Technical description

Water Mist Fire Suppression System

Accommodation

Amendments

AMENDMENT INCORPORATION RECORD		
Amendment Number	**Brief Description of Content**	**Name of Person Incorporating Amendment**
1 2011-08-05	Issued for information	L. Elsrud
2		
3		
4		
5		
6		
7		
8		
9		
10		

Table of Contents

1 FOREWORD

This manual is written for those who design, install and maintain Autronica Fire and Security AS Accommodation Water Mist 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 AS Accommodation 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.

Any questions concerning the information presented in this manual should be addressed to:

Autronica Fire and Security,
Division Maritime
Industriveien 7,
3410 Spikkestad, Norway
Phone: +47 73 58 25 00
Fax: +47 31 29 55 01
sales.maritime@autronicafire.no

World Wide Service Assistance
Phone: +47 73 58 25 00
Fax: +47 73 58 24 75
service.maritime@autronicafire.no

Original Spare Parts
Phone: +47 73 58 25 00
Fax: +47 73 58 24 75
spares.maritime@autronicafire.no

24-hour Support
Fire Detection Systems
+47 48 25 60 00
Suppression Systems
+47 48 25 70 00

2 GENERAL.

The water Mist System is designed in accordance to SOLAS Regulation. All fire tests according to IMO MSC Res 265(84).

The accommodation system is a wet pipe or dry pipe system which consists of a water tank, a Nitrogen system, zone valves with flow switches and nozzles.

Activation of the different systems in the following ways:

- Automatically by a heat sensitive element on every nozzle. Wet System

The water mist system extinguishes or controls fires by cooling, oxygen displacement by water vapour and radiant heat attenuation. The exceptional cooling effect of water mist is a result of the division of water into very fine droplets, which increase the total surface area available to absorb heat and maximises the evaporation rate of the water. The process of evaporation takes the heat away from the flame and fire plume. It is not necessary to extract all of the heat being generated in a combustion reaction to stop it. By extracting 30 to 60 percent may be enough to drop it below a threshold burning condition.

The second mechanism by which water controls or extinguishes a fire is oxygen displacement. The expanding water vapour displaces normal air and reduces the amount of oxygen in the vicinity of the fire. If the water vapour can be confined to the vicinity of the fire in an enclosure or directed against the base of the fire, flammable vapour concentrations and free oxygen levels at the fuel surface will be reduced and the fire will be extinguished or reduced in intensity. The third Suppression mechanism that water mist suppression systems use is radiant heat attenuation. Small water droplets suspended in air reduce the radiant heat transfer between the flames and nearby objects by scattering or absorbing the heat. Droplet size, as well as volume concentration, is critical to radiation attenuation.

2.1 Low Pressure System vs. High Pressure System

Generally 3 pressure ranges for water mist are defined:

Pressure Regime	Bar	kPa	psi
Low pressure	1 to 17	101 to 1.725	15 to 250
Intermediate pressure	17 to 34	1.725 to 3.450	250 to 500
High Pressure	34 - 280	3.450 to 28.400	500 to 4.120

Commercially available low-pressure type nozzles, requiring pressure between 4 and 10 bar, produce spray with suitable drop size distribution, volume flow rate and spray angle for use in water mist fire suppression systems. There are engineering advantages to working with low pressure nozzles, primarily in savings in energy costs to produce the high pressures, and in reduced system cost and complexity.

Average droplet size for FlexiFOG Nozzles:

FlexiFOG M5	$DV_{0,9}$ 3 Bar 277 µm
	$DV_{0,9}$ 7 Bar 255 µm
	$DV_{0,9}$ 12 Bar 247 µm

Low weight on the system, due to the reduced number/sizes of components in the system and then special in the pump station gives better stability onboard.

Low power consumption (important when system is driven by emergency power onboard).

Low dimensions on pump station and cabinets, saves spaces onboard.

Less stress in piping compared to a high-pressure system reduces the possibilities to leakage and failure in the system during testing and service.

More effective installation which saves time and money.

No welding on pipes needed during installation.

Easier to maintain. Time saving during installation.

