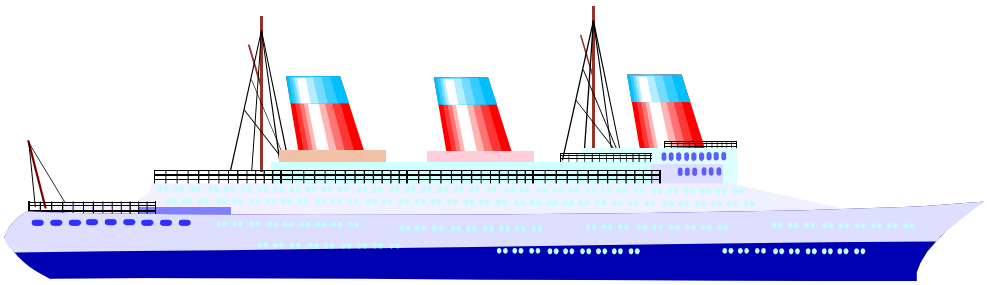
GW Model M5

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



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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 maneouvrability. 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.

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 \ 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 (η) 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.

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

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 cable 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. (Dv90 = 250μm). 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 below listed system components. The GW M5 nozzle is manufactured by GW Sprinkler.

Components under section 2 shall be sourced from relevant 3rd party provider, in compliance with project design and approval requirements.

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: System components to satisfy the requirements in MSC.1/Circ. 1387 for controlling and monitoring of systems:

- Control of water to the nozzle application zones (on/off zone valve).
- Isolation of nozzle zones (isolation valve).
- Activation of nozzle zones (automatic/manual).
- Filtration of water to nozzle zones.
- Functional tests.
- Activation of alarms (when system is activated).
- 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.

Key parameters	**Specific for GW Model M5 Nozzles**		
Nozzle connection	½" BSPT Thread		
Nozzle materials System with fresh water priming Systems for sea-water	SnNi plated Brass, w. SS 316 deflectors & filter SS 316 nozzles		
Nozzle protection	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.		
Nozzle k-factor (water)	5 (kg/min √bar)		
Droplet size. (Dv90)	250 μm		
Smallest water passage	Filter: 1mm, Orifices: 2mm		
Water pressures	3.5 bar - 16 bar		
Vertical installation heights above fire risks / minimum water pressure on pendent nozzles:	Installation height	Water pressure	
	0.5m - 8m	3.5 - 10 (bar)	
	8m - 14.5m	9 - 10 (bar)	
Nozzle spacing for vertical installed nozzles	Maximum 3m between nozzles		
Minimum Water flows and waters densities for pendent installed Nozzles.	Installation height over the fire risk (m)	Minimum water flow from each nozzle (l/min.)	Minimum water density on application food-print (mm/min)
	0.5m - 8m	9.4 (l/min)	1.0 (mm/min)
	8m - 14.5m	15 (l/min)	1.7 (mm/min)
Maximum obstructions between pendent installed nozzles and fire risk (obstructions larger than 0.5m wide.) Before additional nozzle should be installed.	The object seen from single nozzle must not obstruct more then 20° of the spray The object seen from the fire risk must not obstruct more than 20°. (see also chapter 2, 3)		
Horizontal installed nozzles	Chapter 2, 3		
Nozzle pipes	GW Recommend the use of stainless steel pipes for nozzle pipes. Systems shall be hydraulic calculated.		

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 cable 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 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. Another 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. Attendance should be taken to design the pipe system in such a way that pipes and components do not need to be dismounted when applications are maintained or repaired. Pipes and components should not obstruct passages, openings, doors or hatches in the room.
Pipes and nozzles should be installed above hoists and other moving equipment in the location.

Pipes and components should be chosen in materials suited for the 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.

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. Ordering system components from GW Sprinkler.

GW Sprinkler is able to supply some of the system key components. Other components such as valves, strainers, 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.

4.1 Ordering GW Model M5 Water Mist Nozzles:

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

GW Model M5, nozzle material	GW Part No.
Brass with SnNi plating	6323111
Stainless Steel ANSI 316	6323450

Table 12: Ordering Numbers for GW Model M5 Water Mist Nozzles.

