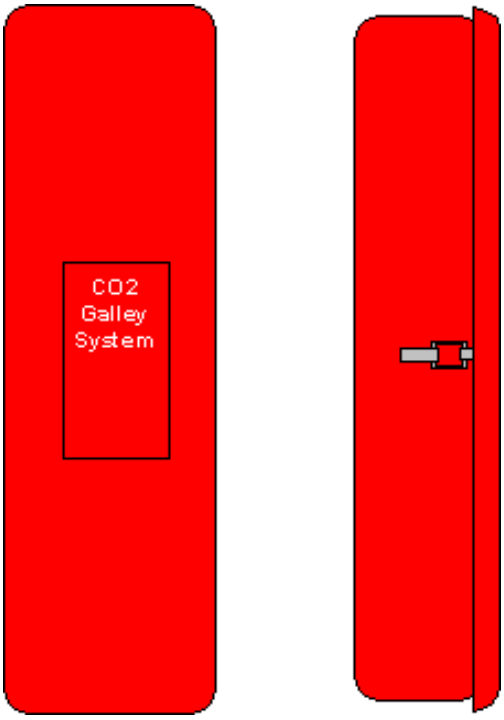
FIRE AND SECURITY

CO2 High Pressure Extinguishing System



Galley Duct System

USERS MANUAL NO. 70749-G4

Yard: XXXXX

Hull No.: XXXXX

AFS Project No.: XXXXX

Protecting life, environment and property...

Amendments

AMENDMENT INCORPORATION RECORD		
Amendment Number	**Brief Description of Content**	**Name of Person Incorporating Amendment**
1 2006-02-16	Updated to AFS Format	L. Elsrud
2		
3		
4		
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6		
7		
8		
9		
10		

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1 FOREWORD

1.1 Supplier address and contact:

Supplier: Autronica Fire and Security AS

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Telefax: + 47 31 29 55 01

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Contact spares Sales support department

Contact service Sales support department

1.2 Description of this manual.

The manual is structured in accordance with Norwegian Standard NS 5820 and shall be used by the operators of the system in any situation.

The manual is divided into 9 different sections, each giving unique data for the system supplied. Each section is divided into different sub sections. The index is specifying the main sections and the sub sections.

1.3 Scope of supply.

It consists of 1 off 6 Kg. CO_2 - cylinder's installed in a GRP Cabinet protecting the Galley Duct. The CO_2 – Cylinder is equipped with a manual operated wheel valve.

2 MAIN DATA

2.1 Part List

Item no.	Part no.	Description	Material	Qty.
1.00	301106	CO_2-Cylinder, 6 Kg Manual Wheel Valve	Steel	1
2.00	304001	Flexible discharge hose, 1/2'', 350 mm.	Steel / Rubber	1
3.00	171020	GRP Cabinet	GRP	1
4.00	140781	Limit switch	Plastic	3
5.00	309101	DN 8 Fog Nozzle.	Brass	4
6.00	139100	Electronic Alarm Siren A100	Plastic	1
7.00	307001	Pressure gauge	Steel	1

2.2 General Description.

2.2.1 Carbon dioxide high-pressure system.

Carbon Dioxide is a colourless, odourless, electrically non-conductive gas that is a suitable medium for extinguishing fires. Liquid Carbon Dioxide forms dry ice snow when released directly into the atmosphere.

Physical properties:	Molecular weight	44,0
	Density at 0 ^{O}C/1 Bar	2,0 kg/m^3
	Specific gravity	1,5

Carbon Dioxide extinguishes fire by reducing the oxygen level, the vapour phase of the fuel or both in the air to the point where combustion stops. Carbon Dioxide is present in the atmosphere at an average of 0,03 %/m^3. It is also a normal end product of human and animal metabolism. Carbon Dioxide influence certain vital functions in a number of important ways, including control of respiration, dilation and constriction of the vascular system – particularly the cerebrum and the pH value of the body.

The concentration of carbon dioxide in the air governs the rate at which Carbon Dioxide is released from the lungs at thus affects the concentration of Carbon Dioxide in the blood and tissues. An increased concentration of Carbon Dioxide in air can, therefore, become dangerous due to a reduction in the rate of release of Carbon Dioxide from the lungs and decrease oxygen intake.

2.2.2 Use limitations.

Carbon dioxide fire extinguishing systems are useful to extinguish fires in specific hazards or equipment, and in occupancies where an inert electrically non-conductive medium is essential or desirable, when cleaning up of other media presents to a problem, or where they are more economical to install than systems using other media.