Time saving during maintenance.

Cost saving during installation and maintenance.

Safer to maintain.

Possibilities for injury to human if a nozzle accidentally is opened is significant reduced

2.2 Use limitations.

It is important to use engineering judgement to take into account design factors that are beyond the scope of experimental work, such as the ventilation conditions, fuel geometry and obstructions at the time of fire. The limitations of water mist systems are the inability to completely extinguish deep-seated Class A fires and with difficulties Suppression shielded/obstructed fires. The difficulties associated with the Class A fires are related to the system's inability to adequately wet the fuel surface (due to low water usage rates) preventing complete Suppression of all glowing/smouldering embers. During most fire tests, the flaming combustion was extinguished/eliminated, but the glowing part embers remained. The difficulty with shielded/obstructed fires is associated with high mist fall out losses (due to gravity) which tend to significantly reduce the mist concentration in areas away from the spray pattern of the nozzles.

2.3 Quality.

The water mist Suppression system is a low pressure, low water consumption system with a complete absence of propellant gases. The water used in the system shall be free from contaminants that may cause corrosion and/or clogging of the FlexiFOG nozzles. Maximum size of any particles allowed in the system, is 500 microns.

2.4 Personal protection and safety aspects.

The water mist Suppression system using pure water do not present a toxicological or physiological hazard and are safe for use in occupied areas. Pure water in this meaning is either water that is potable (drinkable) or natural sea water, that is, water coming from the sea.

3 SYSTEM DESCRIPTION.

The Autronica Fire and Security water mist systems are fully microprocessor controlled using a PLC for inputs and outputs. The system is either operated by a touch screen panel. The system may consist of more than one touch screen panel.

PROFINET is used for communication between the main control panel and the touch screen(s).

The wet pipe systems for the accommodation are grouped into fire zones. Each fire zone has its own dedicated zone valve including a flow switch, test valve and isolation valve. The flow switch is connected to the control panel. When a nozzle is activated due to high temperature, a signal will be sent to the main control panel for activation of the pump(s).

The pump package are to be designed to be capable of supplying the required pressure and flow to the hydraulically most demanding area of not less than 280 m^2.of the accommodation or total flooding zone, whichever is the greater. For yacht system the area to be protected will depend on the actual class / flag requirements. Each pump package consists of 1 or more main pumps. Only one pump will be started at a time, depending on the actual pressure in the system. A hard-wired pressure transmitter constantly monitors the pressure in the riser. In addition to the main pumps, a backup pump is installed, capacity equal to 50% of the total capacity of the main pumps.

In addition to the pump packages a pressure tank are supplied containing a standing charge of fresh water, equivalent to the amount of water required for 280 m2 accommodation area. For yacht system the area to be protected will depend on the actual class / flag requirements. The water is discharged using nitrogen as a propellant gas. The nitrogen is supplied in seamless steel cylinders pressurised to min. 180 Bar. The operating pressure of the water tank is 16 Bar. The amount of nitrogen supplied ensures the pressure will be not less than the working pressure of the sprinkler, plus the pressure exerted by a head of water measured from the bottom of the tank to the highest nozzle in the system.

4 COMPONENT DESCRIPTION.

4.1 Main control panel.

The main control panel is reporting the status of the system back to the operating panels. All actions require for operation of the system, is handled by this panel such as:

- Starting of pumps, when required.
- Opening/closing of correct valves.
- Signals to SMS (Ships monitoring system)

4.2 Operating panel.

The main operation of the system is from a touch screen panel located at the bridge. In addition touch screen(s) panel(s) can be located throughout the vessels in such areas as Engine Control Room, Safety Centre Fire Station etc. All alarms and faults will be displayed in the touch screen. In addition, the stand-by pressure can be monitored.

4.3 Safety valve.

A safety valve is fitted to the nitrogen system. The valve will release any pressure, which is higher than the set point of 16 Bar in the nitrogen system.

4.4 Strainer.

The strainers are fitted in the piping system to avoid particles to flow into the FlexiFOG nozzle. One strainer is fitted after the fire pump and one strainer is fitted in filling line for the FlexiFOG tank All strainers have a filter with 320 microns.

