Technical description

Dry Chemical powder Fire Suppression System

Amendments

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1 FOREWORD

This manual is written for those who design, install and maintain Autronica Fire and Security Dry Chemical Powder (DCP) Fire Suppression Systems

IMPORTANT

Autronica Fire and Security AS assume no responsibility for application of any system other than those addressed in this manual. The technical data concerned herein is limited strictly for information purposes only. Autronica Fire and Security AS believe this data to be accurate, but it is published and presented without any guarantee or warranty whatsoever. Autronica Fire and Security AS disclaim any liability for any use that may be made of the data and information contained herein by any and all other parties.

The Autronica Fire and Security Local Protection Fire Suppression Systems are to be designed, installed, inspected, tested and recharged by qualified and trained personnel in accordance with the following.

All instructions, limitations, etc. contained in this manual.

Storage, handling, transportation, service, maintenance, recharge and test of agent storage containers shall be performed only by qualified and trained personnel in accordance with the information in this manual and the relevant compressed gas standard.

Regulations imposed by the class, flag state or Authorities Having Jurisdiction for the hazard to be protected.

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2 GENERAL.

In the following we have chosen to use the term «Dry Chemical System» to describe the type of fire extinguishing system also called Powder system, Dry Powder System, Dry Chemical Powder System etc. To describe the dry chemical itself we use the term «powder».

2.1 Dry Chemical Powder System.

A Dry Chemical Powder System is defined as a supply of a powder that can be automatically or manually activated to discharge through a distribution system onto or into the protected item/area. The system may also include auxiliary equipment.

2.1.1 Dry Chemical powder.

The Dry Chemical is a powder composed of very small particles, usually of sodium bicarbonate, potassium bicarbonate, urea-potassium based bicarbonate, potassium chloride, or monoammonium phosphate with added particulate material supplemented by special treatment to provide resistance to packing, resistance to moisture absorption (caking), and the proper flow capabilities.

2.1.2 General system principles.

The powder is stored in a pressure tank and is discharged by using a propelling gas, normally nitrogen, but carbon dioxide or air is also used for some applications.

Separately stored propellant.

The principle most frequently used in fixed and larger mobile systems is to have the propellant (normally Nitrogen) stored in separate tanks. The powder is stored in a tank at atmospheric pressure and pressurised when the system is activated. This is done two ways:

Direct pressurising, without pressure regulator between the propellant container is used for portable extinguishers and small fixed systems without shut-off possibilities in the dry chemical discharge line.

Pressurising through a pressure regulator is the normal principle for fixed installations and the basis for the systems further described here. This method gives the best control of the discharge and ensures a steady discharge rate through the whole discharge period.

2.1.3 Theory of combustion and fire extinction.

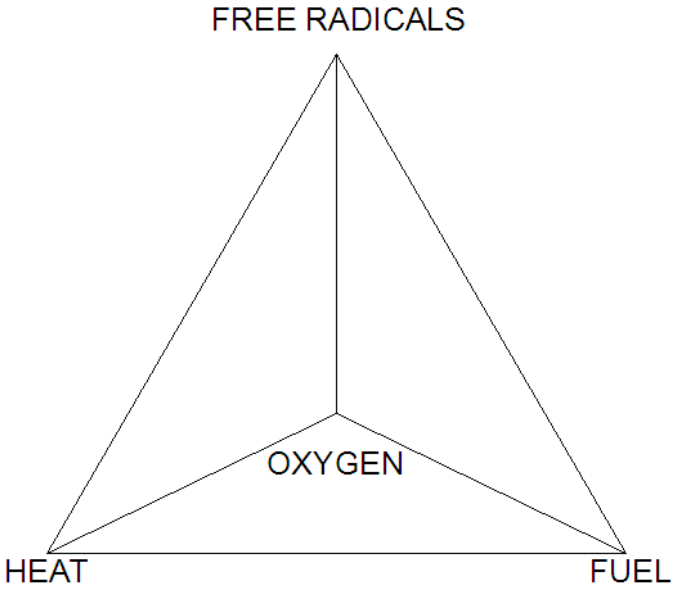
Combustion is a chemical reaction that requires the concurrence of a fuel, a combustion supporter (generally oxygen in the air) and energy (heat).

During the combustion of a substance, some interatomic bonds are broken and extremely reactive entities (free radicals) are generated which, taking part in combustion, allow its propagation.

The above first three factors need to be present at the same time to ensure ignition while free radicals are the vehicle by means of which combustion propagates itself.

Through a series of chain reactions that they provoke, free radicals liberate a great quantity of energy that shows itself in the emission of heat (flames), thus allowing the reaction's self-support. This is the reason why in the most recent theories on combustion the so-called «fire triangle» – at whose vertices stand fuel, combustion supporter and heat respectively – has been changed into a tetrahedron that annexes free radicals at the added vertex.