Some of the most important types of hazards and equipment that carbon dioxide systems protect, may include:

- Flammable liquid materials.
- Electrical hazards, such as transformers, oil switches and circuit breakers, rotating equipment, and electronic equipment.
- Engines utilising gasoline and other flammable liquid fuels.
- Grease in galley ducts.
- Ordinary combustibles such as paper, wood and textiles.
- Hazardous solids.

The discharge of liquid carbon dioxide is known to produce electrostatic charges, which, under certain conditions, could create a spark. Carbon dioxide fire extinguishing systems protecting areas where

explosive atmosphere could exist shall utilise metal nozzles and shall be properly grounded. In addition, objects exposed to discharge from carbon dioxide nozzles shall be grounded to dissipate possible electrostatic charges.

Carbon dioxide will not extinguish fires where the following materials are actively involved in the combustion process:

- Chemicals containing their own oxygen supply, such as cellulose nitrate.
- Reactive metals such as sodium, potassium, magnesium, titanium and zirconium.
- Metal hydrides.
- The CO_2 fire extinguishing effect will be reduced by fire in wood, paper and textile.

Note. The system is only to be used for fire extinguishing and not for inerting purposes, due to the electrostatic ignition hazard.

2.2.3 Quality

Carbon Dioxide used for initial supply and replenishment is of good commercial grade, free of water and other contaminants that might cause container corrosion or interfere with free discharge through nozzle orifices. In general carbon dioxide obtained by converting dry ice to liquid will not be satisfactory unless it is properly processed to remove excess water and oil.

2.2.4 Types of fires.

Surface fires are the most common hazard particularly; adaptable to extinguishment by total flooding systems. They are subject to prompt extinguishment when carbon dioxide is quickly introduced into the enclosure in sufficient quantity to overcome leakage and provide an extinguishing concentration for the particular material involved.

For deep-seated fires, the required extinguishing concentration shall be maintained for a sufficient period of time to allow the smouldering to be extinguished and the material to cool down to a point at which re-ignition will not occur when the inert atmosphere is dissipated.

It is necessary to inspect the hazard in every event immediately thereafter to make sure that the extinguishment is complete and to remove any material involved in the fire. Where the quantity of extinguishing medium is required to protect more than one space, the quantity of the medium available does not have to be more than the largest quantity required.

2.2.5 Leakage and Ventilation.

Since the efficiency of carbon dioxide systems depends upon the maintenance of the extinguishing concentration of carbon dioxide, leakage of gas from the space shall be kept to a minimum and compensated for by applying extra gas where required. Means shall be provided to close all openings, which can admit air to or allow gas to escape from a protected space. Any ventilation fans shall be shut down prior to activation of the CO_2-system

2.2.6 Personal protection and safety aspects.

The CO_2 – gas decrease oxygen intake becomes dangerous in due to a reduction in the rate of release of carbon dioxide from the lungs.

A CO_2 concentration in excess of 8 % on the net volume could be considered hazardous to some people. CO_2 concentration below 6 % is harmless to the majority of people.

Means shall be provided for automatically giving audible alarm, warning the release of fire-extinguishing medium into any space in which personnel normally work or to which they have access. The alarm shall be operated for a suitable period before the medium is released.

2.3 Equipment data.

2.3.1 CO_2 – Cylinder.

Drawing reference	:	**33151 – C3**
Part no.	:	301106
Size	:	9 litre
Filling weight	:	6 Kg.
Dimension	:	ø 140 mm x 760 mm +/- 20 mm
Total weight	:	22 Kg +/- 5 Kg.
Cylinder valve	:	Manual.
Bursting disc	:	190 Barg +/- 5 Barg
Cylinder threads	:	W27,8 DIN 477
Cylinder valve inlet	:	W28,8 DIN 477
Cylinder valve outlet	:	W 21,8 x 1/14''
Material cylinder	:	34CrMo4
Material cylinder valve	:	Cast Brass
Finish cylinder	:	Grey
Storage pressure at 21^{O}C	:	58,6 Barg.
Test pressure	:	250 Barg
Manufacturing standard	:	84/525 EEC
Siphon tube	:	ø 16 x 2 mm

2.3.2 CO_2 – Cylinder cabinet

Drawing reference	:	**42090-D3**
Part no.	:	171020
Dimension	:	1000 mm x 280 mm x 200 mm
Material	:	GRP
Finish	:	RED
Weight	:	5 Kg
Degree of protection	:	IP 65
Micro switch	:	2 Off, NO / NC
Micro switch rating	:	4 Amp / 250 Vac