4.5 Pressure transmitter.

The pressure transmitter is installed on the main pipe line after the fresh water tank. The transmitter gives continuous feedback to the main control panel about the pressure in the system.

4.6 Pneumatic operated butterfly valve with solenoid valve.

Two pneumatic operated valves are installed before the pump. Seawater valve is normally closed, and freshwater valve is normally open.

4.7 Main water pump.

The pump package is to be designed to be capable of supplying the required pressure and flow to the hydraulically most demanding area. The pump package consists of 1 or more main pumps and one stand-by pump.

4.8 Pump isolation valves.

Both upstream and downstream of each pump, an isolation valve is installed. These valves are installed, to make it possible to isolate one or more pumps for maintenance, replacement etc.

The valves installed downstream are in addition fitted with a built-in check valve, to avoid back-pressure into the pumps, on the discharge side.

4.9 Pump around safety valve.

A pump around safety valve is fitted to the pump package, avoiding overpressure in the piping system upon start of a pump against closed valves. The valve will release any pressure, which is higher than the set point of 16,5 Bar.

4.10 Pump starter cabinet.

Each pump has its own starter cabinet including direct on line or soft starter (if 33A or more) and an overload protection switch. The power to the pumps is supplied from the main switchboard and from the emergency switchboard. In addition to the automatic switch over device, if one of the two supplies should fail, a built in transformer is included. Only 2 x 3-Phase supply is required.

4.11 Power distribution cabinets (Option).

Two power distribution cabinets should be supplied (One for mains power and one for emergency power). The power distribution cabinets have main fuses incorporated for the pumps. A three-phase power supply shall be connected to the power distribution cabinet. Included in the cabinet is a transformer from 3 x 690 VAC or 3 x 440 VAC or 3 x 380 VAC to 1 x 220 VAC.

5 ACCOMMODATION.

To design the Autronica Fire and Security AS accommodation Fire Suppression System, carry out the following steps:

5.1 Perform a hazard analysis and survey of protected spaces.

The system should be designed in accordance with the guidelines of the International Maritime Organisation Resolution MSC/Res. 265(84) Sprinkler systems equivalent to that referred to in SOLAS Regulation II-2/12, and the guidelines and requirements of the authorities and societies in request.

5.2 Activation times.

Accommodation systems should be designed for immediate activation in case of fires.

5.3 Water.

The system should be capable of continuously supplying the water-based Suppression medium for a minimum of 30 minutes.

The system should be fitted with a permanent sea inlet and be capable of continues operation using seawater.

A pressure tank should be provided and sized to be capable of maintaining the required flow to the hydraulically most demanding area of not less than 280 m^2 for 1 minute operation.

5.4 Hydraulic calculated systems.

The system shall be hydraulic designed to be capable of supplying the required pressure and flow to the hydraulically most demanding area of not less than 280 m^2.

William Hazel model may be used for hydraulic calculation of the systems. Considerations should be taken to filters in the system, when calculating the systems

5.5 System activation.

The system should be automatic in operation, with no human action necessary to set in operation. The water mist nozzles should have a nominal temperature rating at 68 dg.C, except that in locations such as drying rooms, where high ambient temperature might be expected, the nominal temperature may be increased by not more than 30 dg. C above the maximum deckhead temperature.

5.6 Water mist section.

Water mist nozzles should be grouped into separate sections. Any section should not serve more than two decks of one main vertical fire zone,

Each water mist sections of nozzles should be capable of being isolated by one stop valve only. The stop valve should be readily accessible and its location should be clearly and permanently indicated. means should be provided for preventing the stop valves being operated by an unauthorised persons.

Each water mist section is provided with a means for giving a visual and audible alarm at a continues manned central control station within one minute of flow from one or more water mist nozzles.

Each water mist section valve is fitted with a permanently reading pressure gauge downstream of the valve, check valve, drain/test connection and a flow switch.

5.7 Design of pipe installation.

Systems should be designed and installed in ways, which make it easy to maintain components and systems.