Best known theories on fire extinction by Dry Chemicals State that combustion is fundamentally limited and interrupted because of the following phenomena:



Endothermic scission of the dry chemical's main component (usually a bicarbonate of sodium, potassium or other salt) that causes absorption of heat and, consequently, favours extinction; production of carbon dioxide, consequent to the scission of the extinguishing dry chemical, that reduces the quantity of oxygen involved in combustion and formation, in some cases, of water vapours that once more reduce oxygen. In most recent times, however, the theory of free radicals has been more and more credited because it has been demonstrated that their activity is slowed down, until completely blocked, by the action of other radicals, generated by certain substances which have particular properties (e.g. dry chemicals) when subjected to the action of heat.

Conclusion:

When projected onto fire, extinguishing dry chemicals actually interfere with the combustion chain reactions to hinder their propagation: the larger the surface area on contact between flames and a dry chemical, i.e. the smaller the powder particles, the more effective is the dry chemical itself as a fire extinguishant. When the above-indicated phenomena occur and free radicals are reduced, there is corresponding progressive decrease of the combustion reaction; the whole process culminates in complete extinction.

2.1.4 Use.

Types of hazards and equipment that can be protected using dry chemical systems include the following:

Flammable liquids and gases.

Extinguishing flowing flammable liquid fires, especially Class I Liquids, may result in a reflash unless all sources of ignition have been removed. Flammable gases present a potential explosion hazard if the flow of gas is not stopped before or during the extinguishing.

- Combustible solids having burning characteristics similar to naphthalene and pitch, which melt when involved in fire.
- Electrical hazards such as transformers or oil circuit breakers.
- Textile operations subject to flash surface fires. Where bicarbonate-based dry chemical is used, water shall be provided to extinguish possible smouldering or deep-seated fires. Ordinary combustibles such as wood, paper or cloth, using multipurpose dry chemical when it can reach all surfaces involved in combustion.
- Restaurant and commercial hoods, ducts and associated cooking appliance hazards such as deep fat fryers.
- Some plastics, depending upon the type of material and its configuration of hazard. For more specific information, consult the manufacturer.

2.1.5 Limitations.

Dry chemical extinguishing systems shall not be considered as satisfactory protection for the following:

- Chemicals containing their own oxygen supply, such as cellulose nitrate.
- Combustible metals such as sodium, potassium, magnesium, titanium and zirconium.
- Deep-seated or burrowing fires in ordinary combustibles where the dry chemical cannot reach the point of combustion.
- Before dry chemical extinguishing equipment is considered for use to protect electronic equipment or delicate electrical relays, the effect of residual deposits of dry chemical on the performance of this equipment shall be evaluated.
- Multipurpose dry chemical shall not be considered satisfactory for use on machinery such as carding equipment in textile operations and delicate electrical equipment because, upon exposure to temperatures in excess of 250°F (121°C) or relative humidity in excess of 50 percent, deposits will be formed that may be corrosive, conductive, and difficult to remove.
- Dry chemical, when discharged, will drift from the immediate discharge area and settle on surrounding surfaces. Prompt cleanup will minimise possible staining or corrosion of certain materials that may take place in the presence of moisture.

2.1.6 Personnel safety.

Safety requirements.

In total flooding and local application systems where there is a possibility that personnel may be exposed to a dry chemical discharge, suitable safeguards shall be provided to ensure prompt evacuation of such locations, and also provide means for prompt rescue of any trapped personnel. Safety items to be considered shall include, but not be limited to, personnel training, warning signs, discharge alarms, pre-discharge alarms, and respiratory protection.

Hazards to personnel.

The discharge of large amounts of dry chemical may create hazards to personnel such as reduced visibility and temporary breathing difficulty.

Caution:

If the discharge piping has been removed from the dry chemical tank, the discharge outlet shall be provided with a protective diffusing safety cap to protect personnel from recoil and high flow discharge in case of accidental actuation. Such protective caps shall also be used on empty pressure tanks to protect threads.

3 TECHNICAL DESCRIPTION

The dry chemical system can be activated automatically (by detection) or manually to discharge the powder through nozzles, handguns or monitors to the protected area. The powder is contained in a pressure tank and is discharged with the aid from a propellant gas, normally Nitrogen (N_2), but Carbon Dioxide (CO_2) or air can also be used.

3.1 General.

Dry Chemical Systems are available in a wide range of capacities and for different applications within marine and industrial use.