2.4 Electric alarm siren.

Drawing reference	:	**139100-PDS**
Type	:	A100DC
Part no.	:	139100
Voltage	:	24 V DC
Current consumption	:	19 mA
Sound level at 1 m.	:	104 dB
Weight	:	0,26 Kg
Dimension A100 DC/AC	:	87 mm x 87 mm x 77 mm
Sound frequency	:	440 Hz – 2900 Hz (Adjustable tone)
Material	:	Taxlan free ABS
Finish	:	Red
Cable entry	:	1 x 20 mm

2.4.1 CO_2 – Discharge hose

Drawing reference	:	**33165 – C3**
Part no.	:	30401
Length	:	350 mm
Weight	:	0,35 Kg.
Type	:	DN 15 (1/2'') High pressure rubber hose.
Pressure rating	:	PN 100
Bursting pressure	:	600 Barg
Inlet connection	:	W21,8x1/14'' Female
Outlet connection	:	1/2'' BSP Male
Material hose	:	Nitril rubber
Material couplings	:	Steel

2.4.2 CO_2 – Nozzle

Drawing reference	:	**33159-C4**
Description	:	DN 8 (1/4'')
Part no.	:	309101
Height	:	32 mm
Across flats (Hex)	:	27 mm
Weight	:	0,10 Kg.
Inlet connection	:	1/4'' BSP Male
Material	:	Brass

3 TECHNICAL DESCRIPTION.

3.1 General.

The system is used where there is a requirement for protection of one or more galley ducts, and where the CO_2 - cylinder are located within a GRP Cabinet nearby the protected object.

3.2 Design.

The system is designed to supply CO_2 – concentration sufficient to achieve extinguishment only and in accordance with the authorities having jurisdiction. Each of the protected areas are fitted with a master valve and a valve release cabinet.

The CO_2 - system is of the total flooding type protecting the galley duct.

The CO_2 - cylinder is located inside a CO_2 - cabinet.

A number of CO_2 - nozzles are fitted inside each protected area. The nozzles are evenly distributed throughout the area. Nozzles are installed both downstream and upstream of the fire damper..

One audible alarm is installed inside the protected area warning the personnel to evacuate upon activation of the system.

3.3 CO_2 – Cylinder.

Drawing reference : 33151 – C3

The cylinder's supplied for high pressure carbon dioxide systems are manufactured in accordance with European Standards.

Pressure testing from factory is 250 Barg, and all cylinders are supplied with a third party verification certificate.

Standard colour supplied is grey. Other colours like red and black are available upon request. Cylinders for storage of fire extinguishing mediums and associated pressure components shall be designed in accordance with pressure codes of practice to the satisfaction of the authorities having jurisdiction.

The filling ration of CO_2 – Cylinders shall not exceed 0,67 kg/l..

The CO_2 – Cylinders shall be stored in an effectively ventilated room. Means shall be available for the personnel to safely check the quantity of medium in the cylinders.

The CO_2 – cylinders are located inside a GRP cabinet located nearby the protected area. The CO_2 – cylinder's are of equal filling and pressurisation, 58,6 Bar at 21 ^{O}C.

The CO_2 - cylinders are equipped with a manual operated CO_2 - valve

3.4 CO_2-Cylinder cabinet..

Drawing reference : 42090 – D3

The CO_2-Cylinder cabinet is supplied for bulkhead mounting and is made from GRP. The cabinet is supplied with 2 off limit switches for automatically giving alarm and shut down dampers and fans by opening the door.

At each location it will be a clear instruction related to operation of the system.

3.5 Alarm sirens.

Drawing reference: 139100-PDS

Opening the cylinder cabinet will activate the alarm siren

The power supply to the electronic alarm siren is from the emergency power supply system.

All the alarm sirens are operated on either 24 VDC or 220 VAC. Other voltages are available upon request.

The sound level of the alarm siren is to be approximately 30 dB A above the normal sound level in the area they are fitted. It is also important the frequency is different than the frequency on the equipment in the area it self.

3.6 Flexible hoses.

Drawing reference: 33165 – C3

The CO_2 – discharge hose is 350 mm long and fitted inside the cylinder cabinet.

The hoses are made of synthetic rubber with two wire cords. The couplings are made from mild steel. The end connections is 1/2'' BSP Male on the manifold side and W21,8x1/14'', swivel coupling on the CO_2 – valve side.