Pipes, components, and nozzles should be installed so that they are protected against damage. Attendance should be taken to design the pipe system in such a way that pipes and components do not need to be dismounted when applications are maintained or repaired. Pipes and components should not obstruct passages, openings, doors or hatches in the room.

Pipes and nozzles should be installed above hoists and other moving equipment in the location.

Pipes and components should be chosen in materials suited for the Suppression agent (fresh or seawater) and the ambient temperature. Attentions should be taken to avoid corrosion of the system. When possible pressurised pipe system should be charged with clean fresh water. Means of connection to fresh water supply, and sufficient drainage, should be made to allow all pipes to be firmly rinsed with fresh water after having been exposed to seawater.

Autronica Fire and Security AS recommends piping to be made in stainless steel, or copper and joints between stainless steel pipes and system components in other materials to be flanged, and isolated from each other with the flange gaskets, and plastic isolation bushes on the flange bolts. Other solutions such as bronze press fittings may also be used.

Water Mist systems require extra high attentions on avoiding impurities in the pipe work.

After the installation of pipes, the internal surfaces of the pipes should be firmly cleaned from shavings, chips, and left over sealant materials, before system components are joined to the pipes. When sealing threaded joints, the sealant should only be applied on the male thread, and care should be taken not to apply sealant materials in the cavities. Attentions should be taken to firmly clean re-used thread for old sealant before re-using the threads.

Pipe system should always be rinsed with lots of fresh water after being exposed to seawater.

5.8 System supports.

The support system should be accepted by the authorities, and by the societies in charge. The water mist system piping should be supported with pipe supports, which holds the system firmly supported. The spacing of the supports should be sufficiently small not to allow the pipe system to move, and cause vibrations in the pipe system. The supports should be strong, and they should allow the system to be maintained, and sections to be changed if necessary. Supports should be attached to foundations, which are ridged and strong enough to support the pipe system against the vibrations of the ship, and the harshest movements of the ship at sea.

Supports should be protected against corrosion. If steel supports are used together with stainless steel or copper pipes, the two materials should be galvanic isolated from each other to prevent galvanic corrosion between the two metal alloys.

5.9 Occupancy classification

Occupancy classification		**Cabin**	**Corridor**	**Public space**	**Storage**
(1)	Control stations			X	
(2)	Stairways		X[1]		
(3)	Corridors		X[1]		
(6)	Accommodation spaces of minor fire risk	X[2]		X[3]	
(7)	Accommodation spaces of moderate fire risk	X[2]		X[3 4]	
(8)	Accommodation spaces of greater fire risk			X[3 4]	
(9)	Sanitary and similar spaces	X[2]		X[3]	
(11)	Refrigerated chambers			X	
(12)	Main galleys and annexes			X	
(13)	Store rooms, workshops, pantries etc				X
(14)	Other spaces in which flammable liquids are stowed				X

Notes:

1 For corridors and stairways wider than 1.5 m, use public space.

2 For spaces up to 20 sq.m.

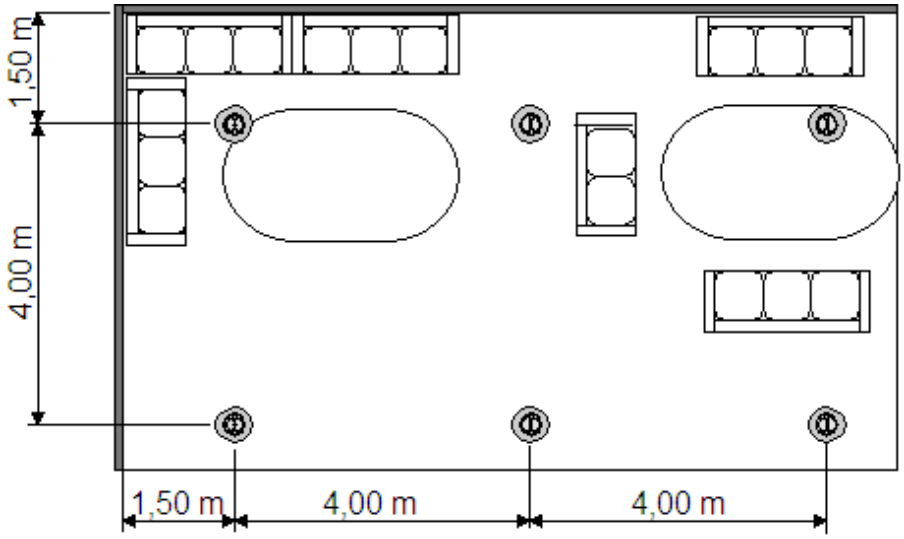
3 For spaces over 20 sq.m.

