take out the spare pilot cylinder, or dry air line from the release control cabinet and put the all the condition in normal service condition.
10. Connect the air line on the air connection valve fitted on the main manifold pipe and put the 7kg/㎥ air after opening of the main valve in same procedure as above function test, or by manually so that all distribution pipe to the nozzles to be blown through. In case of cargo hold, blow through after turning the 3-way valve to CO2 room. Thus, thoroughly check and repair if there is any blocked, or leak points in the distribution pipe line and nozzles. After completion of air blowing, place all the parts to the original service position.

--ANNEX 1.5 (On-board test of actual pressure)



1. Remove **all** valve actuator on the cylinder valve.
2. Remove **all** valve discharge hose **from manifold Connection point.**
3. Main valve shall be close.



4. Remove end plug on manifold or main manifold in co2 room.
(Manifold is connection pipe of each flexible hose. // Main manifold is connection pipe each manifold.)
5. Test cylinder or compressor air into distribution piping by test Connection
Test pressure shall be higher than pressure calculation result as per system approved and Normally Discharge pressure is below 55 bar in calculation data.
Recommendation Test pressure is approx. 55~58bar.
If higher the pressure, Shall be provided reducing component for suitable pressure and safety.
6. Checked the leak of each flange and thread point by bubble test.