3.7 CO_2 – Discharge nozzles.

Drawing reference. 33159 – C4

CO_2 – Nozzles are supplied in one sizes, 1/4''. The material is brass and the end connection is BSPP Male threads. The nozzles are drilled with 4 x 3 mm holes.

4 INSTALLATION INSTRUCTION.

4.1 The main equipment installed in or nearby the galley duct.

CO_2-Cylinder cabinet
Alarm siren

Before starting the installation this procedure shall be read carefully.

Please pay attention to the following :

The CO_2 - gas is extremely dangerous to human life. Due to this make sure that the cap on the CO_2 - valve outlet is fitted and that the protective cap on the CO_2 - cylinder is properly installed before any handling of the CO_2 - cylinder's take place.

4.1.1 CO_2 – Discharge hose.

Do not connect the discharge hose to the CO_2 - valve outlet before the commissioning is finalized.

When the commissioning is finalised, remove the CO_2 – cylinder valves outlet caps and connects the discharge hose. Tighten up.

Reference is also made to attachment 4.

4.2 Installation within the galley duct.

The following equipment is normally installed inside the protected area.

CO_2 – Nozzles.

Piping

4.2.1 Piping.

The piping has to be installed in accordance with the general arrangement and the isometric piping drawing.

The piping has to be securely supported to avoid any damages upon release of a CO_2 - system. Upon supporting the pipes, the direction of flow should be considered; to avoid any elbows and/or Tee's to be blown off.

All pipes used shall be made from steel and the minimum dimensions have to be in accordance with the below table.

Nominal diameter			Minimum wall thickness		
Mm	Inch	External Diameter mm	From CO_2 – cylinder to main valve	From main valve to nozzles	Minimum inside dia. Mm
8	1/4“	13,5	2,9	2,3	8
10	3/8“	17,2	2,9	2,3	10
15	1/2’’	21,3	3,2	2,6	13

Table 4.2.1-1

The piping has to be pressure tested when the installation is completed as follows.

Class	From CO_2 –cylinder to main valve/pilot tube.	From main valve to nozzles
Det Norske Veritas	150 Barg.	10 Barg. (Air)
Lloyds Register of shipping	190 Barg.	50 Barg. (Hydraulic)
American bureau of shipping	150 Barg.	50 Barg. (Hydraulic)
Bureau Veritas	128 Barg.	7 Barg. (Air)
Germanish Lloyds	150 Barg.	10 Barg. (Air)

Table 4.2.1-2

4.2.2 CO_2 – Nozzles.

The CO_2 – Nozzles shall be installed in accordance with the general arrangement drawing and the isometric piping drawing.

The nozzles are supplied with 1/4” BSP Male threads.

Reference is also made to attachment 3.

4.2.3 Alarms.

The alarm siren shall be located in galley near the exit.

Power supply to the alarm sirens shall be from the Main and Emergency power supply on board.

The electric alarm siren is generally of the electronic type, with adjustable sound and frequency. The sirens are normally supplied pre- adjusted. At site adjustment may be necessary to achieve a sufficient volume of the sound.

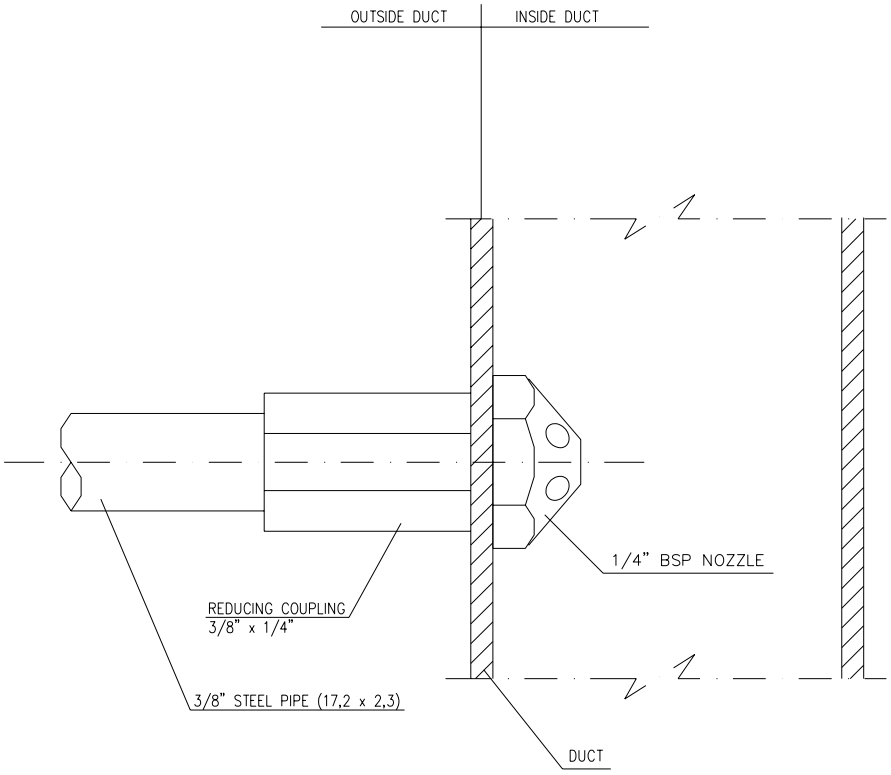
The cable for the siren shall be 1 x 2 x 1,5 mm^2 ship cable. 11 mm is the maximum outside diameter .Two standard voltages are supplied, 24 VDC or 220 VAC.