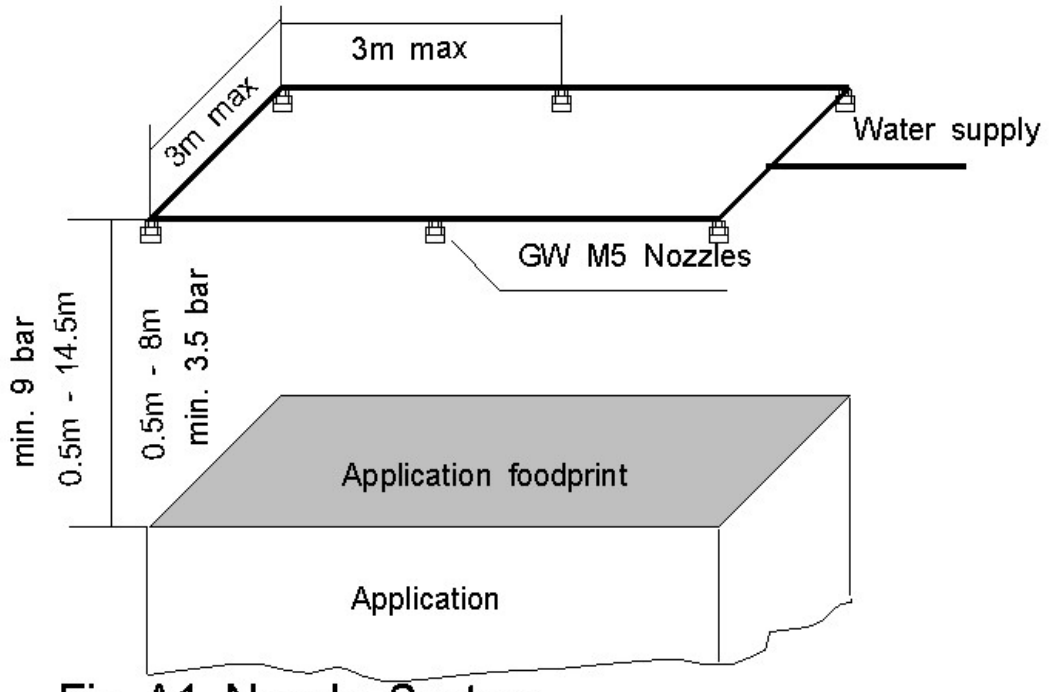


Fig A1 Nozzle System

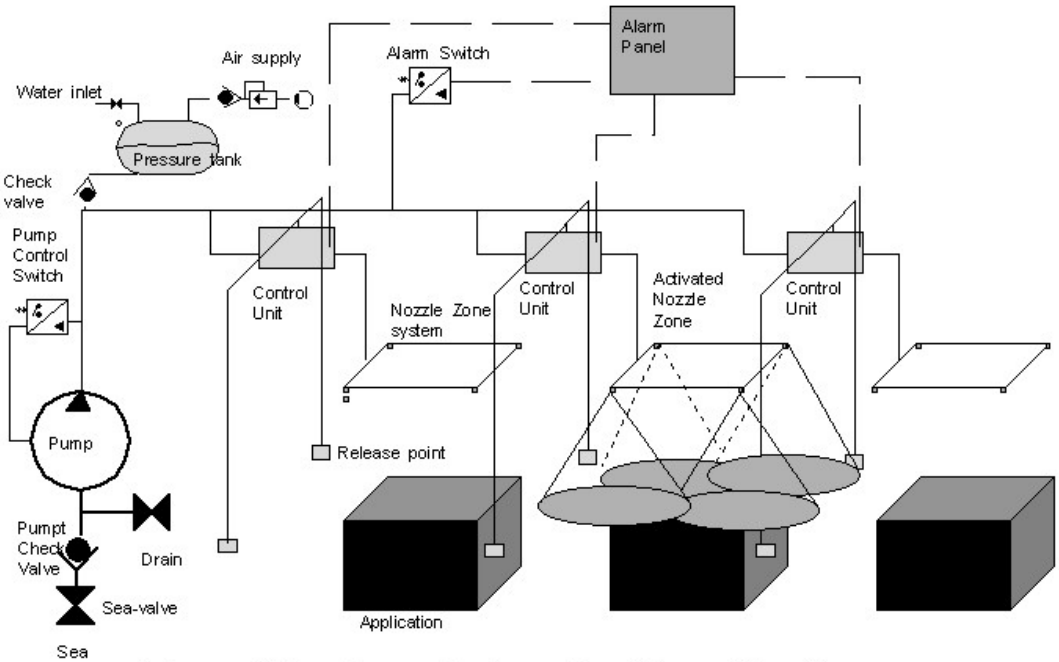


Fig. A2 Local Application System

"Control Unit" = section valve

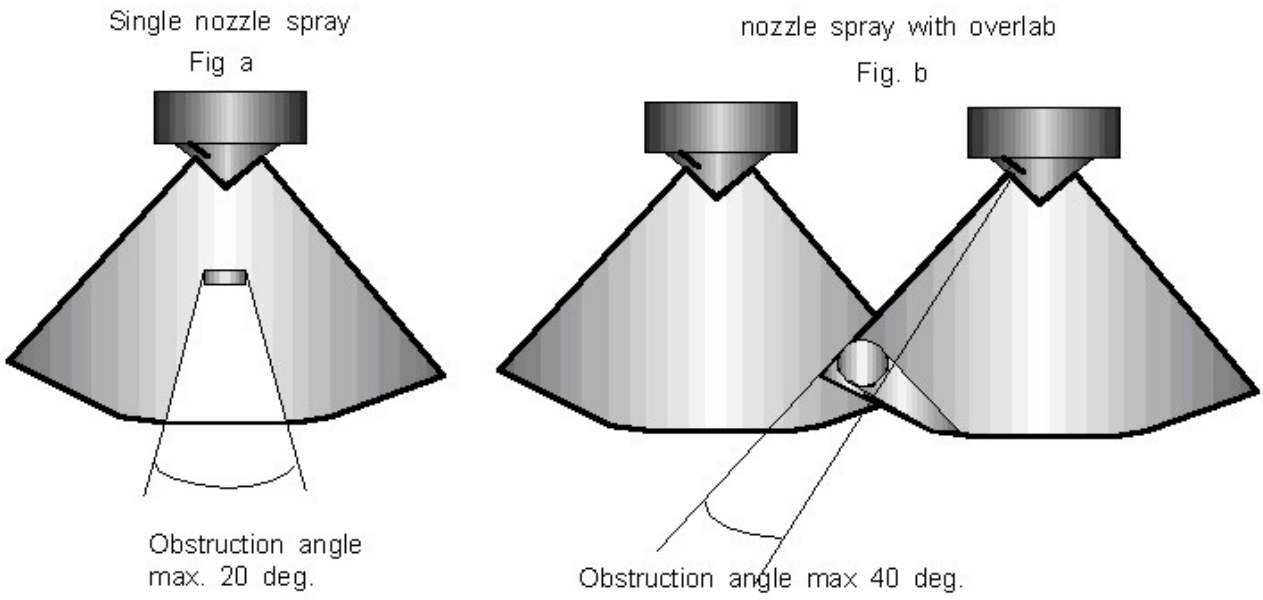


