GW Model M5
Low Pressure Water Mist Fire Protection
Local Application Fire Protection System for
Category A machinery spaces and other spaces
with similar high-risk applications.

GW Sprinkler A/S
Kastanievej 15 DK5620 Glamsbjerg - Denmark
Tel: +45 64 722055
Fax: +45 64 722255
e-mail: sales.dep@gwsprinkler.com
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Data-sheets: 140209 Impulse solenoid valve
         140178 Pressure Switch
         140187 GW M5 - water mist nozzle
         140158 GW PyroStop valves
         14590 GW-DD1 QR heat detectors
         14457 GW-DD1 QR-El / heat sprinkler detectors
         140080 GW Control Boxes
         14628 Heat Collector, Sprinkler Detector Guards etc.
1. The system & the applications.

1.1 Principal requirements for the system

(as outlined in MSC.1/Circ.1387 Annex : Revised Guidelines for the approval of fixed water based local application fire-fighting systems for use in category A machinery spaces):

Fixed water-based local application fire-fighting systems should provide localized fire suppression in areas, as specified in SOLAS regulation II-2/10.5, for category A machinery spaces, without the necessity of engine shut-down, personnel evacuation, shutting down of forced ventilation fans, sealing of the space – or activities that could lead to loss of electrical power and/or reduction of manoeuvrability.

1.2 System operation

.1 The system should be capable of manual release.

.2 The activation of the system should not require engine shutdown, closing fuel oil tank outlet valves, evacuation of personnel or sealing of the space, which could lead to loss of electrical power or reduction of manoeuvrability. This is not intended to place requirements on the electrical equipment in the protected area when the system is discharging freshwater.

.3 The operation controls should be located at easily accessible positions inside and outside the protected space. The controls inside the space should not be liable to be cut off by a fire in the protected areas.

.4 Pressure source components of the system should be located outside the protected areas.

.5 Where automatically operated fire-fighting systems are installed:

.1 a warning notice should be displayed outside each entry point stating the type of medium used and the possibility of automatic release;

.2 the detection system should ensure rapid operation while consideration should also be given to preventing accidental release. The area of coverage of the detection system sections should correspond to the area of coverage of the extinguishing system sections. The following arrangements are acceptable:

.1 set-up of two approved flame detectors; or

.2 set-up of one approved flame detector and one approved smoke detector. Other arrangements can be accepted by the Administration. However, use of heat detectors should in general be avoided for these systems;

.3 the discharge of water should be controlled by the detection system. The detection system should provide an alarm upon activation of any single detector and discharge if two or more detectors activate. The Administration may accept other arrangements; and

.4 visual and audible indication of the activated section should be provided in the engine control room and the navigation bridge or continuously manned central control station. Audible alarms may use a single tone.

.6 Operating instructions for the system should be displayed at each operating position.
.7 Appropriate operational measures or interlocks should be provided if the engine-room is fitted with a fixed high-expansion foam or aerosol fire-fighting system, to prevent the local application system from interfering with the effectiveness of these systems.

1.3 Arrangement of nozzles and water supply
.1 The system should be capable of fire suppression based on testing conducted in accordance with the appendix to these Guidelines. Any installation of nozzles on board should reflect the arrangement successfully tested in accordance with the appendix to these Guidelines. If a specific arrangement of the nozzles is foreseen on board, deviating from the one tested, it can be accepted provided such arrangement additionally passes fire tests based on the scenarios of these Guidelines.

.2 The location, type and characteristics of the nozzles should be within the limits tested in accordance with the appendix to these Guidelines. Nozzle positioning should take into account obstructions to the spray of the fire-fighting system. The use of a single row of nozzles or single nozzles may be accepted for installation where this gives adequate protection according to paragraph 3.4.2.4 of the appendix.

.3 The piping system should be sized in accordance with a hydraulic calculation technique such as the Hazen-Williams hydraulic calculation technique and the Darcy-Weisbach hydraulic calculation technique, to ensure availability of flows and pressures required for correct performance of the system.

.4 The system may be grouped into separate sections within a protected space. The capacity and design of the system should be based on the section demanding the greatest volume of water. In any case the minimum capacity should be adequate for a single section protecting the largest single engine, diesel generator or piece of machinery. In multi-engine installations, at least two sections should be arranged.

.5 Nozzles and piping should not prevent access to engine or machinery for routine maintenance. In ships fitted with overhead hoists or other moving equipment, nozzles and piping should not be located to prevent operation of such equipment.

1.4 System components
.1 The system should be available for immediate use and capable of continuously supplying water-based medium for at least 20 min in order to suppress or extinguish the fire and to prepare for the discharge of the main fixed fire-extinguishing system within that period of time.

.2 The system and its components should be suitably designed to withstand ambient temperature changes, vibration, humidity, shock, impact, clogging and corrosion normally encountered in machinery spaces. Components within the protected spaces should be designed to withstand the elevated temperatures which could occur during a fire. Components should be tested in accordance with the listed sections of appendix A of MSC/Circ.1165, as amended by MSC.1/Circ.1269, as modified below:

`Where the Hazen-Williams Method is used, the following values of the friction factor "C" for different pipe types which may be considered should apply:
Pipe type C
Black or galvanized mild steel 100, Copper and copper alloys 150, Stainless steel 150`

.3 The system and its components should be designed and installed based on international standards acceptable to the Organization, and manufactured and tested in accordance with the appropriate elements of the appendix to these Guidelines.

.4 The electrical components of the pressure source for the system should have a minimum rating of IPX4 if located in the protected space. Systems requiring an external power source need only be supplied by the main power source.
.5 The water supply for local application systems may be fed from the supply to a water-based main fire-fighting system, providing that adequate water quantity and pressure are available to operate both systems for the required period of time. Local application systems may form a section(s) of a water-based main fire-extinguishing system provided that all requirements of SOLAS regulation II-2/10.5, these Guidelines, and MSC/Circ.1165, as amended by MSC.1/Circ.1237 and MSC.1/Circ.1269, are met, and the systems are capable of being isolated from the other sections of the main system.

.6 A means for testing the operation of the system for assuring the required pressure and flow should be provided.

.7 Spare parts and operating and maintenance instructions for the system should be provided as recommended by the manufacturer.

.8 A fitting should be installed on the discharge piping of open head systems to permit blowing air through the system during testing to check for possible obstructions.

* Pending the development of international standards acceptable to the Organization national standards as prescribed by the Administration should be applied.

** X means the characteristic numeral used to mark the degree of protection against access to hazardous parts and ingress of solid foreign objects, which could be 0.1 to 6.

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1.5 Protection of applications in category A machinery spaces, and applications of similar risk in other spaces.

With the GW Model M series, GW Sprinkler offers a series of Low Pressure Water Mist systems, for fixed installation, for fire protection of Category A machinery spaces, and other spaces with applications of similar high fire risks.

The GW Model M series contain GW Model M5 Local Application System, which is described in this manual, (Manual no. 846) and GW Model M5/M2 Full Flooding System which are described in GW Manual No. 894.

The GW Model M5 Local Application System is tested and approved in accordance with the requirements of IMO MSC.1/Circ. 913. The GW Model M5/M2 Full Flooding System has been tested in accordance with IMO MSC 668/728 for protection of Category A Class 3 machinery spaces, and Factory Mutual Standard No.860 for the protection of Machinery Spaces with Volumes Exceeding 260m$^3$

The GW Model M5/M2 Full Flooding system is water based main fire extinguishing system for engine rooms. It may be combined with the GW Model M5 Local Application System, so that the two fire fighting systems share the same pump and nozzle pipe system.

The GW Model M5 Local Application System is installed for protection of "hot spots" in maritime category A machinery spaces in accordance with MSC.1/Circ. 1387, and land based spaces of similar high fire risks. The GW Model M5/M2 MisterySpray system is installed as the main fire extinguishing system.

This manual No. 846 describes the function and design, which together with the applicable IMO Circulars MSC.1/Circ. 1387, and SOLAS are necessary for designing local application installations for engine rooms.

1.6 System performance.

The GW Model M5 Local Application Fire Protection System is designed to accommodate the requirements of the International Maritime Organisation for water based local application protection in category A machinery spaces, as described in MSC.1/Circ. 1387. The local application fire protection systems are additional systems to the main fire fighting systems installed in the engine rooms.

In accordance with MSC.1/Circ. 1387, Local Application Protection Systems shall be installed to provide the possibility for immediate localised fire fighting directly on high-risk applications. The system should be
installed in such a way that the activation of a nozzle zone does not affect the performances of the applications in the engine rooms. It should be possible to activate local application systems without having to evacuate persons from the space.

A Local Application Fire Protection System limits the damages, it cools and it allows additional manual fire fighting to take place, and hereby provides time to activate the main fire fighting system of the engine room if that should become necessary.

Local application fire protection systems are only for indoor fire fighting. Strong draft in the protected area should be avoided/prevented, when systems are activated.

1.7 Low water pressures. Low water flows. Wide installation heights. Low electric power requirements.

The GW Model M5 Water Mist Nozzle has a hydraulic k-value of 5 (l/min \(\Delta\) bar). The GW Model M5 Local Application Fire Protection System controls fires with low-pressure water mist system. 90% of the water sprayed from the GW Model M5 nozzles is distributed in water droplets, which are smaller than 250 µm in diameter. The system has passed the IMO MSC.1/Circ.913 (acceptable to MSC.1/Circ 1387) fire test requirements with an array of only four nozzles.

This allows, in accordance with MSC.1/Circ. 1387, applications to be locally fire protected with GW Model M5 nozzles installed only above the periphery and within the foot print of the protected area. Attention should be made to obstructions between the nozzles and the application surfaces (chapter 2.3).

The power required for a water mist system \((E)\) is a function the efficiency factor \((\eta)\) times the water pressure \((P)\) times the water flow \((Q)\): \(E = \eta \times P \times Q\). From this formula it is obvious that low-pressure \((P)\), results in low power requirements.

<table>
<thead>
<tr>
<th>Nozzle installation heights above fire risk (metres)</th>
<th>Minimum water pressure on Nozzles (Bar)</th>
<th>Maximum spacing between pendent installed nozzles above applications (Metres)</th>
<th>Minimum water density on applications. (mm/m per min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5m to 8m</td>
<td>3.5 bar</td>
<td>3m</td>
<td>1.0</td>
</tr>
<tr>
<td>&gt;8m to 14.5m</td>
<td>9 bar</td>
<td>3m</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Table 1.1 Installation parameters for GW M5 nozzles in local application systems in accordance with MSC.1/Circ. 1387.

The wide tolerances in installation heights makes the GW Model M5 Local Application System suitable for installation in almost all types of engine rooms, in almost all types of ships. The high installation height allows that nozzles are installed above hoists and other moving equipment in the engine rooms. It also allows people to work on the applications without having to dismount the local fire fighting system.