Please refer to wiring diagram or the siren nameplate for correct voltage, as faulty voltage can destroy the solenoid.

The siren is supplied with two holes for supporting, each 6,5 mm dia. Minimum 5 mm bolts to be used for supporting the siren to the bulkhead.

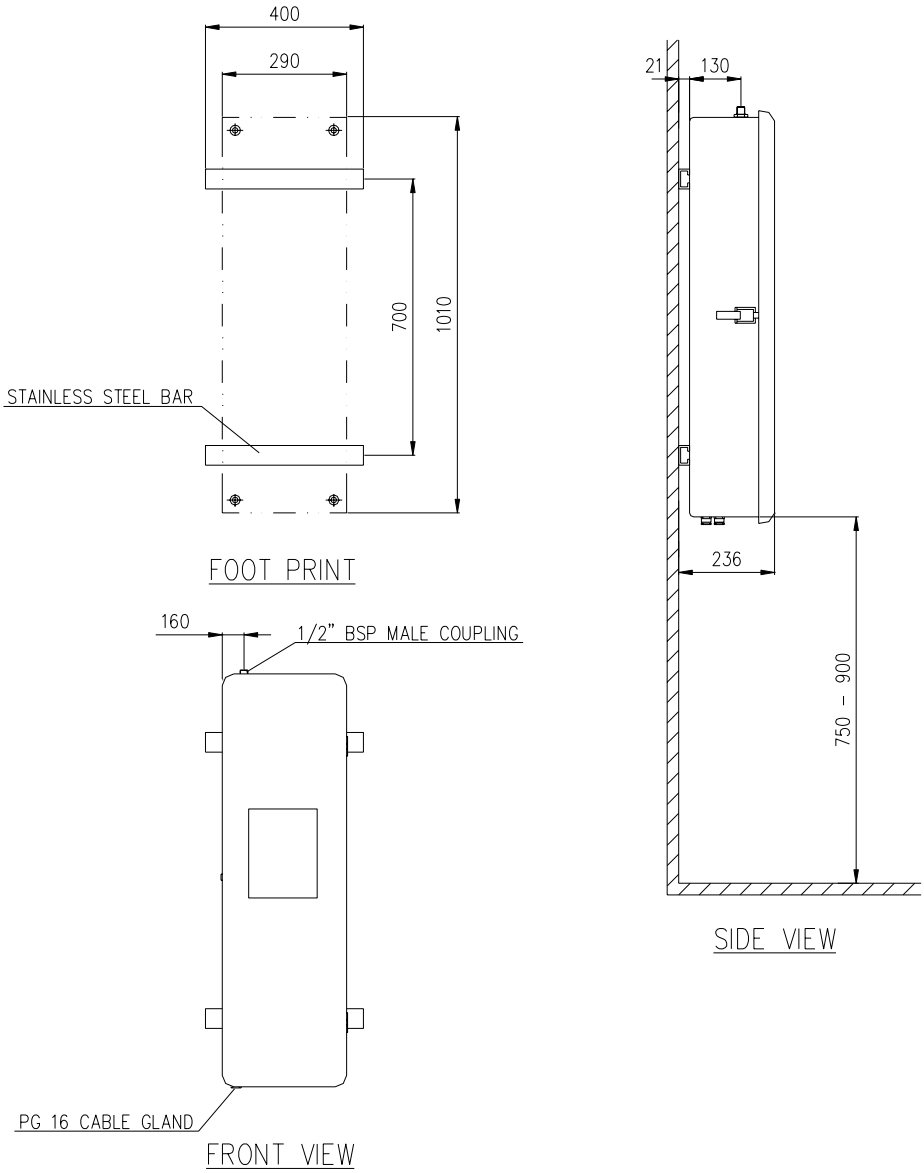
CO_2 - Nozzles.