4 Refer to annex, item 3.24. “3.24 For atriums with intermediate level deck openings exceeding 100 m2, ceiling mounted sprinklers are not required.”

5.10 Nozzle location.

The following figures is a guideline on where to locate the nozzles.

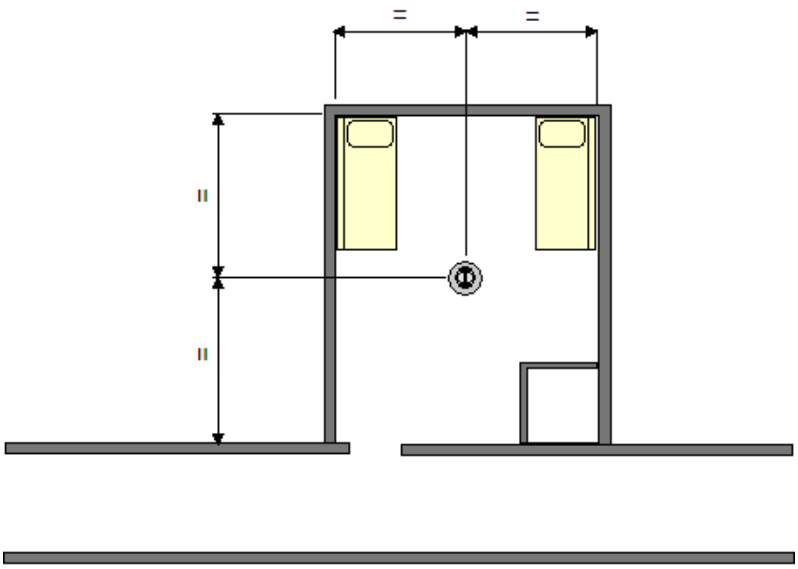
5.10.1 Public space, nozzle type PS-01/PS-02



Public space, occupancy classification 1, 6, 7, 8, 9, 11, 12
Occupancy classification 2 and 3, wider than 1, 5 meter
Nozzle type PS-01 - Ceiling height 2,50 m
Nozzle type PS-02 - Ceiling height 5,00 m
All dimensions are maximum

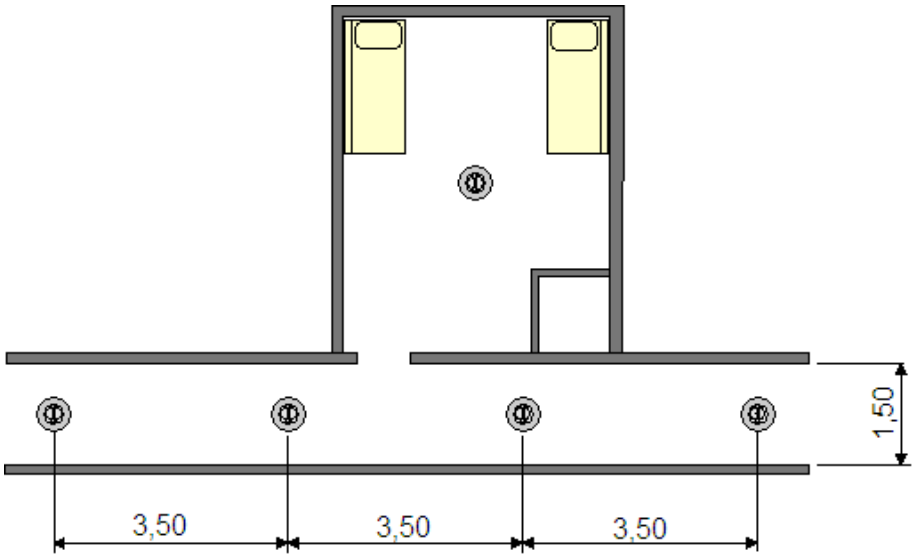
NOTE: LR vessels with non-EU flag, distance between nozzle type PS01 and PS02 is 3,50 meter.