Local Application Systems may, in accordance with MSC.1/Circ. 1387, be directly connected to the main switchboard, or to the water supply of a main fire fighting system. The requirements to power and water supply is that the systems are able of supplying water for minimum 20 minutes to the application zone, which requires the highest water flow. (For applications, installed close to each other, the requirement may be to supply water to two applications.)

The little power requirements of the system, and the little water-flow requirements of the system sets low requirements to the power supply, and the flow supply. GW Model M5 Local Application Systems may therefore often be installed in ships without having to install additional power supply, or pump supplies.

1.8 Fire hazards and fuels:

GW Model M5 Local Application System has been tested in accordance with the requirements of IMO MSC.1/Circ. 913 (acceptable to MSC.1/Circ. 1387) for the protection of local applications. The test fires in this scenario are designed by the International Maritime Organisation. The fires are chosen to represent fires in high-risk applications, where the dominant fire load consists of heated heavy fuel, diesel fuel and lubrication oils under pressure.

The "hot spots" to be protected are described in SOLAS. These applications are typically: engine tops, boiler fronts, oil separators, fuel heaters etc.
1.9 Water as extinguishing agent:
The extinguishing agent of the GW Model M5 Local Application System is water without any extinguishing enhancing agents. This makes the GW Model M5 Local Application System an environmental friendly fire fighting system for maritime engine rooms.
The GW Model M5 water mist nozzles distribute 90% of the total amount of water in droplet with diameters less than 0.250mm. \((D_{90} = 250 \mu m)\). The unique distribution of drop size makes it possible to fight fires from 0.5m to 14.5m above the fire risk, with very small water densities.
The water, which is supplied to the nozzles, must be free of impurities. Fresh water and seawater may be used as extinguishing agents. It is important that the systems are designed for the water quality, which is used in the system.
Seawater is corrosive, and seawater may leave impurities on internal surfaces of pipes and components. It is therefore important that pipes and components are firmly rinsed (flushed) with fresh water after having been exposed to seawater.

1.10 Key system components:
The GW Model M5 System contains two key system components. Both manufactured by GW Sprinkler.

1: The GW Model M5 Water Mist Nozzles: The nozzles atomise water to a water mist with a distinct droplet size pattern, and which distributes the water mist to the place on fire.

2: The GW Control Units: The control unit satisfy the requirements in MSC.1/Circ. 1387 to control and monitoring of systems, and provides the requested features of:

- Control of water to the nozzle application zones.
- Isolation of nozzle zones.
- Activation of nozzle zones.
- Filtration of water to nozzle zones.
- Functional tests.
- Activation alarms.
- Nozzle zone drain facilities.
- Monitoring.
2 Nozzle system and system installation requirements.

2.1 GW M5 Water Mist Nozzle design and nozzle installation:

The GW model M5 Nozzle is a key component in the GW model M5 Local Application Systems.

<table>
<thead>
<tr>
<th>Key parameters</th>
<th>Specific for GW Model M5 Nozzles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nozzle connection</td>
<td>½” BSPT Thread</td>
</tr>
<tr>
<td>Nozzle materials</td>
<td>System with fresh water priming Systems for sea-water</td>
</tr>
<tr>
<td></td>
<td>SnNi plated Brass, w. SS 316 deflectors &amp; filter SS 316 nozzles</td>
</tr>
<tr>
<td>Nozzle protection</td>
<td>Transport/blow-off nozzle cap. Caps should stay on nozzles when being installed in pipe work. Caps should stay on nozzles installed in spaces where objects may risk touching nozzles. Stainless steel Caps will blow off from water pressure in pipe system, at system release.</td>
</tr>
<tr>
<td>Nozzle k-factor (water)</td>
<td>5 (kg/min √bar)</td>
</tr>
<tr>
<td>Droplet size (Dv90)</td>
<td>250 μm</td>
</tr>
<tr>
<td>Smallest water passage</td>
<td>Filter: 1mm, Orifices: 2mm</td>
</tr>
<tr>
<td>Water pressures</td>
<td>3.5 bar - 16 bar</td>
</tr>
<tr>
<td>Vertical installation heights above fire risks / minimum water pressure on pendent nozzles:</td>
<td>Installation height</td>
</tr>
<tr>
<td>0.5m - 8m</td>
<td>3.5 - 10 (bar)</td>
</tr>
<tr>
<td>8m - 14.5m</td>
<td>9 - 10 (bar)</td>
</tr>
<tr>
<td>Nozzle spacing for vertical installed nozzles</td>
<td>Maximum 3m between nozzles</td>
</tr>
<tr>
<td>Minimum Water flows and waters densities for pendent installed Nozzles.</td>
<td>Installation height over the fire risk (m)</td>
</tr>
<tr>
<td>0.5m - 8m</td>
<td>9.4 (l/min)</td>
</tr>
<tr>
<td>8m - 14.5m</td>
<td>15 (l/min)</td>
</tr>
<tr>
<td>Maximum obstructions between pendent installed nozzles and fire risk (obstructions larger than 0.5m wide.) Before additional nozzle should be installed.</td>
<td>The object seen from single nozzle must not obstruct more than 20° of the spray. The object seen from the fire risk must not obstruct more than 20°. (see also chapter 2, 3)</td>
</tr>
<tr>
<td>Horizontal installed nozzles</td>
<td>Chapter 2, 3</td>
</tr>
<tr>
<td>Nozzle pipes</td>
<td>GW Recommend the use of stainless steel pipes for nozzle pipes. Systems shall be hydraulic calculated.</td>
</tr>
</tbody>
</table>

Table 2: GW-M5 Nozzle design and nozzle characteristics.

2.2 Nozzle installation in machinery spaces:

Nozzles and pipe system should be installed by people, who have the necessary skills and understanding of installing water mist sprinkler systems. The installers should know this manual, and they should be aware of the risks of system mal-function, if the instructions and precautions listed in this manual are not followed.

Nozzles should be installed in such a way that installation heights, nozzle distances and water pressures, as listed in table 2, are satisfied.
Nozzle pipe work should be hydraulic calculated to ensure that the water pressure satisfy the recommended water pressure on all nozzles in an activated nozzle zone.

Nozzle pipe system should be made in materials, which are corrosion proof to the extinguishing agent, and which do not cause galvanic corrosion between pipes and components, or pipes and pipe supports. GW Sprinkler recommends the use of stainless steel for nozzle pipes.

Nozzle pipe support must be designed to withstand vibrations and movement, which might occur on ships at sea.

Nozzle pipes and other pipe-works should be designed and installed in such a way, that the pipe works do not interfere with the normal use and maintenance, which take place in the space.

Nozzle pipe-systems should be designed in such a way that nozzles only are installed only so that there is no risk of damaging the pipe system, or the nozzles.

Nozzle pipes should, when possible, be installed above hoists and other moving equipment. Nozzle pipe-work should be installed away from door openings and hatches, and other areas where nozzle pipes or nozzles may limit the free movement of personal in the engine room. Nozzle pipe-work should be installed away from machinery and areas where maintenance often takes place, or where there is a risk that the nozzle spray might be obstructed.

Nozzle pipes and nozzles should be installed in such a way that it is not necessary to dismount pipes or nozzles to be able to maintain or repair machinery or application in the engine room.

Before installing the nozzles, it should be checked that the female nozzle fittings are positioned in such a way that the nozzles will be correctly positioned. This is easily done with a ½” BSP threaded pipe temporarily screwed into the fitting to indicate the nozzle direction.

Nozzles should only be installed in the pipe work, after that the full pipe-work has been installed and fully secured, and after all internal water-ways have been rinsed for impurities, and dried with compressed air.

Nozzles should be installed using a nozzle spanner for the M-series nozzles. The transport cap should be left on while installing the nozzles, not to risk damaging the nozzles. Nozzles should be tightened to the pipe system ½” female BSP thread applying a torque of 4 Nm ± 1Nm.

If a nozzle deflector pin is bent, off centre to the orifice hole, or knocked up against the orifice hole, the nozzle will not distribute the water correctly. Such damaged nozzles should be replaced with new.

When installing nozzles and pipes, it is important only to apply thread sealant on the male parts, and to ensure that there are no sealant surfaces internally in the pipe system. This is important to avoid orifices from clogging.

Threaded female parts should be firmly cleaned before assembled with male parts, to avoid any impurities in the pipe.

2.3 Obstructions Between Applications and Pendent Installed Nozzles

Caution should be taken to avoid obstructions between nozzles and the fire risks.

Additional nozzles should be installed if obstructions are wider than 0.5m, and shields an angle wider than 20°, when seen from a nozzle, or when seen from the fire risk. (Fig. B1 & B2)

If the obstruction is located between two nozzles the shielded angle from a single nozzle may be 40°.
2.4 Additional Nozzles

Additional nozzles should be installed to provide coverage on shielded surfaces (see 2.3). Additional nozzles may be installed in vertical position below the obstructions, or the nozzles may be installed in horizontal position away from the footprint of the application. The number of additional nozzles needed is calculated from the maximum from the Nominal Spray Angle, and the distance from the nozzles to the object. The whole footprint surface of the application should be covered, and all shielded surfaces should be covered, too. The Nominal Spray Angles are shown in fig. C1 & C2.

2.5 Horizontal installed Nozzles:

GW Model M5 Nozzles may be installed in horizontal position. This position is an advantage when protection applications surrounded with narrow space. Horizontal installation of nozzles may also be an advantage when supplying water coverage below obstructions. (Fig C2)

Horizontal installed nozzles may be installed to spray in parallel with the application surfaces, or to spray directly on to the surfaces.

2.5.1 Nozzles installed horizontally to spray in parallel with the application surfaces:

Water Mist sprayed in parallel with the application surfaces provides a good protection of applications surrounded with narrow space, or where a good water mist protection in front of an application is necessary because of risks of spray fires. The best protection is achieved when the horizontal installed nozzles are spraying against each other. Design parameters for parallel installed horizontal nozzles are shown in Fig. C1 (installation parameters) and Fig. B3 & B4 (obstruction of sprays).

2.5.2 Nozzles installed horizontally to spray direct on the application surfaces:

Water Mist may also be aimed to spray directly on to the application surface. For such installations the maximum distance from GW Model M5 nozzle to the application surface is 3m. The spray angle may be calculated to be 90°, and the maximum spray diameter to be 3m. (Fig. C2).

An obstruction must not cover an angle larger than 20° when regarded from the nozzle, and the place of fire. (Fig. B3).

3 System design

3.1 Overall system design:

Fig. A2 shows a typical design of a Local Application System. Variations from the design may be acceptable. Examples here of are found described in fig. D1 & D2, and in the description of the designs in chapter 3.1.