Minimum one nozzle on each side of the fire damper.



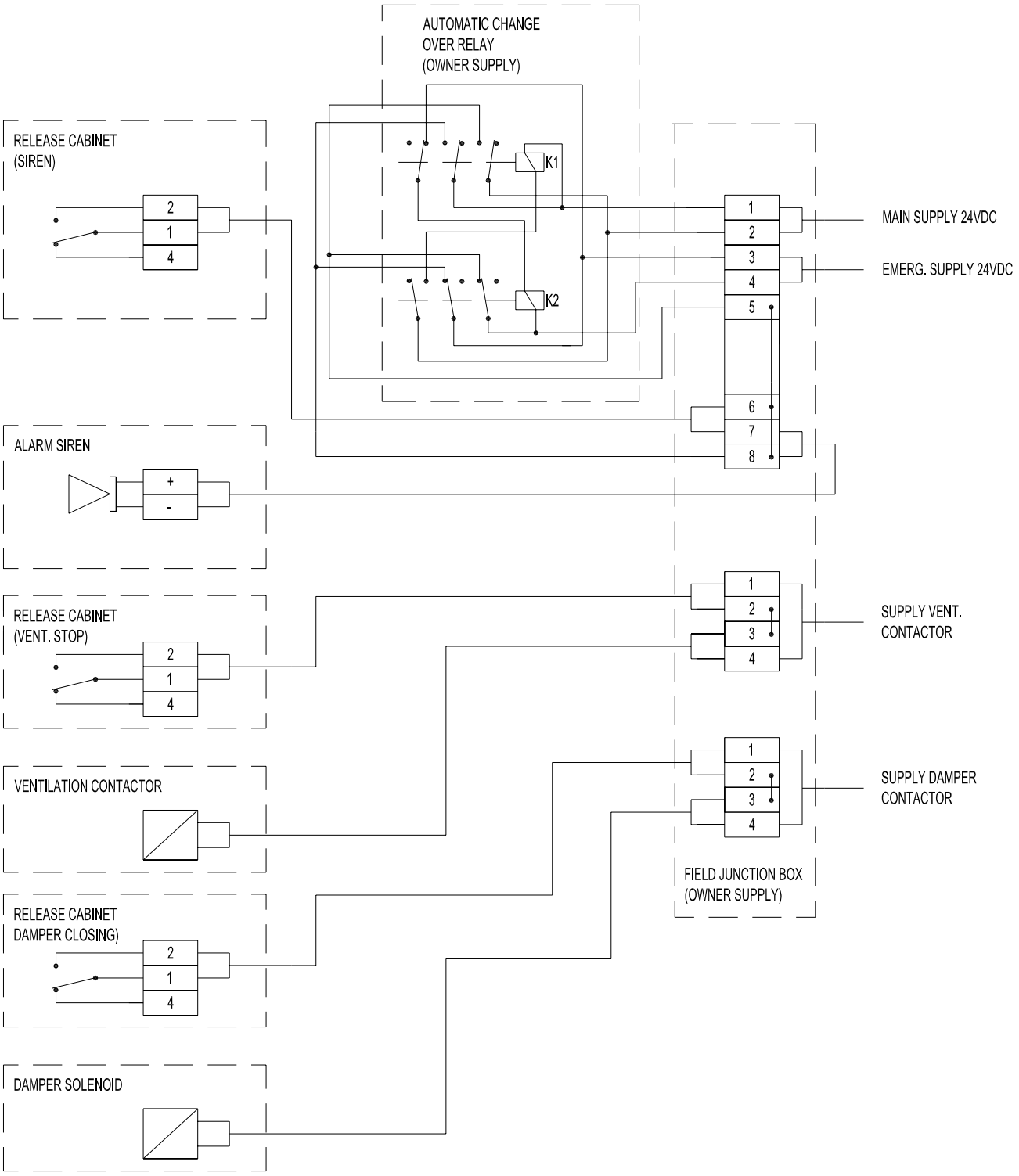
Attachment 3

CO_2-Cylinder cabinet



Attachment 4

Wiring diagram



Attachment 5

5 OPERATION INSTRUCTION.

5.1 General.

All personnel shall be trained with respect to all procedures related to a CO_2 - fire-extinguishing system. It is also important to respect and to take notice of the CO_2 – alarm. The area shall be evacuated immediately. The CO_2 - gas is a suffocating gas that by 8% mixture is dangerous to people. When used for Galley Duct Protection it shall be verified upon design of the system that the total CO_2-Concentration within the Galley does not exceed 6%

5.2 Release of the system

Each cabinet is fitted with an instruction sign pointing out the steps to operate the system. The system shall be operated in the following manner.