Fig. B1 Maximal obstruction seen from Nozzle

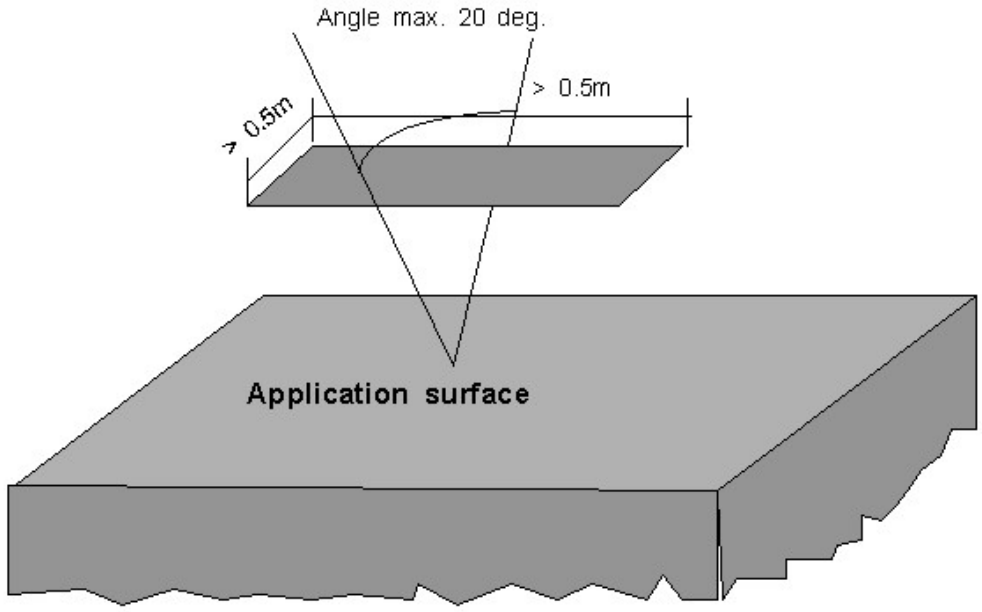


Fig. B2 Obstructions seen from the application surface, which require additional nozzles