3.1.1 Guidelines and recommendations:

GW Model M5 Local Application Water Mist systems should be designed in accordance with the guidelines of the International Maritime Organisation (IMO) MSC.1/Circ. 1387, and the guidelines and requirements of the authorities and societies in request. This manual does not include all the requirements of all authorities and societies. Therefore GW Sprinkler recommends system designers to consult the authorities and societies in request, and to get their acceptance of the system designs before the systems are quoted and installed.

3.1.2 Activation times:

Local application protection systems should be designed for immediate activation in case of fires. The systems should be designed for continuous flow for at least 20 minutes-duration time.

3.1.3 Hydraulic calculated systems:

Local application systems shall be hydraulic designed to be able of supplying the required pressure and flow at the most demanding nozzle zone. (See table 1). The local application system should be cable of
supplying two local application zones with water, if two high risk applications are positioned closed to each other, and if there is a risk of that fire may spread from the one application to the other. Hazen-Williams or Darcy-Weisbach model may be used for hydraulic calculation of the systems. Considerations should be taken to filters in the system, when calculating the systems.

3.1.4 Power supplies:
Power to the system may be taken from the main switchboard of the ship, if this is sufficient to supply the system, as well as the ship with the necessary power. In case of fire, priorities should be taken to ensure that the requested power supply are available for the fire fighting system. Power supply should be outside the protected location.

3.1.5 Water Supplies:
Water supplies may be shared with a main fire fighting system, provided that this system have the sufficient capacity to simultaneously supply the main fire fighting system, and the most demanding system of the local application system. The local application system(s) shall be capable of being isolated from the other sections of the main system.

If combined with a water based main fire fighting system for engine rooms, it is not required that the two systems are simultaneously activated, however the system should have the capacity of supplying water to the most demanding local application zone for at least 20 minutes. Hereafter the system should be able to perform as a main fire fighting system.
Pumps etc. should be installed outside the protected area.

The water supply should be designed for the possibility of immediate activation of the system. This is most often done by pressurising the feeding pipes from the pump to the Control Unit Valves of the local application zones, as in traditional wet pipe systems. In traditional wet pipe sprinkler systems a pressure tank keeps the water in the feeding pipes pressurised. Fig. D1. An other alternative is to install a small pump to the feeding pipes (jockey pump); to keep the pipes pressurised with fresh water. Fig. D2. The benefits of the pressure tank, is that the use of sea-water in the pipe system may be avoided, depending on the size of local application zone systems, and the size of the tank. The benefit of the jockey pump solution is the small installation. Both the pressure tank and the jockey pump should be installed outside the protected area.

3.1.6 System activation:
Local application systems should always have manual activation.

Automatic activation may be installed, as additional activation system to the manual activation, in non-manned engine rooms. Automatic activation systems should be activated from double knock detection / activation systems acceptable to the authorities and societies in request. A sign, which warns people about automatic release of water mist fire fighting system should be placed at the entrance to the protected space where automatic activated local application systems are installed.

There shall be at least two manual activation stations for each local application nozzle zone. The manual activation stations should be positioned at locations, which are easy to access. One activation station should be installed inside the protected space, and one activation station should be located outside the protected space. The activation stations should be clearly marked with the application system they activate, and how to operate the system. Manual system activation stations should be protected against accidental activation.

3.1.7 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. Attention 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 extinguishing agent (fresh or seawater) and the ambient temperature. Attention should be taken to avoid corrosion of the system. Where 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.
GW Sprinkler recommends piping to be made in stainless steel, 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.

Water Mist systems require extra high attention 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. Attention should be taken to firmly clean re-used thread for old sealant before re-using the threads.

If Local Application Systems are combined with a main fire fighting system, strainers should be installed between the pipes of the main fire fighting system and the local application system. (Strainers are integrated in the GW Control Units).

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

A fitting should be installed on the discharge piping of open head systems to permit blowing air through the system during testing to check for possible obstructions.

3.1.8 System supports:
The support system should be accepted by the authorities, and by the societies in charge. The local application systems 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.

4. System Control Valve Units.

4.1 GW Control Units in general:

GW Model M5 Local Application Systems are controlled with the GW Control Units, which control the water access from the wet pressurised feeding pipes to the dry nozzle zone pipes of the systems. (Fig. E2)

The GW Control Units provide the control, activation, tests, drain and monitoring features, as required by The International Maritime Organisation in their circular MSC Circ. MSC.1/Circ. 1387.

The GW Control Units provide the following features:
- Filtration of water from feeding pipes to nozzle pipes.
- Separation valve for the individual nozzle pipe zone.
- System connection to activation/detection systems, and closing feature for the water access to the individual nozzle zones.
- System activation alarm for the individual nozzle zones.
- Nozzle pipe drain.
- Test features for functional tests of water supply and the individual local application zones.
- Monitoring of water pressure in feeding pipes.
- Monitoring of valves in the control system.

The GW Control Units are prepared for multiple activation stations. GW control units are hydraulic or electric controlled. Control units are prepared for activation from manual activation stations, as well as automatic activation from electric detection/activation, or automatic activation from a hydraulic activation system with electrically activated heat detectors (sprinklers).
4.1.1 Sizes and hydraulic connections:

Control Unit Size | Connections to feeding and nozzle pipes | Connections to drain pipe | Connection to hydraulic activation.
--- | --- | --- | ---
1” | DN 25 | 1” BSP female thread | 1” BSP female thread | ½” BSP female thread
1 1/4” | DN 32* | 1 1/4” BSP female thread | 1” BSP female thread | ½” BSP female thread
1½” | DN 40 | 1½” BSP female thread | 1½” BSP female thread | ½” BSP female thread
2” | DN 50 | 2” PN 16 BS Flanges | 2” BSP female thread | ½” BSP female thread
2½” | DN 60 | 2½” PN 16 BS Flanges | 2” BSP female thread | ½” BSP female thread
3” | DN 80* | 3” PN 16 BS Flanges | 2” BSP female thread | ½” BSP female thread

* 1 1/4” and 3” are not standard sizes. Extended delivery times may be expected.

Table 3: Hydraulic connections for GW Control Units.

4.1.2 Sizes and friction losses:

<table>
<thead>
<tr>
<th>Control Unit Size</th>
<th>Water flow through Control Unit (Litres/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water pressures in feeding pipe</td>
<td>With 4 bar back-pressure in down-stream nozzle pipes.</td>
</tr>
<tr>
<td>Differential pressure between inlet and outlet:</td>
<td>5 bar</td>
</tr>
<tr>
<td>1”</td>
<td>67</td>
</tr>
<tr>
<td>1½”</td>
<td>279</td>
</tr>
<tr>
<td>2”</td>
<td>408</td>
</tr>
<tr>
<td>2½”</td>
<td>764</td>
</tr>
</tbody>
</table>

Table 4: Friction loss in GW Control Units, with 4 bar backpressure in nozzle pipes.

4.1.3 Components and materials:

Main components are shown on fig. E2:

<table>
<thead>
<tr>
<th>No.</th>
<th>Component</th>
<th>Basic materials</th>
<th>Coatings and specialities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 9</td>
<td>Flanges on 2”, 2½”, 3” Control Units, threaded connections on 1”, 1 1/4”, 1½” Control Units</td>
<td>Steel</td>
<td>Galvanised, Natural or chromed</td>
</tr>
<tr>
<td>2</td>
<td>System Isolation Valve</td>
<td>Brass/bronze</td>
<td>Natural or chromed</td>
</tr>
<tr>
<td>3</td>
<td>Filter</td>
<td>Bronze w. stainless steel filter basket</td>
<td>Natural or chromed</td>
</tr>
<tr>
<td>4</td>
<td>Inlet pressure gauge</td>
<td>Brass internals, glycerine filled</td>
<td>Steel housing</td>
</tr>
<tr>
<td>5</td>
<td>Control Valve</td>
<td>Cast ductile iron</td>
<td>Epoxy coated</td>
</tr>
<tr>
<td>6</td>
<td>Pressure switch</td>
<td>Brass internals, galvanised steel connection</td>
<td>Galvanised</td>
</tr>
<tr>
<td>7</td>
<td>Drain Valve</td>
<td>Brass/bronze</td>
<td>Natural or chrome</td>
</tr>
<tr>
<td>8</td>
<td>Outlet Valve</td>
<td>Brass/bronze</td>
<td>Natural or chrome</td>
</tr>
<tr>
<td>10</td>
<td>Outlet pressure gauge</td>
<td>Brass internals, glycerine filled</td>
<td>Steel housing</td>
</tr>
<tr>
<td>13</td>
<td>Plug and trim pipes</td>
<td>Brass/Steel</td>
<td>Galvanised</td>
</tr>
<tr>
<td>14 &amp; 15</td>
<td>By-pass valve &amp; direct activation valve</td>
<td>Brass</td>
<td>Chrome</td>
</tr>
<tr>
<td>16</td>
<td>Connection Box</td>
<td>Plastic</td>
<td>IP 65</td>
</tr>
<tr>
<td>11</td>
<td>Impulse solenoid valve</td>
<td>Brass</td>
<td>Natural</td>
</tr>
<tr>
<td>12</td>
<td>Filter</td>
<td>Brass/Stainless steel</td>
<td>Natural</td>
</tr>
</tbody>
</table>

Table 5: Standard GW Control Unit, Components and materials. * Solenoid activation and filter is an option.
4.1.4 Electric connections:

4.1.4.1 Monitoring system:
The electric connections for the monitoring system are an IP 65 connection box, which are attached to the GW Control Unit. The electric connections are shown in fig. E4.

The Connection Box are prepared for ø4mm -ø6mm cable connection. (see Fig E4)
The monitoring current: 24V DC.

The monitoring system consists off:

<table>
<thead>
<tr>
<th>Reference to fig E4 &amp; fig E2</th>
<th>Component</th>
<th>Positions in standby model</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW1 &amp; 8</td>
<td>Micro-switch on outlet valve</td>
<td>Open On</td>
</tr>
<tr>
<td>SW2 &amp; 14</td>
<td>Micro-switch on By-pass Valve</td>
<td>Open On</td>
</tr>
<tr>
<td>SW3 &amp; 7</td>
<td>Micro-switch on Drain Valve</td>
<td>Closed On</td>
</tr>
<tr>
<td>SW 4 &amp; 2</td>
<td>Micro-switch on System isolation Valve</td>
<td>Open On</td>
</tr>
<tr>
<td>PSW &amp; 6</td>
<td>Pressure Switch</td>
<td>Pressure-less On</td>
</tr>
</tbody>
</table>

Table 6: Monitoring system for GW Control Units.

The Micro-switches and the pressure switch are all connected in series in the connection box. They should be connected to a monitoring system, which provides an alarm when the electric monitoring circuit disconnects.

4.1.4.2 Impulse Solenoid Valve:
For electric activation an impulse solenoid valve may as an option be fitted the Control Unit.

The Control Valve will open and allow water to flow into the dry nozzle pipes when the Solenoid Valves opens. The Control Valve will automatically close for the water exit to the nozzle pipe system when the solenoid valve is closed.