Open the door to the CO_2-Cylinder cabinet.

The alarm siren will start, ventilation damper will close and the ventilation will stop.

Be sure that no personnel are nearby the duct.

Open the CO_2-Cylinder valve.

The system is now released.

5.3 Escape ways, emergency routines.

The following general safety requirements should be considered when making Emergency Safety Routines at Site:

The steps and safeguards necessary to prevent injury or death to personnel in areas whose atmosphere will be made hazardous by the discharge of CO_2 may include the following:

- Provision of adequate aisle ways and routes of exit and keeping them clear at all times.
- Provision of emergency lighting and directional signs as necessary to ensure quick, safe evacuation.
- Provision of alarms within such areas that will operate immediately upon detection of the fire and activation of the CO_2 – system.
- Provision of only outward swinging self-closing doors at exists from hazardous areas, and, where such doors are latched, provision of panic hardware.
- Provision of continuous alarms at entrances to such areas until the atmosphere has been restored to normal.
- Provision of warning and instruction signs at entrances to and inside such areas. These signs should inform persons in or entering the protected area that a CO_2 system is installed, and may contain additional instructions pertinent to the conditions of the hazard.
- Provision for prompt discovery and rescue of persons rendered unconscious in such areas. This may be accomplished by having such areas searched immediately by trained personnel equipped with proper breathing equipment. Self-contained breathing equipment and personnel trained in its use, and in rescue practices, including artificial respiration, should be readily available.
- Provision of instruction and drills of all personnel within or in the vicinity of such areas, including maintenance or construction people who may be brought into the area, to ensure their correct action when CO_2 protective equipment operates.

- Provision of means for prompt ventilation of such areas. Forced ventilation will often be necessary. Care should be taken to really dissipate hazardous atmospheres and not merely move them to another location.
- Provision of such other steps and safeguards that a careful study of each particular situation indicates are necessary to prevent injury or death.

5.3.1 Before release.

Check the following before release:

- Personnel. Evacuate all personnel that are nearby the area on fire.
- Fans and dampers. Check that all fans are closed and that all other air leaks are stopped.

5.3.2 After release.

Immediate warning should be given to proper site safety personnel after CO_2 has been released mechanically. Please check site routines and note the following points:

a) Control that CO_2 cylinder has been released.

b) Before entering room make sure to:

- Cut power supply if required.
- Wear a breathing apparatus if required.
- Carry a safety axe and an ABE hand extinguisher if required. The CO2 system is only protecting the galley duct itself. A fire in galley shall be stopped with hand extinguisher or fire blanket.
- Do not enter fire room alone. When entering keep doors closed and check as follows:
- Check for people.
- Localise where fire started.
- Ventilate room thoroughly before permitting people to enter without breathing apparatus.
- Refill CO_2 cylinder immediately.

6 MAINTENANCE INSTRUCTION

6.1 Introduction.

Procedures laid down in this manual should be followed strictly. If deviations from this procedures are made H-L should be informed as this may result in system failure.

6.2 Precautions.

Make sure that all personnel are informed that the CO_2 – system shall be tested, and the no one are left in the protected space, as an accidental release of CO_2 will be life threatening to personnel in the flooded area.

Check that the ventilation is running.

6.3 Periodical control of the CO_2 - system.

The CO_2 – system shall be tested and certified by the manufacturer or by representative authorised by him as follows.

Passenger ships / On-shore installations. : Every year

Commercial ships : Every second year

6.3.1 CO_2 – gas content.

Using a liquid level indicator, if available on board can check liquid level on the cylinders. If liquid level is below required level according to bar chart the cylinder must be weighed. Please note that level varies with temperature.

If a liquid level indicator is not available the cylinders has to be weighed. The total weight shall be as stamped on the cylinders. The total content of CO_2 – gas in the system shall be within a limit of +/- 10%.