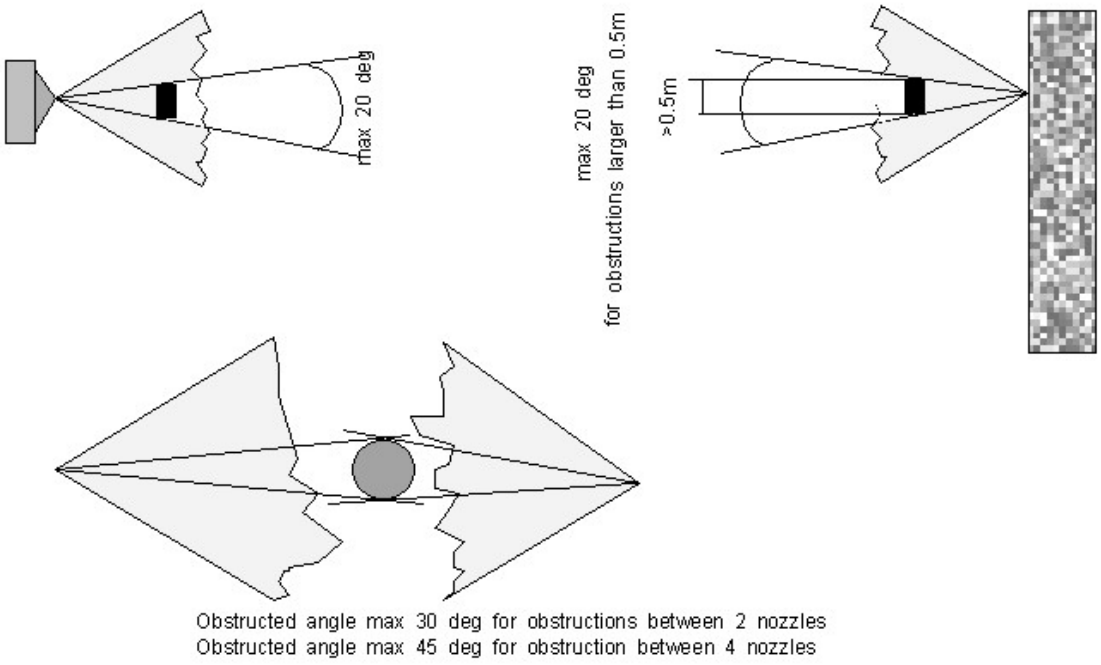


Fig B3 & B4 Obstructed horizontal spray

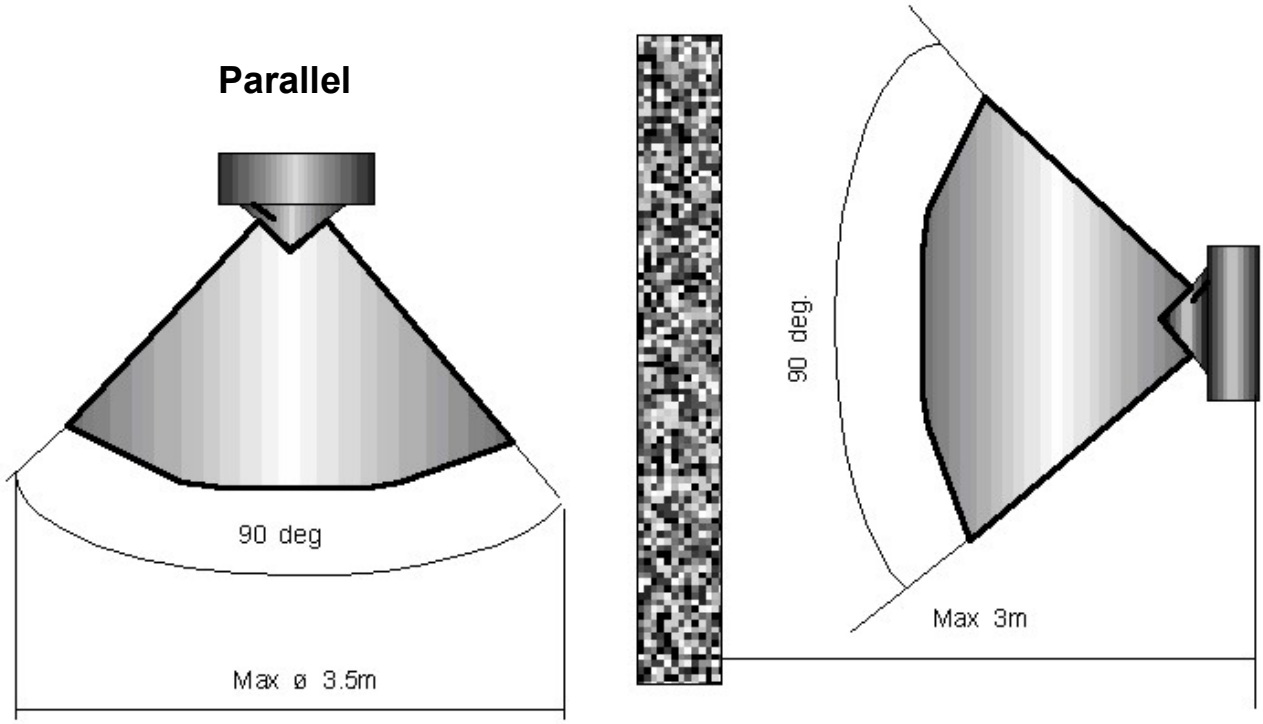
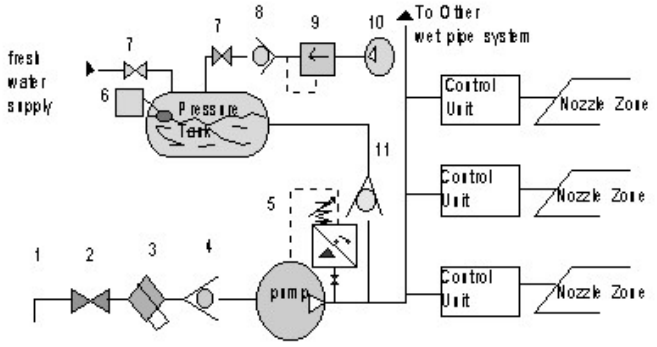