The impulse solenoid only needs a short electric 24Vdc impulse to open. It stays open until it is closed deliberately with an electric 24 V DC signal on an other lead termination port, than that of the opening impulse.

An open electric activated control unit, continue to stay open, also if the detection/activation/power panel breaks down.

Impulse solenoid valves should only be installed with a filter (mesh size < 1mm) up-stream the Solenoid valves. The filter should be cleaned regular, and the solenoid valves should also be operated, and checked and maintained in regular intervals. At least every two years the diaphragm should be changed with new.

Referring to the terminals on the impulse solenoid fig. E3: The solenoid is activated with an electric impulse on terminal 2 & 3. The solenoid is re-closed with an electric impulse on terminal 1& 3.

The Impulse solenoid valve is connected the GW Control Units in such a way that an additional drain from the solenoid valves is not necessary.

Control Valves with impulse solenoid valves may be manual activated from manual controlled electric switches. The switches have two active positions, and a neutral position. The switches should clearly be marked with position for opening the valve, and position for closing the valve. The switch should automatically return to neutral.

Activation switches should be protected against accidental activation.
4.2 The Performance of GW Control Unit.

Fig. E5: The figure shows the performance of the GW Control Units.

4.2.1 Control Unit in standby model:

Fig. E5 - Shows the GW Control Unit in standby model.

Water from the wet feeding pipe pressurises the Control Unit upstream the control valve, including the inlet, and the pilot chamber of the control valve, and the wet activation pipe system, which is connected to the Control Unit.

The check-valve integrated in the valve plate of the Control Valve allows water to flow from the feeding pipes into the pilot camer of the Control Valve, and from here into the wet pipes of the hydraulic activation system, if such is fitted to the Control Unit.

(When pressurising the hydraulic activation system it is important that the by-pass Valve (Fig. E2-No.14) is closed. The by-pass valve shall be fully opened when the hydraulic activation system is fully filled and pressurised with pilot water from the Control Unit)

In standby model the pilot water pressure is the same, or higher, than the water pressure in the feeding pipes.

<table>
<thead>
<tr>
<th>Reference to fig. E1,E2 &amp; E3 &amp; E5</th>
<th>Valve</th>
<th>Position in standby</th>
<th>Position of corresponding monitoring switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>System isolation valve</td>
<td>Fully Open</td>
<td>On</td>
</tr>
<tr>
<td>5</td>
<td>Control Valve</td>
<td>Fully Closed</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Drain Valve</td>
<td>Fully Closed</td>
<td>On</td>
</tr>
<tr>
<td>8</td>
<td>Outlet Valve</td>
<td>Fully Open</td>
<td>On</td>
</tr>
<tr>
<td>14</td>
<td>by-pass Valve</td>
<td>Fully Open</td>
<td>On</td>
</tr>
<tr>
<td>12,15, and detectors and activation valves remote from the control unit</td>
<td>Solenoid valves, Manual release valves, sprinkler detectors etc. Valve in the activation system, with the exception of the by-pass valve</td>
<td>Fully Closed</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 7: Positions of control unit valves with, local application system in standby model.

The electric monitoring system does not provide any alarms when the Control Unit is in standby mode.

4.2.2 Activation of the Local application System:

Referring to Fig. E5.

The GW Control Unit opens and release water into the dry nozzle pipes, when the pilot water is release from the pilot chamber of the control unit.

The pilot water flows from the pilot chamber if a valve, or sprinkler detectors in the hydraulic activation line are opened. (Fig. E5 -B)

The pilot water can also flow from the pilot chamber if the control valve is fitted with a solenoid valve for electric release, and the solenoid valve is opened. (Fig. E5-C).

The Control Unit opens because the water pressure below the valve plate becomes higher than the pressure from the spring and the pilot water pressure in the pilot chamber.

Water, which flows into the nozzle pipes, passes the Y-strainer in the Control Unit, which catches the impurities that the water contains, so that the nozzles do not block.
4.2.3 Closing and returning the Control Unit back to standby model after activation:

Referring to fig. E3 and E5.

4.2.3.1 Control Unit activated on solenoid valve, or manual released valve.

After the Control Unit has been activated. The Control Unit returns automatically to standby model when the activation valve is re-closed.

When the activation valve is closed, the pilot chamber is sealed. Water flowing through the check-valve in the control valve plate allows that the pilot water pressure in the pilot chamber becomes the same pressure as that of the water supply pressure. The spring in the pilot chamber making the valve plate gasket seal against the valve seat. The water stops flowing from the feeding pipes into the nozzle system. The control unit is closed, and it has been returned to its standby mode.

GW Sprinkler recommends that pipes, which have been exposed to seawater, be firmly rinsed with freshwater. GW Sprinkler does also recommend that filters cleaned after the control unit has been activated.

To clean filters, the separation valve is closed, and filters are cleaned, and resealed. The separation valve is slowly opened, and the control unit has been returned to standby mode.

4.2.3.2 Control Unit activated from sprinkler detectors.

If the control unit is activated from sprinkler detectors in the hydraulic activation system:
- The separation valve (Fig E2-2) is closed. Water stops flowing from the open nozzles and from the broken sprinkler detectors.
- The sprinkler detectors are replaced with new.
- Filters are checked and cleaned, and filter baskets are re-fitted and sealed.
- If the pipe system has been exposed to seawater, the exposed pipes are firmly rinsed with fresh water.
- The by-pass valve is closed. (Fig. E1,E2 - 14)
- The separation valve is slowly opened, to let water flow into the pilot chamber and the hydraulic activation system.
- The hydraulic activation system is bled.
- The by-pass valve is re-opened,
- And the control Unit has been returned to standby mode.

4.2.4 Pre-Action Activation Trim:

Pre-Action trim (see fig. E3)

In pre-action trim the hydraulic activation system contains a by-pass valve, an impulse solenoid valve and electrically activated heat detectors. The solenoid valve and electrical heat detector (sprinkler) are independently connected to the smoke detection system of the engine room.

To activate the system, the smoke/flame detection system shall independently activate the solenoid valve, and the electrical heat detector, before the pilot water is released from the pilot chamber of the control unit and water is allowed to flow into the open nozzle.

Failures to the hydraulic activation pipes or sprinkler detectors without electric signal to the solenoid valve will not activate the system, and fail signal to the solenoid valve without release of electrical heat detectors will also not activate the system. Pre-action control units are manual released from additional solenoid valve or hydraulic activation system which is connected to the pilot chamber of the control valve in parallel with the pre-action control pipes.

When pre-action activation systems with pilot water the by-pass valve is opened and the solenoid valve is closed to set the system in stand-by mode.

4.3 Installation and tests of control Units:

4.3.1 Installation position:

Control Units are supplied as one whole unit, ready for installation in pipe work between feeding pipes and nozzle pipes. Control Units should only installed in horizontal position, with the pilot chamber pointing upwards, and with the flow arrow pointing from the feeding pipe to the nozzle pipe system.
4.3.2 **Hydraulic installation:**
Before the control unit is installed, it is checked for visual faults. GW Sprinkler recommends that the installer installs control units with flange connections, also for control units smaller than 2".

The installer should connect the drain valve on the Control Unit to a drain with the sufficient capacity to be able to drain full flow from the Control Unit.

4.3.3 **Electric installation:**
The installer should only use electric wiring approved for maritime use by the authorities and societies in charge. The wiring should be strapped, so that wires do not swing, and cause the electric system to male function. See chapter 4.1.4 for electric connections.
The alarm circuits should be connected to relay or panel, to sound alarm when the electric monitoring circuit is broken.
The installer should consult the authorities and societies in request for their requirements to alarms.

After installation of the Control Unit in the pipe system, and the electric connection of the monitoring system, the activation system is connected.
The solenoid valve is connected in accordance with chapter 4.1.4, and the figures E5 & E3. The wiring should be in accordance with the requirements of the societies and authorities in request. Electric wires should be strapped, to avoid free hanging wires.

4.3.4 **Installing & designing hydraulic activation system.**
The hydraulic activation system should be installed in accordance with the requirements for support of the Local Application System in this manual, and as requested by the authorities and the societies in request.
Pipes should be in stainless steel, and pipes should be of sizes no less than ½".

Hydraulic activation pipe systems should have an equivalent pipe length no more than that of 20m of ½" stainless steel piping. The hydraulic activation system should be connected to the ½" by-pass valve connected to the Control Unit trim, and marked with a black band.

4.3.5 **Test of monitoring circuits.**
After installation the function of the control valve is tested.
The monitoring circuits are tested. The valves on the Control Unit are opened and closed, and it controlled that alarm sounds when the valves are not in the standby mode positions. (Table 7)

4.3.6 **Functional tests of Control Unit:**
Functional test is conducted to check the performance of the control unit, the activation stations, and the alarm from the pressure switch.

To conduct functional in connection with system installation:
- Separation valves on all Control Units are closed. (Fig. E1 & E2 - No. 2)
- Outlet Valve is closed on control Unit to be tested. (Fig. E1 & E2 - No.8)
- Drain Valve is opened on Control Unit to be tested. ((Fig. E1 & E2 - No.7)
- The By-pass valve is closed. (Fig. E1 & E2 - No.14)
- The Feeding Pipe is pressurised with water.
- The Separation Valve is slowly opened.
- The Hydraulic Activation system is bled (Fig. E3 & E5).
- The By-pass valve is opened.
- Open the activation valves, which are connected to the Control Unit being tests, one at the time.
  - Control on pressure alarm, and pressure gauge ((Fig. E1 & E2 - No. 6 &10), that water pressure immediately builds up at the control valve outlet, when each of the activation valves is being opened. It should also be checked that the Control Unit closes, and water pressure disappears from the control valve outlet when the activation valves are being closed. A delay in closing the Control Valve might occur. The Check Valve in the control valve plate, and the filter and the solenoid valve should be cleaned, if the delay in closing the valve is larger than 30 sec.
  - After the test the Control Unit should be left in standby mode. (See table 7)

Continue to test the other Control Units in the Local Application Installation.
4.3.7 Spares which should be available on site

<table>
<thead>
<tr>
<th>Component</th>
<th>Per Control Unit</th>
<th>Per 2 Control Units</th>
<th>Per 4 control Units</th>
<th>Per 6 Control units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control valve plate gasket *</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Control Valve diaphragm *</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Control Valve check-valve filter*</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Control valve check-valve bolt *</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Large filter basket</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Solenoid valve filter basket</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Solenoid valve repair set, diaphragm, etc.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Pressure switch, pressure gauge</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>M5 Nozzles</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 8: Recommended spares available when handling over installations. * All enclosed in Control Unit Spare Kit.

4.4 Maintenance and tests of Control Units:

GW Sprinkler recommends that Control Units be maintained in regular intervals. Control Units should always be repaired and maintained when faults are found.