If the weight is to low the cylinder must be sent to for recharging.

6.3.2 CO_2 – Cylinder valves.

Check cylinder valves for damages. If damage is observed the cylinder has to be taken on-shore for repair.

6.3.3 CO_2 – discharge hose.

The connections between the CO_2 – cylinder valve and the discharge pipe shall be checked for damages. Check also the hose is properly tightened..

6.3.4 Ventilation.

Re – start the ventilation to the area protected.

NOTE: The CO_2 – Content shall be checked before the area is entered.

6.3.5 Instruction signs and operating instructions.

Check that all instruction signs and operating instructions are in good condition and properly fastened.

6.3.6 CO_2 – Cylinder clamps.

Check that all cylinders are properly secured and that all clamps are tightened.

6.3.7 CO_2 – Pipes / CO_2 – Nozzles

All CO_2 – using instrument air or equal shall blow through pipes to the protected areas. Pressure to be 6 – 10 Barg.

6.3.8 Improper function / Damaged items.

Any item, which has an improper function or is damaged shall be repaired or replaced immediately.

6.4 System testing.

The installation is intended for CO_2 ''Total flooding'' Fire extinguishing system in Galley hoods/ducts.

WARNING!
All CO_2 - cylinder valves shall be sealed with the cap supplied with the CO_2 - cylinder's from the filling station. This to secure that no CO_2 - Gas will leak out by an accidental release.

6.4.1 Leakage test, CO_2 – pipes.

Blank off all nozzle outlets with pipe caps in the protected space.

Connect an air source with 7 – 10 Barg pressure to the discharge hose within the CO_2-Cylinder cabinet.

After completion of the test re-install all the CO_2 - nozzles.

When the installation of the CO_2 - nozzles are completed, put a small piece of tape on each CO_2 – nozzle. Pressurise the CO_2 - discharge pipe with air, 7 – 10 Barg and blow through the pipes. Check that the tape has been blown off.

Re-connect the discharge hose.

6.4.2 Test of ventilation shut down & damper closing.

The ventilation shut down and damper closing will be activated by the below mentioned system.

Make sure that the ventilation is running and dampers are open.

Activated by the CO_2 – cylinder cabinet.

Open the cylinder cabinet door.

Check that the ventilation fan has stopped and the damper has closed.

Close the release cabinet door.

NOTE!
This test shall be carried out for all area's protected which has a shut down signal connected.

6.4.3 Test of alarm siren.

The alarm siren will be activated by the below mentioned system.

Activated by the CO_2 – cylinder cabinet.

- Open the cylinder cabinet door.
- Check that the ventilation fan has stopped and the damper has closed.
- Close the release cabinet door.

Important note!

All the alarm siren's should be tested during the sea trial to verify that the sound level is acceptable for the area that are installed in, when all the machinery's are in normal operation.

.

6.4.4 Final check before leaving the CO_2 system in normal operation.

The following shall be checked before the system is left in normal operation.

- CO_2 – cylinder cap is stored inside the CO_2-cylinder cabinet.
- Operating instruction is installed.
- CO_2 – cylinder cabinet is closed and secured.
- CO_2 – valve is unsecured and in closed position.

6.5 Refilling of CO_2 – Cylinder's.

6.5.1 General.

Upon a discharge of the system, the CO_2 – cylinders should be refilled immediately. This should be carried out as follows.

Cylinder(s) to be removed.

Disconnect the 1/2" Discharge hose.

Plug the CO_2 – valve outlet.

Install the cylinder valve protection cap.

Remove the cylinder clamping.

Ship the cylinder to an authorised gas filling station.

6.5.2 Installation of refilled cylinders.

Fasten the cylinder with the cylinder clamps.

Remove the CO_2 –cylinder cap.

Remove the CO_2 – valve outlet plug.

Re – connect the 1/2" Discharge hose.

7 DRAWINGS AND DATA SHEET

7.1 Equipment drawings and data sheet.

Description	Drawing number	Revision
CO_2 – Cylinder, manual release.	33151 – C3	B
1/4” Fog Nozzle	30159 – C4	C
1/2’’ Flexible discharge hose.	33165 – C3	2
EI – Switch	140781–PDS	A
Sign for CO_2 - Alarm.	33188 – C3	1
Electric alarm siren.	139100-PDS	B
CO_2 system for Galley Duct, Cabinet	42090 – D3	D
Schematic diagram	23051 – B3	C
Instruction sign	70750- G4	A
General arrangement		