5.10.2 Cabin 0 – 20 m2, nozzle type CA-01



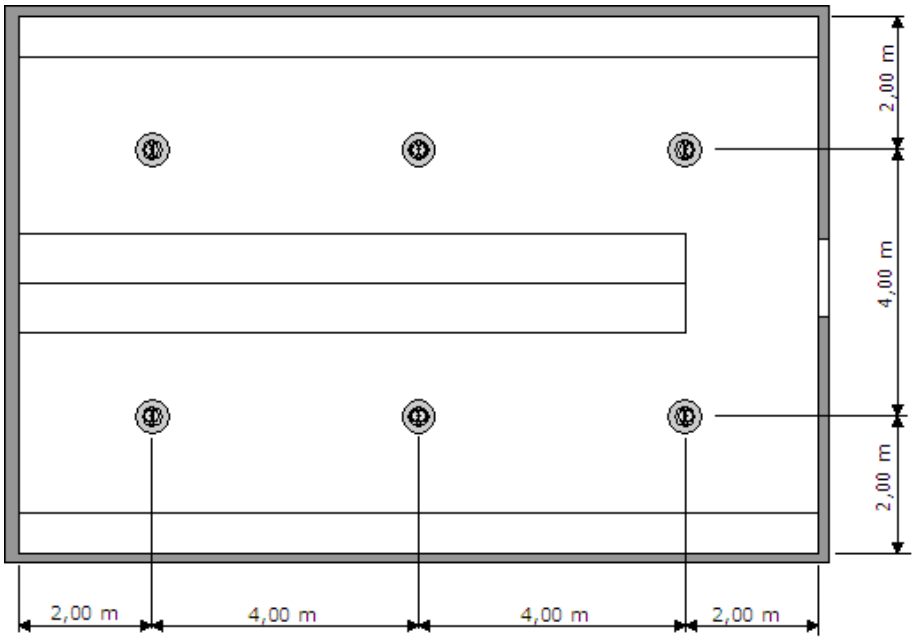
Cabin, occupancy classification 6, 7, 9, max. 20 sq.m
Nozzle type CA-01 - Ceiling height 2,50 m
All dimensions are maximum

5.10.3 Corridor, nozzle type CO-01



Corridor and stairways, occupancy classification 2 and 3
Nozzle type CO-01 - Ceiling height 2,50 m
All dimensions are maximum
Corridors and stairways wider than 1,50 m use public space

5.10.4 Shopping and storage, nozzle type ST-01



Storage, occupancy classification 13 and 14
Nozzle type ST-01
Ceiling height - 2,50 meter
All dimensions are maximum

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.

Autronica Fire and Security AS

Headquarters, Trondheim, Norway. Phone: + 47 73 58 25 00, fax: + 47 73 58 25 01.
Head Office Oil & Gas, Stavanger, Norway. Phone: + 47 51 84 09 00, fax: + 47 51 84 09 99.
Division Oil & Gas, Oslo, Norway. Phone: + 47 23 17 50 50, Fax: + 47 23 17 50 51
Division Oil & Gas, PO Box 416, Farnborough GU14 4AT, UK. Phone: + 47 51 84 09 00, Fax: + 44 84 52 80 20 55
Division Maritime, Suppression/New Build Detection & Alarm. Norway. Phone: + 47 31 29 55 00, Fax: + 47 31 29 55 01
Division Maritime, After Sales/Service Detection & Alarm, Norway. Phone: +47-73 58 25 00, Fax: +47-73 58 25 01

Visit Autronica Fire and Security's Web site: www.autronicafire.com