Fig. C1 & C2 Nominal design parametres for Horizontal spray (TOP DOWN VIEW)

Local Application water mist system design (schematic) – main components:



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. D1 Water supply system w. pressure tank

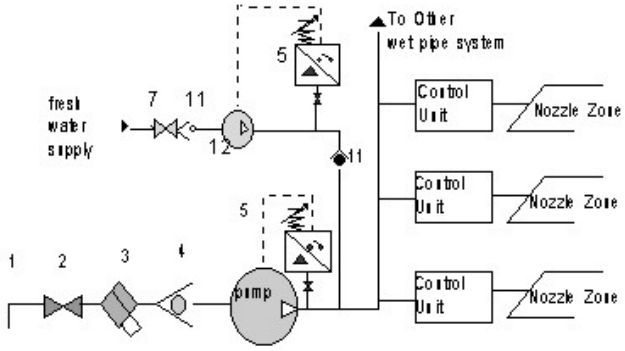


Fig. D2 Water Supply system w. jockey pump

"Control Unit" = section valve +

system components to satisfy the requirements in MSC.1/Circ. 1387 for controlling and monitoring of systems:

- Control of water to the nozzle application zones (on/off zone valve).
- Isolation of nozzle zones (isolation valve).
- Activation of nozzle zones (automatic/manual).
- Filtration of water to nozzle zones.
- Functional tests.
- Activation of alarms (when system is activated).
- Nozzle zone drain facilities.
- Monitoring.

GW M5
WATER MIST NOZZLE
K-5, LOW PRESSURE, NON-AUTOMATIC

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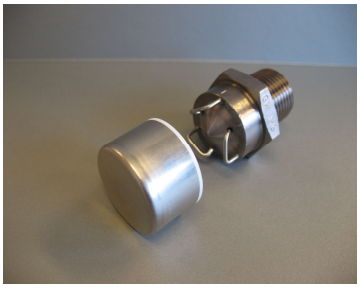

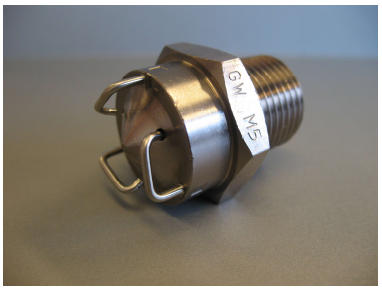

DESCRIPTION
The **GW M5** is a compact low pressure water mist nozzle specifically developed for use in total and local protection water mist fire extinguishing systems – both for marine and land based applications.

The nozzle is designed to efficiently produce a fine mist of small water droplets at low pressure (3,5 to 16 bar). This makes the nozzle suitable for a large variety of fire protection applications, where fuel pool and high pressure spray fires may occur. Relevant applications are:

- engine rooms
- engine test bench
- turbine enclosures
- paint booths
- cable tunnels
- switch board installations
- other enclosed occupancies with limited draft conditions, suitable for fire-protection with water mist.

If required, the GW M5 water mist nozzle can be used in AFFF (aqueous film forming foam) enhanced systems.

BLOW-OFF CAP
The GW M5 water mist nozzle is fitted with a robust stainless steel protective cap to prevent any damage to the deflectors during handling, installation and service. The protective cap is specification tested by FM and is designed to remain in place after nozzle installation, thus effectively protecting the nozzle orifices from clogging caused by external contamination.
The protective cap is fitted with a high quality virgin PTFE bush to provide reliable low friction ejection (Blow-Off) when the water mist system is activated and water is discharged.

FILTER/STRAINER
The GW M5 water mist nozzle is as standard fitted with a SS316 wire mesh strainer in the nozzle inlet, to prevent water born debris from entering the nozzle and clogging of the orifices.