<table>
<thead>
<tr>
<th>Maintenance action</th>
<th>Monthly</th>
<th>Every ½ year</th>
<th>Annually</th>
<th>Every 2 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional test of monitoring circuits</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional tests of Solenoid valves</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional tests of Control Valve</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning of strainers</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning of check valve in control valve valve-plate</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning of Solenoid valve, and solenoid valve filter.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change control valves diaphragm, gasket, filter and check valve nut.</td>
<td></td>
<td></td>
<td>X (spares package)</td>
<td></td>
</tr>
<tr>
<td>Change of solenoid valve diaphragm</td>
<td></td>
<td></td>
<td></td>
<td>X (new diaphragm)</td>
</tr>
</tbody>
</table>

Table 9: Tests, services and maintenance of Control Valve Units, and spares required for the maintenance.

Other system components should be tested and maintained in accordance with the requirements of SOLAS, the authorities, and the societies in request, and the guidelines of the component manufacturers.

GW Sprinkler recommends a service log for each system installed.
4.5 Checklist for faults:

If fault is found, first check with table 7 that all valves are in standby mode.

<table>
<thead>
<tr>
<th>Fault observed</th>
<th>Possible fault</th>
<th>Cure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor alarm does not sound when valve is out of standby-mode</td>
<td>Electric Circuit or micro-switch damaged, or out of position.</td>
<td>Check electric circuit. Check that micro-switch on valve is off.</td>
</tr>
<tr>
<td>Monitor alarm sounds when all valves are in standby</td>
<td>System may be operated. Wire may be broken Micro-switch may be damaged, or pushed out of position to be on. Pressure switch may e damaged.</td>
<td>Check if system is activated and water flows from the system. Check monitoring circuits. Check that all micro-switches are on. Change with new if necessary. Check that Pressure switch is on. Check pressure setting. Change with new if necessary.</td>
</tr>
<tr>
<td>Alarm from solenoid valve monitoring system.</td>
<td>System is activated. Faults on solenoid. Faults on electric circuit.</td>
<td>Check that water does not flow from the system. Check resistance in the solenoid. Change with new if necessary. Check resistance in the electric circuit. Fix the fault.</td>
</tr>
<tr>
<td>Solenoid valve do not activate control unit</td>
<td>Sufficient electric signal is not provide to solenoid. Solenoid valve does not open sufficiently. Solenoid valve or filter is blocked.</td>
<td>Check power supply and wiring for activation impulse of 24 VDC, min. 8W on terminal 2 &amp; 3 on solenoid. Check electric connections on solenoid. Check resistance on solenoid. Check and clean solenoid valve, and clean filter.</td>
</tr>
<tr>
<td>Control Unit does not activate when valve in hydraulic activation system is operated.</td>
<td>Pilot pressure is not released</td>
<td>Check that by-pass valve is full open. Check that the equivalent length of the hydraulic activation system does not exceed 20m for ½” stainless steel pipe.</td>
</tr>
<tr>
<td>Control Unit does not close when activation valve is closed</td>
<td>Pilot water pressure does not build up in the pilot chamber when activation valve closes.</td>
<td>Check for leakage in hydraulic activation system. If solenoid valve, check solenoid valve circuit for 24V DC 8W closing signal on terminal 1 &amp; 3 on solenoid. Clean solenoid valve and solenoid valve filter. Clean check valve, and check valve filter in control valve plate. Check control valve diaphragm for ruptures and holes.</td>
</tr>
<tr>
<td>Control Unit leaks internally</td>
<td>The valve plate does not seat right on the valve seat. The control valve leaks because it is slightly open. The control valve leaks because of a ruptured diaphragm. The control valve leaks because of dirt between gasket and valve seat. The control valve leaks because of a ruptured gasket.</td>
<td>Seal leaks in the activation system, including leaks in the solenoid valve. Clean seats and gaskets in control valve and solenoid valve, and change gaskets or diaphragms if necessary.</td>
</tr>
</tbody>
</table>

Fig. 10: Faults and cures for control units.
5. Hydraulic Activation System

5.1 By-pass valve to avoid water access to dry nozzle pipes when setting system in standby.
A By-pass valve should be installed between the pilot chamber of the control valve and the hydraulic activation system on all control units. The by-pass valve is a ½" ball valve type valve, with a black band. The by-pass valve shall be closed when filling the activation system with water, and when bleeding the activation system. The by-pass valve should be fully open, and locked with the padlock, when the control unit is in standby mode.

5.2 Acceptable friction loss for hydraulic activation system.
The full hydraulic activation system may have friction loss, which is equivalent to that of a straight 20m ½" Stainless steel pipe, from any point in the activation system to the pilot chamber on the Control Valve (Fig. E5). This includes activation systems with manual releases, and (double knock) electrically activated systems via approved detection system with a solenoid valve in series with a hydraulic activation system (Fig. E3).

5.3 Hydraulic manual activation:
Hydraulic manual activation consists of one or more manuals released valves, which are positioned in locations remote from the control units. Manual system release valves are often ½" ball valves. The manual release valves may be fitted in hydraulic activation systems together with other means of activation devices, such as automatic heat released sprinkler detectors or solenoid valves etc. Requirement for hydraulic activation systems is applicable for remote manual activation systems, too.

5.4 GW Manual Release Control Boxes:
GW Sprinkler offers control boxes where up to four manual released valves is assembled in one cabinet. The cabinet is prepared for instructions of how to operate systems, and which activation valve is for what application. The control boxes are with clear sign, and it can be locked to avoid false activation. (See datasheet enclosed)

5.5 Hydraulic activation system pipes.
GW Sprinkler recommends the use of stainless steel pipes in the activation systems. Pipes should be secured in such a way that vibrations of the pipes are avoided.

5.6 Heat activated sprinkler detectors.
According to 1.2.5.2.2 the use of heat detectors should in general be avoided for these systems. Approved flame and smoke detectors shall be used – see 1.2.5.2

If accepted by the approving authorities sprinkler heat detectors (also with electric activation) may be connected in series to hydraulic activation systems. Sprinkler heat detectors should be positioned on locations above the applications, which are to be heated the most from a fire, and which are not affected by heat from other applications in the protected space. Heat collectors might be fitted above the sprinkler heat detectors.
The normal release temperature of heat detectors should be 20 °C above the expected peak temperature of the location of the heat detector. Heat detectors should have fast heat response (RTI < 50ms½). GW Sprinkler recommends the use of stainless steel, or ENP coated heat detectors to be used. Heat detectors should have ½" connection thread.

Manual release valves may be installed in hydraulic activation systems together with automatic heat detectors.
GW Sprinkler recommends that GW Control Boxes be used for hydraulic manual release stations. The boxes are prepared for four application nozzle zones.

<table>
<thead>
<tr>
<th>Nominal Release Temperature</th>
<th>Colour Code on glass bulbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>57 °C</td>
<td>Orange</td>
</tr>
<tr>
<td>68°C</td>
<td>Red</td>
</tr>
<tr>
<td>79°C</td>
<td>Yellow</td>
</tr>
<tr>
<td>93°C</td>
<td>Green</td>
</tr>
<tr>
<td>141°C</td>
<td>Blue</td>
</tr>
</tbody>
</table>

Table 11: Colour codes for heat activated glass bulb detectors.
5.7  Electrical methods of activation

5.7.1  Solenoid valve activation:

Manual and Electric Activation of Control Units may be by releasing Pilot Water with Solenoid Valves. The Control Unit may be supplied with trim, which includes a solenoid valve, or solenoid valves may be built into a hydraulic activation system. GW Sprinkler offers an Electric Activation Box, for activation of up to four Control Units. The Electric Control Box function with the Hydraulic Activation Pipes, which are connected to the Control Units, are connected to the solenoid valves in the Electric Control Box.

The hydraulic activation systems should be designed in accordance with the guidelines as listed in this chapter for design and installation of hydraulic activation systems.

GW Sprinkler recommends the use of ½” Impulse Solenoid Valves protected by an up-stream strainer. The Impulse Solenoid Valve locks in open position, when activated, until electric impulse orders the valve to close. GW Sprinkler offers a ½” Impulse Solenoid Valve for 24 V DC, 8W. The solenoid valve requires wire with three leads and earth.

Attention should be taken to maintenance of solenoid valves. Solenoid valves are sensitive to dirt, and they should be cleaned, maintained and performance tested regularly.

5.7.2  Electric operated sprinkler heat detectors:

Manual and Electric Activation of Control Units may be released by an Electric operated sprinkler heat detector, which is installed in the Hydraulic Activation System.

The electric sprinkler detectors are released with heat, and with an electric impulse. (Heat detectors Chapter 5.6). The electric sprinkler detectors are heat detectors with an additional electric activation. The electric activation is released with an electric impulse. If the electric circuit should fail, the heat detector will still automatically release from the heat of fire.

In this respect electric released heat detectors, connected to an automatic electric fire detection, may be regarded as an activation system with back up. For electrical data is in GW Data-Sheet for electric sprinklers. The Data-sheets are enclosed in the appendix.

Nominal release temperatures are determined in accordance with chapter 5.6. Hydraulic Activation System is designed in accordance with the guidelines in chapter 5.

6.  Ordering system components from GW Sprinkler.

GW Sprinkler is able to supply some of the system key components. Other components such as pumps, pipes, fittings, hangers, and pressure tanks etc. should be ordered from other suppliers, who offer components which are suitable and type approved for maritime installations.

When ordering components from GW Sprinkler for GW Model M5 Local Application Fire Fighting Systems, please fill in Ordering Table in appendix, and post copy to GW Sprinkler together with the order.

6.1  Ordering GW Model M5 Water Mist Nozzles:

When ordering GW Model M5 Water Mist Nozzles, please refer to the GW ordering No.

<table>
<thead>
<tr>
<th>GW Model M5, nozzle material</th>
<th>GW Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brass with SnNi plating</td>
<td>6323111</td>
</tr>
<tr>
<td>Stainless Steel ANSI 316</td>
<td>6323450</td>
</tr>
</tbody>
</table>

Table 12: Ordering Numbers for GW Model M5 Water Mist Nozzles.
6.2 **Ordering GW Control Units:**

When ordering GW Control Units you order the Control Unit Size (table 13), and you order the performance of the Control Valve by ordering the valve trim (table 14).

The control units are then supplied fully assembled with trim ready to be installed.

<table>
<thead>
<tr>
<th>Std. Control unit size, and spares Control Units without trim. (Only for fresh water primed installations)*</th>
<th>GW Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>DN 25</td>
</tr>
<tr>
<td>1½&quot;</td>
<td>DN 40</td>
</tr>
<tr>
<td>2&quot;</td>
<td>DN 50</td>
</tr>
<tr>
<td>2½&quot;</td>
<td>DN 60</td>
</tr>
</tbody>
</table>

Table 13: Standard Control Unit Sizes, Ordering numbers for control Unit Sizes for Units to be primed with fresh water Only. Control Units designed for priming with seawater should be specified when ordered from GW Sprinkler A/S.