The systems can be arranged for:

- Automatic discharge when connected to a fire detection system, electric or pneumatic.
- Remote controlled manual discharge, using a pneumatic or electric system.
- Local manual discharge.

The systems modular design allows flexibility in the different applications, and the systems can therefor also be designed to meet specified customer requirements.

3.2 Powder tank.

The powder tank is produced according to standards of acknowledgement such as DnV or similar. The tank can be delivered with a certificate from a third party such as DnV or similar classification companies after agreement with the customer.

3.3 Safety valve.

A safety valve is mounted on the powder tank to evacuate high pressure. The valve is tested and opens at a pressure of 16,5 Bar.

3.4 Pressure gauge.

A pressure gauge is mounted on the powder tank to always show the pressure in the tank.

3.5 Isolation valve for pressure gauge.

The isolation valve is mounted between the powder tank and the pressure gauge. The valve is to be closed if the pressure gauge has to be changed, calibrated or similar.

3.6 Nitrogen 3-way valve.

The powder tank is pressurised with nitrogen through a nitrogen pilot line and a 3-way valve which is mounted at the tank. After a release, it is important that the powder hose or the pipes is cleaned with nitrogen to get all the powder out. By changing the direction of the valve, the nitrogen gas will be pouring into the powder hose or the pipes instead of the tank.

3.7 Filter.

The filter is placed on the pilot line between the powder tank and the main valve to insure clean nitrogen without any powder.

3.8 In-Line relief valve

The in-line relief valve is mounted on the same pilot line as the filter, but after this. When the pressure in the tank has reached 10 Bar, the valve will open up and let filtered nitrogen through with the pressure of 10 Bar.

3.9 Pressure regulator.

The regulator is mounted before the butterfly valve. The nitrogen pressure will be reduced from 10 Bar to 5,5 Bar before nitrogen is lead to the pneumatic actuator on the butterfly valve.

3.10 Bleeding valve.

The bleeding valve is mounted after the pressure regulator. The valve is decreasing the pressure in the pilot line so that the pneumatic butterfly valve can be closed.

3.11 Nitrogen pressure regulator.

The Pressure regulator is mounted on the nitrogen manifold. The regulator controls the release pressure in the powder tank. The regulator is designed for a pressure of 200 Bar, and the pressure out can be regulated from 0 - 21 Bar.

3.12 Nitrogen cylinder 40 litre.

Nitrogen is used as propelling gas to release the powder from the tank. The cylinder is a standard 40-litre cylinder produced according to the European standards, and it has a quick opening valve for quick evacuation of nitrogen gas.

3.13 Nitrogen cylinder valve.

The valve is mounted on the nitrogen cylinder and is operated manually and pneumatically. The valve has a built in pressure gauge and safety disc.

3.14 Cylinder clamps

It will be delivered 2 sets of clamps for each cylinder. Each set consist of a UNI-rail, 2 pcs. cylinder brackets and a bolt with nut.

3.15 Butterfly valve with pneumatic actuator.

The valve is mounted on the outlet of the powder tank, and is operated pneumatically. The valve is in addition fitted with a manual declutchable gear operator.

3.16 Pneumatic release cabinet.

The pneumatic release cabinet is supplied with a 1,3 Kg pilot cylinder and a ¼” ball valve.

3.17 Nitrogen pressure regulator.

The pressure regulator is mounted on the nitrogen cylinder, and it is designed for a pressure of 200 Bar. The pressure out can be regulated from 0 - 21 Bar.

3.18 Powder nozzle.

The powder nozzle is a ½” spiral jet nozzle with a capacity of 0,44 Kg/sec.

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Autronica Fire and Security is an international company, headquartered in Trondheim, one of the largest cities in Norway.

Our products cover a broad range of systems for integrated solutions, including fire detection systems, integrated fire and gas detection systems, control and presentation systems, voice alarm systems, public address systems, emergency light systems, plus suppression systems.

All products are easily adaptable to a wide variety of applications, among others, hospitals, airports, churches and schools, as well as to heavy industry and high-risk applications such as power plants, computer sites, offshore installations and to the marine market, world wide.

The company's strategy and philosophy is plainly manifested in the business idea:

Protecting life, environment and property.

Quality Assurance

Stringent control throughout Autronica Fire and Security assures the excellence of our products and services. Our products are CE marked and developed for worldwide standards and regulations, and conform to the CEN regulation EN54 in addition to IMO, classification societies and marine administrations. Our quality system conforms to the Quality System Standard NS-EN ISO 9001:2000 and is valid for the following product and service ranges: marketing, sales, development, engineering, manufacture, installation, commissioning and servicing of suppression, integrated fire and gas detection and alarm systems, plus petrochemical, oil and gas instrumentation systems for monitoring and control.

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