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GW M5
WATER MIST NOZZLE
K-5, LOW PRESSURE, NON-AUTOMATIC

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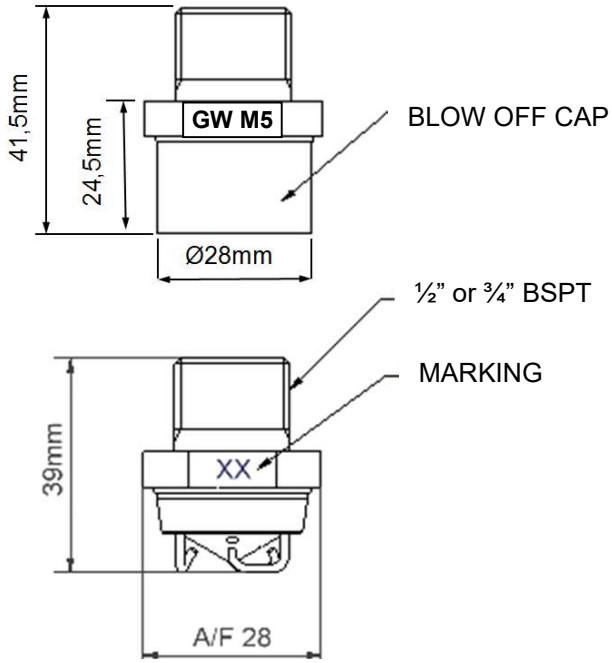
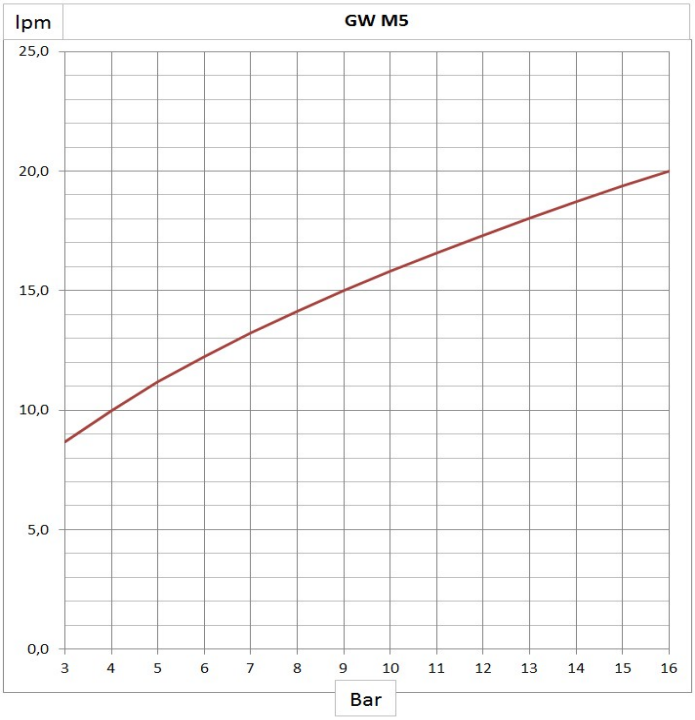
TECHNICAL DATA



K-factor	5 (metric) / 0,34 (imperial)
Spray Angle	90°
Droplet Size	See table (below)
Materials	
Nozzle Body	Brass (SnNi-plated), SS316 or Titanium*
Deflector	SS316, Titanium*
Strainer	SS316, Titanium*
Protective Cap	SS304
Bush	Virgin PTFE
Weight	98 g (brass, incl. Blow Off Cap)
Thread	½" BSPT or ¾" BSPT
Working Pressure	3,5 to 16 bar
For use with	Fresh Water, Sea Water or Foam (AFFF) enhanced water

Working Pressure	DROPLET SIZE (µm)		
BAR	D_{V90}	D_{V50}	D_{V10}
3	277	171	69
7	250	151	55
12	247	138	50

PRESSURE / FLOW GRAPH



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INSTALLATION

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 be familiar with GW Manual No. 846 M5 / Local Application Fire Protection of Category A Engine Rooms – IMO / MSC.1/Circ. 1387, and they should be aware of the risks of system mal-function, if the instructions and precautions listed in the manual are not followed.

Nozzles should be installed in such a way that installation heights, nozzle distances and water pressures, as listed in table 1 and Fig A1, are satisfied.