<table>
<thead>
<tr>
<th>Control Unit Trim</th>
<th>Performance / special components</th>
<th>GW Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Std. Hydraulic Release Trim</td>
<td>Trim used for all options, which hydraulic Activation Trim allows. Manual and automatic release. By-pass valve included. (chap.5).</td>
<td>BE26691</td>
</tr>
<tr>
<td>Std. Electric Release Trim</td>
<td>Trim used for electric release. Solenoid Valve impulse type included. (Fig. E5) Trim is prepared for hydraulic Activation Trim. By-pass Valve not included.</td>
<td>BE26692</td>
</tr>
</tbody>
</table>

Table 14: Standard Control Unit Trim, for fresh water primed systems. Both trims include monitoring of Control Unit in Standby Mode, liquid filled pressure gauges, and pressure switch alarm, when nozzle pipes fill with water.

6.2.1 **Ordering spare parts for Control Units:**

A series of spares are available for the Control Units. In tables 9 & 10 are lists of spares which are recommended on site, and when maintaining the Control Units.

<table>
<thead>
<tr>
<th>Control Unit spare part</th>
<th>Specification of spare part</th>
<th>GW Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure gauge</td>
<td>Liquid filled with top-down connection</td>
<td>6922251</td>
</tr>
<tr>
<td></td>
<td>Liquid filled with back connection</td>
<td>BE26256</td>
</tr>
<tr>
<td>Pressure Switch</td>
<td>Switch on when pressure free. (Model Suco)</td>
<td>BE26256</td>
</tr>
<tr>
<td>½&quot; Solenoid Valve</td>
<td>Impulse Solenoid Valve (24V DC 8W)</td>
<td>BE26615</td>
</tr>
<tr>
<td>½&quot; Solenoid Valve Filter</td>
<td>Filter upstream solenoid valves</td>
<td>DEO7892</td>
</tr>
<tr>
<td>Control Unit Kit (Diaphragm, gasket, spindle filter, Spindle O-ring, Spindle check valve)</td>
<td>1&quot; Control Unit – Kit</td>
<td>BE26737</td>
</tr>
<tr>
<td></td>
<td>1½&quot; Control Unit – Kit</td>
<td>BE26738</td>
</tr>
<tr>
<td></td>
<td>2&quot; Control Unit – Kit</td>
<td>BE26739</td>
</tr>
<tr>
<td></td>
<td>2½&quot; Control Unit – Kit</td>
<td>BE26740</td>
</tr>
<tr>
<td>Switch</td>
<td>Switch for monitoring of valves</td>
<td>BE26256</td>
</tr>
<tr>
<td>By-pass Valve</td>
<td>Electric monitored ½&quot; By-pass Valve</td>
<td>BE26682</td>
</tr>
<tr>
<td>Electric monitored valves</td>
<td>1&quot; valve including switch and bracket</td>
<td>BE26683</td>
</tr>
<tr>
<td></td>
<td>1½&quot; valve including switch and bracket</td>
<td>BE26684</td>
</tr>
<tr>
<td></td>
<td>2&quot; valve including switch and bracket</td>
<td>BE26685</td>
</tr>
<tr>
<td></td>
<td>2½&quot; valve including switch and bracket</td>
<td>BE26686</td>
</tr>
<tr>
<td>Strainers</td>
<td>1&quot; bronze housing, stainless steel filter basket</td>
<td>BE26687</td>
</tr>
<tr>
<td></td>
<td>1½&quot; bronze housing, stainless steel filter basket</td>
<td>BE26688</td>
</tr>
<tr>
<td></td>
<td>2&quot; bronze housing, stainless steel filter basket</td>
<td>BE26689</td>
</tr>
<tr>
<td></td>
<td>2½&quot; bronze housing, stainless steel filter basket</td>
<td>BE26690</td>
</tr>
</tbody>
</table>

Table 15: Spares for Control Units.
6.3 Ordering components for Hydraulic Activation Systems:

6.3.1 Sprinkler detectors.

According to 1.2.5.2.2 the use of heat detectors should in general be avoided for these systems. Approved flame and smoke detectors shall be used – see 1.2.5.2.

However, for the activation of valves/control units fitted with a hydraulic pilot line, GW Sprinkler offers an electrically activated heat detector, which can be triggered via a detection system according to 1.2.5.2.

Electrical heat detectors (sprinklers) may be installed in hydraulic activation system to release control Units from smoke/flame of fire to supply water to the nozzle systems. Hydraulic activation systems should always be fitted with a monitored by-pass valve between the hydraulic activation pipes and the control Unit. The by-pass valve, when closed, allows hydraulic activation pipes to be filled with pilot water without water leaking into the open nozzle system. By-pass valve (table 15) shall be open on system in standby mode.

Electric sprinkler detectors are heat detectors with additional electric activation consisting of a Metron Actuator. The electric device on the sprinkler is connected to a panel or circuit with manual switches. Electric sprinklers have a lifetime of 10 years. The expire date is written on a label, which is attached to the wire.

<table>
<thead>
<tr>
<th>Nominal release temperature °C</th>
<th>Part No. for GW-DD1 QR - EL Electric heat detectors in brass with ENP - Nickel plating.</th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>G17.132.202.500</td>
</tr>
<tr>
<td>79</td>
<td>G17.132.203.500</td>
</tr>
<tr>
<td>93</td>
<td>G17.132.204.500</td>
</tr>
</tbody>
</table>

Table 16: Ordering No. for electric released heat detectors. All detector used in maritime applications are quick response (QR) detectors with Response Time Index (RTI) < 50 ms½.

6.3.2 Pre-Action Electric/Smoke/Flame released system:

The hydraulic activation system may be made as a Pre-Action (double knock) activation system. The system requires independent electrical impulses from the detection system, to activate both a solenoid valve and the electrically activated heat detectors. Electrical activation alone without electrical activation of the electrical heat detectors will not activate the system, nor will electrical activation of the heat detectors alone without an electric impulse to the solenoid. However the system can always be activated from manually operated switches. Electric detection errors, or defects to the detection pipes will not activate the nozzle system.

Pre-action detection are made from Control Unit trim with electric release (Table 14), and the hydraulic activation system consists of a by-pass valve (table 15), an Impulse Solenoid Valve (table 15), and electrically activated heat detectors (table 16). Manual activation system is here connected to the solenoid valve on the Control Unit. Automatic electric detection system (activation signal) is connected to, and shall trigger, the solenoid valve in the Hydraulic Activation System thus activating the Control Unit valve.

6.3.3 Control Boxes:

GW Control Boxes are connected to the Hydraulic Activation System. Control boxes are designed for fresh water filled systems.

The Control Boxes contain valves for the control of up to four application nozzle zones. The control boxes are fitted on the walls. The Control Boxes are hydraulic connected the Activation Systems of the control Units, and to an open drain. The Control Box is a red steel cabinet, which may be locked with a pad lock to prevent accidental release of application protection systems. The key may be attached to the cabinet. Inside the cabinet two valves needs to be opened before water mist is distributed in an application zone. On the inside of the cabinet door is a rack for instructions of how to operate which application system.

The Manual control box contains manual activated valves. Boxes are fitted inside and outside the protected area.
The Electric Control Box contains impulse Solenoid Valves. The box may be operated from manual operated switches, as well as from automatic operated addressable fire detection system. Manual release switches are to be fitted easily accessible inside and outside the protected space.

<table>
<thead>
<tr>
<th>Manual Activation Box - four stations.</th>
<th>GW Part No: BE26741</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Activation Box - four stations.</td>
<td>GW Part No: BE26742</td>
</tr>
</tbody>
</table>

Table 17: Manual Activation Boxes. Ordering No.

### 6.4 Manual Activation Switches:

Manual activation switches for impulse solenoid valves. The switches switch between two leads, with one common neutral. The switches return automatically to neutral.

The switches are installed in a cabinet with five switches. The cabinet should be connected to a 24V DC power supplies, with the capacity of minimum 10W. The cabinet has outlets to wires of diameter ø4 -ø6. The cabinet is fitted with an LED to allow electric connection from power supply to cabinet to be monitored. The cabinets are installed on walls inside and outside the protected areas.

<table>
<thead>
<tr>
<th>Activation Switch Cabinet, with five switches</th>
<th>GW Part No.: BE26743</th>
</tr>
</thead>
</table>

Table 18: Manual Switch Cabinet.

---

**Fig. E5 Water Flow in Electric activated Control Unit**
Fig. E5 shows the performance of the GW Control Unit with activation from hydraulic release of pilot water from points remote from the Control Unit (Fig. E5-B), and with activation from release of pilot water from Impulse Solenoid valve on the Control Unit (Fig. E5-C).
Fig. B1 Maximal obstruction seen from Nozzle

Fig. B2 Obstructions seen from the application surface, which require additional nozzles
**Fig B3 & B4 Obstructed horizontal spray**

**Fig. C1 & C2 Nominal design parameters for Horizontal spray**
Fig. D1 Water supply system w. pressure tank

Fig. D2 Water Supply system w. jockey pump

1: Seawater intake
2: Seawater valve, monitored
3: Inlet strainer
4: Pump Check Valve
5: Pressure Switch Pump activation
6: Level indicator
7: Valve
8: Check valve
9: Pressure Regulator
10: Air pump
11: Check valve
12: Jockey Pump
Fig E1 Schematic Diagram Control Unit

1: Water inlet < DN 50 Threaded, > DN 50 flanged
2: Inlet Shut Off Valve, electric monitored Normally open
3: Inlet strainer
4: Inlet pressure gauge
5: Control valve, GV Pyretstop DN 25,40,50,65,80
6: Alarm pressure switch
7: Drain valve, electric monitored Normally Closed
8: Outlet Valve, Electric Monitored
9: Outlet to Nozzle zone, Threaded < DN50, Flanged> DN50
10: Pressure gauge Nozzle zone
11: Impulse solenoid valve (option)
12: Strainer, mandatory with solenoid valve
13: Outlet to Hydraulic activation system
14: Bypass Valve, to be used with hydraulic activation
15: Manual release valve, normally closed
16: Electric termination box, IP 65

Fig E2 Control Unit

Water supply → Drain system

Fig E3 Water Flow in Electric activated Control Unit

A: Control Unit in Standby Mode

B: Hydraulic Activation

C: Electric Activation
SW1: Outlet ball valve
SW2: Ball valve on pilot chamber
SW3: Drain ball valve
SW4: Inlet ball valve
PSW: Pressure switch

Fig. E4. Connection box

Fig. E5 Water Flow in Electric activated Control Unit
GW Model M5 Local Application System
Ordering Table

A: GW Model M5 Nozzles:

<table>
<thead>
<tr>
<th>GW Model M5, nozzle material</th>
<th>GW Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brass with SnNi plating</td>
<td>6323111</td>
</tr>
<tr>
<td>Stainless Steel ANSI 316</td>
<td>6323450</td>
</tr>
</tbody>
</table>

B: Control Units

B1 Size:

<table>
<thead>
<tr>
<th>Std. Control Unit size, and spares Control Units without trim. (Only for fresh water primed installations)*</th>
<th>GW Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1” DN 25</td>
<td>BE26676</td>
</tr>
<tr>
<td>1½” DN 40</td>
<td>BE26678</td>
</tr>
<tr>
<td>2” DN 50</td>
<td>BE26679</td>
</tr>
<tr>
<td>2½” DN 60</td>
<td>BE26680</td>
</tr>
</tbody>
</table>

B2 Activation Trim

<table>
<thead>
<tr>
<th>Control Unit Trim</th>
<th>Performance / special components</th>
<th>GW Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Std. Hydraulic Release Trim</td>
<td>Trim used for all options, which hydraulic Activation Trim allows. Manual and automatic release. By-pass valve included. (chap.5).</td>
<td>BE26691</td>
</tr>
<tr>
<td>Std. Electric Release Trim</td>
<td>Trim used for electric release. Solenoid Valve impulse type included. (Fig. E5) Trim is prepared for hydraulic Activation Trim. By-pass Valve not included.</td>
<td>BE26692</td>
</tr>
</tbody>
</table>
C: Activation boxes:

<table>
<thead>
<tr>
<th></th>
<th>GW Part No:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Activation Box - four stations.</td>
<td>BE26741</td>
</tr>
<tr>
<td>Electric Activation Box - four stations.</td>
<td>BE26742</td>
</tr>
<tr>
<td>Activation Switch Cabinet, with five switches</td>
<td>BE26743</td>
</tr>
</tbody>
</table>

D: Sprinkler detectors:

<table>
<thead>
<tr>
<th>Nominal release temperature °C</th>
<th>Part No. for GW-DD1 QR - EL Electric heat detectors in brass with ENP - Nickel plating.</th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>G17.132.202.500</td>
</tr>
<tr>
<td>79</td>
<td>G17.132.203.500</td>
</tr>
<tr>
<td>93</td>
<td>G17.132.204.500</td>
</tr>
</tbody>
</table>

E: Spares:

<table>
<thead>
<tr>
<th>Control Unit spare part</th>
<th>Specification of spare part</th>
<th>GW Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure gauge</td>
<td>Liquid filled with top-down connection</td>
<td>6922251</td>
</tr>
<tr>
<td>Pressure Switch</td>
<td>Switch on when pressure free. (Model Suco)</td>
<td>BE26256</td>
</tr>
<tr>
<td>½ Solenoid Valve</td>
<td>Impulse Solenoid Valve (24V DC 8W)</td>
<td>BE26615</td>
</tr>
<tr>
<td>⅝ Solenoid Valve Filter</td>
<td>Filter upstream solenoid valves</td>
<td>DEO7892</td>
</tr>
<tr>
<td>Control Unit Kit (Diaphragm, gasket, spindle filter, Spindle O-ring, Spindle check valve)</td>
<td>1” Control Unit – Kit</td>
<td>BE26737</td>
</tr>
<tr>
<td></td>
<td>1½” Control Unit – Kit</td>
<td>BE26738</td>
</tr>
<tr>
<td></td>
<td>2” Control Unit – Kit</td>
<td>BE26739</td>
</tr>
<tr>
<td></td>
<td>2½” Control Unit – Kit</td>
<td>BE26740</td>
</tr>
<tr>
<td>Switch</td>
<td>Switch for monitoring of valves</td>
<td>BE26256</td>
</tr>
<tr>
<td>By-pass Valve</td>
<td>Electric monitored ½” By-pass Valve</td>
<td>BE26682</td>
</tr>
<tr>
<td>Electric monitored valves</td>
<td>1” valve including switch and bracket</td>
<td>BE26683</td>
</tr>
<tr>
<td></td>
<td>1½” valve including switch and bracket</td>
<td>BE26684</td>
</tr>
<tr>
<td></td>
<td>2” valve including switch and bracket</td>
<td>BE26685</td>
</tr>
<tr>
<td></td>
<td>2½” valve including switch and bracket</td>
<td>BE26686</td>
</tr>
<tr>
<td>Strainers</td>
<td>1” bronze housing, stainless steel filter basket</td>
<td>BE26687</td>
</tr>
<tr>
<td></td>
<td>1½” bronze housing, stainless steel filter basket</td>
<td>BE26688</td>
</tr>
<tr>
<td></td>
<td>2” bronze housing, stainless steel filter basket</td>
<td>BE26689</td>
</tr>
<tr>
<td></td>
<td>2½” bronze housing, stainless steel filter basket</td>
<td>BE26690</td>
</tr>
</tbody>
</table>

Ordering Table:

<table>
<thead>
<tr>
<th>A: Nozzles GW M5</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number:</td>
<td>Material:</td>
</tr>
<tr>
<td>B: Control Units</td>
<td>Number:</td>
</tr>
<tr>
<td></td>
<td>B2. Activation Trim</td>
</tr>
<tr>
<td>C: Control Boxes</td>
<td>Number:</td>
</tr>
<tr>
<td>D: Sprinkler detector</td>
<td>Number:</td>
</tr>
<tr>
<td>E: Spares</td>
<td>Number:</td>
</tr>
<tr>
<td>E: Spares</td>
<td>Number:</td>
</tr>
</tbody>
</table>
Solenoid Valve Type 281 is a 2/2 – Way Servo-Assisted Impulse Valve, The Solenoid valve is normally closed (NC).

Circuit function as described in diagram 1:

For function and connection description please see page 2 this data sheet.

**TECHNICAL DATA**

- **Cable Wire:** ø7mm
- **Power:** 24 VdC/8W
- **Power Tolerance:** ±10%
- **Min. Impulsetime:** 50 Ms
- **Max. Abienttemperature:** 55°C
- **Working Pressure:** 0,2 – 16 bar
- **Opening time:** 200-500 ms
- **Speed of shifting** ca.10-50 shift/min.
- **Weight:** 0,7 Kg.
- **Connection:** G ½” (ISO 228)
- **Order No.:** BE26615

**DIMENSION**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>L</th>
<th>E</th>
<th>SW</th>
</tr>
</thead>
<tbody>
<tr>
<td>83.5</td>
<td>97.5</td>
<td>100</td>
<td>60</td>
<td>32.0</td>
</tr>
</tbody>
</table>

**MATERIAL**

- **Valve Housing:** Brass
- **Coils:** Epoxy coated encapsulated coil
- **Cable Connector Material:** Plastic

**RANGE OF APPLICATIONS:**

Natural fluids, compression air, town gas, water, hydraulic oil, oils and fats without additives (-10 to +90°C).
Function and Connection of Solenoid Valve Type 281

The Solenoid Valve Type 281 is a bistable system consisting of coils.

The Solenoid Valve Type 281 is being activated with a short electric impulse.

The Solenoid Valve Type 281 is designed to be built in upright systems.

An impulse over clamps 2 and 3 causes that the armature pulls on and the valve is switching. If the electric impulse is removed, the armature will stay in the same position.

An impulse over clamps 1 and 3 causes that the coils are losing its power. The armature will be reset back to original position with help from a spring.

The Solenoid Valve Type 281 is supplied with 4 terminals marked 1, 2, 3 and earth armature.

The impulse system has to be connected as described in diagram no.: 1 this page.

Connection clamps in the cable connector is marked with the same 1, 2, 3 and earth armature.

Note: Clamp 1 and 2 should not be connected at the same time. No other users (relay or others) should not be connected parallel to the claims.
DATA SHEET - 140178
PAGE - 1 OF 1
DATE - (MARCH 2001)

TECHNICAL DATA

Description: SUCO Pressure Switch Model 0166

Part No.: BE26255

Body material: Zinc plated steel (Fe/Zn 12cC)

Protective cap: EPDM

Thread: ¼” BSP/NPT

Duty: 100VA

Protection: IP65, terminals IP 00

PRODUCT DESCRIPTION

The Pressure Switch Model 0166 consists of a zinc plated steel body and a diaphragm made of EPDM.

The Pressure Switch Model 0166 can be used in spaces with Water, Hydrogen, Seawater, acetylene, ozone & oxygen.

Max.Operation: 200/min.

Max. Voltage: 42

Temperature range: -30°C to +120°C (Depends on diaphragm material)

Over pressure: up to 300 bar

GW SPRINKLER A/S
KASTANIEVEJ 15 – DK5620 GLAMSBJERG DENMARK
TEL.: +45 64 72 20 55
FAX: +45 64 72 22 55
e-mail: sales.dep@gwsprinkler-com

SUOCO PRESSURE SWITCH
MODEL 0166
TECHNICAL DATA:

K-Factor and Water Flow: \( Q = K \sqrt{\text{bar}} \)

K-Factors Available: 5 litre (min x \( \sqrt{\text{bar}} \))

Spray Angle of Water Mist: 90°

Nozzle Materials:

Naval Brass with NiSn plating
Aluminium bronze*
Stainless Steel 316*
*Made to order.

Finish: Natural

Blow off Cap: SS 316 with teflon bush

Extinguishing Agent:
- Fresh water
- Seawater
- Foam enhanced water

Water Droplet Sizes:

<table>
<thead>
<tr>
<th>BAR</th>
<th>( D_{V90} ) ( \mu m )</th>
<th>( D_{V50} ) ( \mu m )</th>
<th>( D_{V10} ) ( \mu m )</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>277</td>
<td>171</td>
<td>69</td>
</tr>
<tr>
<td>7</td>
<td>250</td>
<td>151</td>
<td>55</td>
</tr>
<tr>
<td>12</td>
<td>247</td>
<td>138</td>
<td>50</td>
</tr>
</tbody>
</table>

Approvals on M5

- Tested in accordance with IMO MSC/Circ. 668/728 for class 3 Category A engine room with M2 nozzle installed in bilge areas.

- Tested in accordance with IMO MSC/Circ.913 (acceptable to MSC/Circ. 1387) for local application category A Engine and pump rooms.

- Tested in accordance with requirements of Factory Mutual Global Requirements for water mist protection of spaces with up to 10m ceiling height and up to 3340m³ volumes.
PRIOR TO INSTALLATION OF NOZZLE:
Pipe works is flushed for debris and swarf and filters to be cleaned.

Nozzles only to operate in clean fresh or saltine water.

INSTALLATION:
Nozzles are fitted in installed pipe work.

Automatic nozzles are fitted in wet or dry-pre-action non-corrosive pipes.

An additional range of rosettes, valves and flow switches, is available from GW Sprinkler A/S.

DESCRIPTION:
The GW M-series consists of low pressure water mist nozzle designed for a large variety of applications and hazards.