Table 1

Key parameters	**Specific for GW Model M5 Nozzles (local protection)**		
Min. distance between nozzle and object	0,5m (vertical)		
Max. distance between nozzle and object	14,5m (vertical)		
Vertical installation heights above fire risks / minimum water pressure on pendent nozzles:	Installation height	Water pressure	
	0.5m - 8m	3.5 - 10 (bar)	
	8m - 14.5m	9 - 10 (bar)	
Maximum nozzle spacing for vertically installed nozzles:	3m between nozzles		
Maximum distance to wall	½ spacing = 1,5m		
Minimum water flows and water densities for nozzles installed in the pendent position:	Installation height over the fire risk (m)	Min. water flow from each nozzle (l/min)	Min. water density on application foot-print (mm/min)
	0.5 – 8,0	9.4	1.0
	8.0 - 14.5	15	1.7
Maximum obstructions between pendent installed nozzles and fire risk (obstructions larger than 0.5m wide) before additional nozzle should be installed.	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° of the spray.		
Horizontally installed nozzles	See chapter 2.5 of Manual no. 846		
Nozzle pipes	GW recommends the use of stainless steel pipes for nozzle pipes. Systems shall be hydraulically calculated.		
System in-line strainer	A strainer (Y or Basket) with a mesh sizes of max. 1.5mm should be installed at the nozzle pipe inlet.		

Nozzle pipe work should be hydraulically 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 are only installed 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 in order to maintain or repair machinery or application in the engine room.
Before installation of 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 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 nozzle protective cap should be left on while and after installing the nozzles, to prevent the risk of damaging the nozzles. Nozzles should be tightened to the pipe system female thread applying a torque of 4 Nm ± 1Nm.
If a nozzle deflector pin is bent off-center to the orifice hole, or knocked up against the orifice hole, the nozzle will not distribute the water correctly. Such damaged nozzles should immediately be replaced with new.
When installing nozzles and pipes, it is important only to apply thread sealant on the male thread parts, and to ensure that there is no excess sealant 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.

Fig A1 – Nozzle Spacing and distance to object

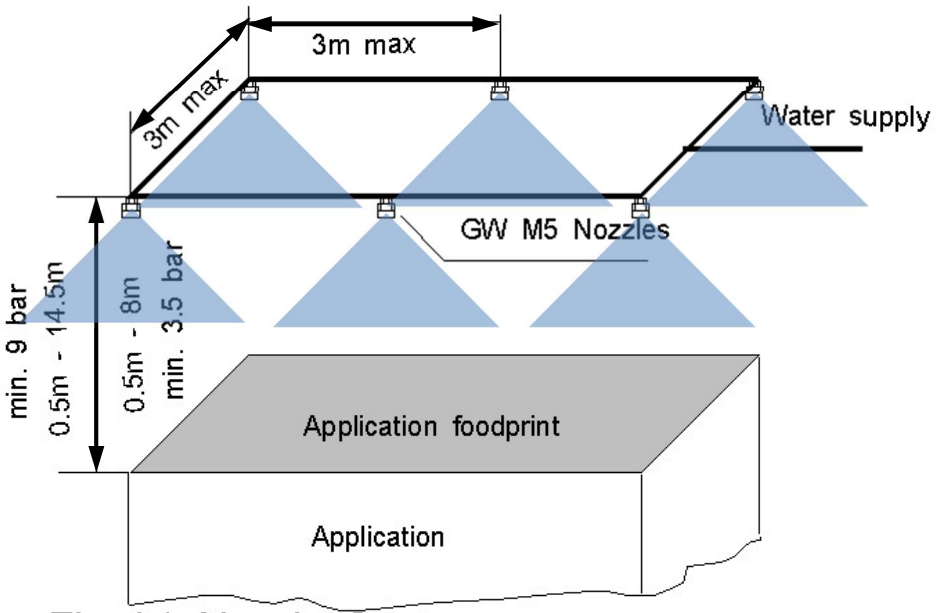

Fig A1 Nozzle System

MAINTENANCE AND INSPECTION

GW M5
WATER MIST NOZZLE
K-5, LOW PRESSURE, NON-AUTOMATIC

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The GW M5 water mist nozzle shall be maintained and inspected according to NFPA 750 and NFPA 25. Special attendance shall be given to any signs of damage and corrosion. The protective cap shall be removed to visually inspect the deflector pins integrity – i.e. correct position = ~1,2mm over, and concentric to, the orifices. A representative number of nozzles shall be unscrewed from the pipework and the nozzle inlet strainer checked (and if necessary cleaned) for any blockage.
Damaged, painted or corroded nozzles must be replaced with new identical type nozzles.