The GW M-Series is Water Mist Nozzles suitable for installation in dry pipe systems.

The Nozzles are designed to produce a fine mist of small water droplets. This makes the nozzles suitable for fire protection of spaces such as engine rooms, turbine enclosures, paint booths, cable tunnels, switchboards installations, other enclosed spaces with limited draft conditions, which and suitable for fire protection with water mist.

The GW M-series Water Mist Nozzles are fitted with blow-off protection caps. The cap protects the nozzle during shipping, handling and installation. The caps automatically blow off the nozzle due to pressure in the pipe work during discharge.

The GW M-Series Water Mist Nozzle is on request available in different k-factors. The K-factors and pressures must match the hazard in accordance with design guidelines.

The GW M-Series Water Mist Nozzles should be installed in a pipe system made of stainless steel or copper alloys. Plastic piping or galvanised steel may be used in protected spaces where authorities and local regulations allow plastic piping for traditional sprinkler systems. A strainer with a mesh sizes of max. 1.2mm should be installed at the nozzle pipe inlet.
PyroStop® Basic Valve

<table>
<thead>
<tr>
<th>POS. NO.:</th>
<th>DESCRIPTION</th>
<th>PYROSTOP® BASIC VALVE</th>
<th>MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DIAPHRAGM</td>
<td>BE25153</td>
<td>BE25115</td>
</tr>
<tr>
<td>2</td>
<td>DIAPHRAGM PLATE</td>
<td>BE25149</td>
<td>BE25108</td>
</tr>
<tr>
<td>3</td>
<td>SEAT CUP</td>
<td>BE25148</td>
<td>BE25107</td>
</tr>
<tr>
<td>4</td>
<td>SEAT RING</td>
<td>BE25151</td>
<td>BE25111</td>
</tr>
<tr>
<td>5</td>
<td>O-RING</td>
<td>BE25152</td>
<td>BE25113</td>
</tr>
<tr>
<td>6</td>
<td>FILTER</td>
<td>BE26614</td>
<td>BE26614</td>
</tr>
<tr>
<td>7</td>
<td>FILTER NUT</td>
<td>BE26609</td>
<td>BE26610</td>
</tr>
<tr>
<td>8</td>
<td>SENSOR SCREW *</td>
<td>BE26613</td>
<td>BE26613</td>
</tr>
<tr>
<td>9</td>
<td>INDUCTIVE SENSOR*</td>
<td>2659051</td>
<td>2659051</td>
</tr>
<tr>
<td>10</td>
<td>PROTECTION PIPE*</td>
<td>BE26248</td>
<td>BE26248</td>
</tr>
<tr>
<td>11</td>
<td>O-RING*</td>
<td>BE25374</td>
<td>BE25374</td>
</tr>
<tr>
<td>12</td>
<td>SENSOR BUSH</td>
<td>BE26247</td>
<td>BE26247</td>
</tr>
<tr>
<td>13</td>
<td>SPINDLE SCREW</td>
<td>BE26618</td>
<td>BE25369</td>
</tr>
<tr>
<td>14</td>
<td>SPRING</td>
<td>BE25836</td>
<td>BE25837</td>
</tr>
<tr>
<td>15</td>
<td>SOLID PLUG</td>
<td>BE26257</td>
<td>BE26257</td>
</tr>
</tbody>
</table>

*Special part for option: Inductive Sensor

GW SPRINKLER A/S
KASTANIEVEJ 15 – DK5620 GLAMSBJERG DENMARK
TEL.: +45 64 72 20 55
FAX: +45 64 72 22 55
e-mail: sales.dep@gwsprinkler-com

PyroStop®
Basic Valve
Spare Part List
Please notice that!
Gasket should be replaced every 2 year.
PyroStop® Valve should be checked and cleaned every year.

For further information please apply for data sheets:
14664   → Connection of inductive sensor
140138 → PyroStop® Basic

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KASTANIEVej 15 – DK5620 GLAMSBÆRGER DENMARK
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FAX: +45 64 72 22 55
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**PyroStop®**
Basic Valve
Spare Part List
TECHNICAL SPECIFICATIONS:

K-Factor: 80±3 (metric)  \( q = K \cdot \sqrt{p} \)

RTI-Value: <43 (metric)  \( q = \frac{1}{\text{min.}} \)  \( p = \text{bar} \)

Weight: 60g (Brass)

Nominal release temperature

Year of manufacture

Quick Response Bulb (3mm)

<table>
<thead>
<tr>
<th>NOM. RELEASE TEMP.</th>
<th>MAX. AMB. TEMP.</th>
<th>COLOUR OF BULB</th>
</tr>
</thead>
<tbody>
<tr>
<td>57°C</td>
<td>27°C</td>
<td>ORANGE</td>
</tr>
<tr>
<td>68°C</td>
<td>38°C</td>
<td>RED</td>
</tr>
<tr>
<td>79°C</td>
<td>49°C</td>
<td>YELLOW</td>
</tr>
</tbody>
</table>

AVAILABLE MATERIALS:
- Brass, ISO CuZn38Pb3
- Stainless steel ASTM 316
- Stainless steel UNS S31254
- Titanium ASTM B367 GR.C2

AVAILABLE FINISHES:
- Natural
- Chrome, ENP, coloured

APPROVALS:
- –

INSTALLATION:
Install in pendant position. GW spanner must always be used when fitting sprinkler into pipework.

Sprinklers that have been dropped or damaged in any way must not be installed, they should be returned to supplier.

GW SPRINKLER A/S
KASTANIEVEJ 15, DK-5650 GLAMSBORG, DENMARK
TEL: +45 64 72 20 55
FAX: +45 64 72 22 55
GW-DD1-EL Sprinklers are automatic GW-DD1 miniature sprinklers based on GW-DD1 Sprinklers as approved by The Loss Prevention Certification Board (LPCB), Factory Mutual (FM) and Verband der Schadenversicherer (VdS) but with an extra opportunity for electrically controlled sprinkler operation.

**Table 1:** Apparatus on GW- DD1-EL

<table>
<thead>
<tr>
<th>TYPE</th>
<th>TEMP</th>
<th>APPROVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø18mm GW-DD1-EL 557 3SU</td>
<td>57, 86, 120</td>
<td>LPCB</td>
</tr>
<tr>
<td>Ø12mm GW-DD1-EL 557 3SP</td>
<td>57, 86, 120</td>
<td>LPCB</td>
</tr>
<tr>
<td>Ø18mm GW-DD1-EL 557 5SU</td>
<td>57, 86, 120</td>
<td>LPCB</td>
</tr>
<tr>
<td>Ø12mm GW-DD1-EL 557 5SP</td>
<td>57, 86, 120</td>
<td>LPCB</td>
</tr>
<tr>
<td>Ø15mm GW-DD1-EL 190 5SU</td>
<td>57, 86, 120</td>
<td>LPCB</td>
</tr>
<tr>
<td>Ø15mm GW-DD1-EL 190 5SP</td>
<td>57, 86, 120</td>
<td>LPCB</td>
</tr>
</tbody>
</table>

* LPCB approved in brass, chrome & coloured

GW-DD1-EL glass bulb sprinklers are available in all traditional types of sprinklers with 3/8" and 1/2" BSPT and NPT threaded, connected sprinklers and K-factors of 57, 80 & 115 (metric).

**SPRINKLER TYPES:**
- Spray upright, (SU)
- Spray upright, (SP)
- Conventional, upright pendant, (CU/P)
- Sidewall, upright pendant, (WU/P)
- Horizontal sidewall, (WHC/P)

**GLASS BULB HEAT RELEASE TEMPERATURES:**
- 57°C (Orange bulb)
- 68°C (Red bulb)
- 70°C (Yellow bulb)
- 83°C (Green bulb)

**SPRINKLER FINISHES:**
- Brass, Chrome, (Mat colours)
- Stainless Steel, Decorative finish

**SPRINKLER GLASS BULB RESPONSES:**
- Standard response: RTI = 100
- Special response: RTI [50, 80]
- Fast response: RTI < 50

**SPRINKLER SIZES:**
- 3/8" Thread: K57
- 1/2" Thread: K57, 80, 115

**AVAILABLE ELECTRIC RELEASE CURRENT:**
- Type 1: -0.9 amps for 10 ms pulse
- Type 2: -0.14 amps for 10 ms pulse

Recommended lifetime for Metron actuator: 10 years. (can be replaced on installed sprinkler by certified GW Sprinkler Installers).

GW Manual No. 846
M5 / Local Application Fire Protection of Category A Engine Rooms – IMO / MSC.1/Circ. 1387
Dated: 04-06-2014
Applications
Control boxes for Manual and Electric control of up to Hydraulic and Pneumatic controlled valves.

Box Design:
Red coated steel for mounting on inside walls. Pipes in brass and ball valves in brass plated with chrome. Alternative: Stainless Steel AISI316

Hydraulic Working Pressure:

Installation Plan Board:
The boxes are prepared for installation. Plan board to be fitted on the inside of the box door.

Safety Against Accidental Activation (Manual Release)
Zone valve and drain valve need to be opened to activate a sprinkler zone. 4 sprinkler zones may be activated momentaniously.

GW SPRINKLER A/S

KASTANIEVEJ 15 – DK5620 GLAMSBJERG DENMARK
TEL.: +45 64 72 20 55
FAX: +45 64 72 22 55
e-mail: sales.dep@gwsprinkler-com

GW Control Boxes
for Manual and Electric release of controlled control valve
SPRINKLER ACCESSORIES

GUARDS
SPRINKLER GUARD: WIRE CLIP TYPE
PART NO.: BE07160

WATER SHIELDS/HEAT COLLECTORS FOR UPRIGHT SPRINKLERS
ø150mm
PART NO.: 09-81511
ø300mm
PART NO.: 09-27200

WATER SHIELDS FOR PENDENT SPRINKLERS
10mm DD1
PART NO.: 09-71501
15mm DD1
PART NO.: 09-71511
20mm DD1
PART NO.: 09-71521

SPRINKLER CABINETS
CABINET FOR 12 SPRINKLER
PART NO.: 09-40021
CABINET FOR 48 SPRINKLER
PART NO.: 09-40041

SPANNERS
KEY SPANNER
PART NO.: BE25061
EL-KEY SPANNER
PART NO.: BE25072
GUARD SPANNER
PART NO.: BE25673
ESFR SPRINKLER SPANNER MODEL ESFR
PART NO.: 09-30440
DRY PENDENT SPANNER MODEL G3
PART NO.: 09-30300

FIX BOX SPANNER
PART NO.: BE25661

STOP KEY
PART NO.: 09-50002

GW SPRINKLER A/S
KASTANIEVej 16 DK-8620 SJAELLAND, DENMARK
TEL: +45 64 72 20 56
FAX: +45 64 72 22 05
e-mail: salesdep@gwspinkler.com

DWG.NO.: 14628 D
DATE: JULY 2000