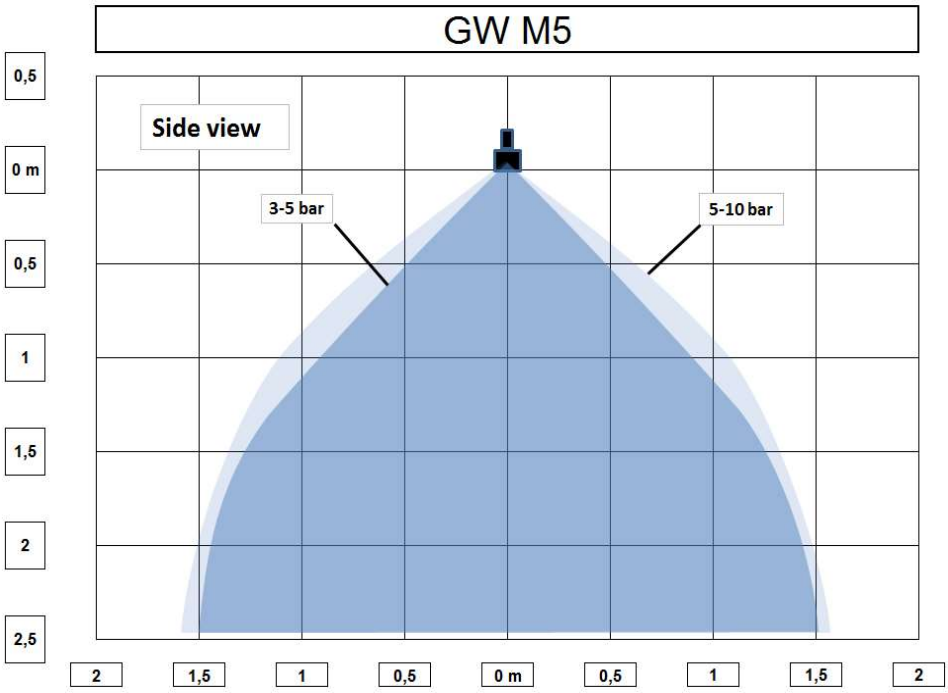
TESTING
The GW M5 water mist nozzle has been tested by recognized 3rd party laboratories:

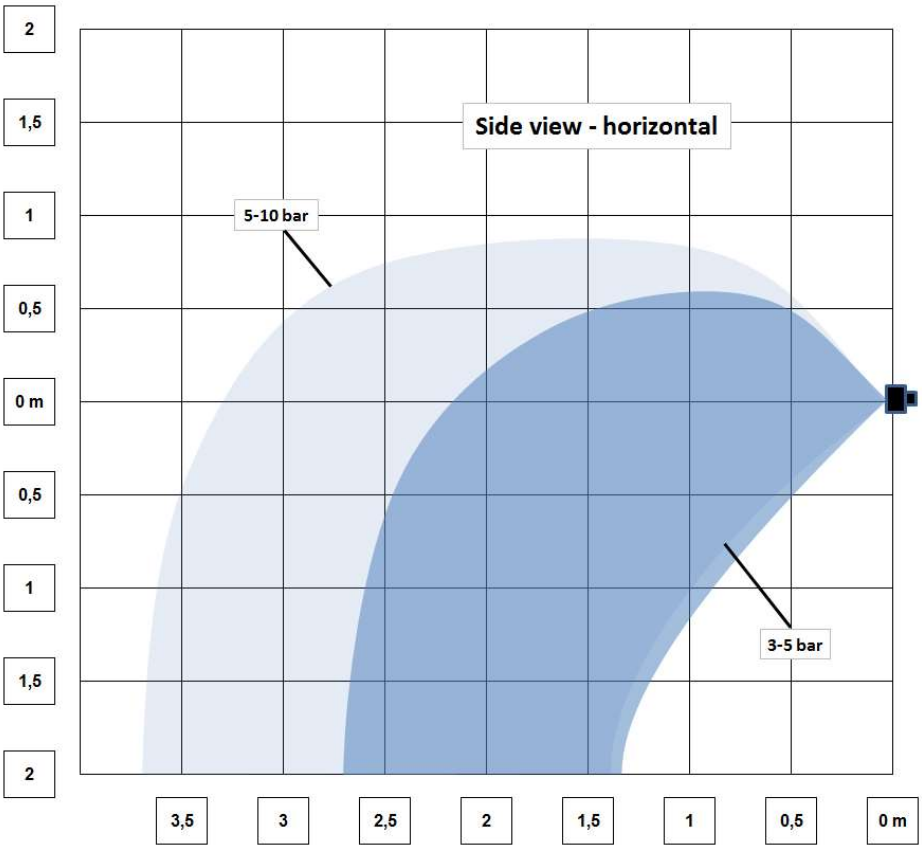
Laboratory	Test Type	Test Code	Test Content
FM	Specification Test	IMO MSC/Circ. 668/728	Component test – Brass (SnNi)
FM	Specification Test	IMO MSC/Circ. 668/728	Component test – Protective Cap
FM	Specification Test	IMO MSC/Circ. 668/728	Component test – Titanium
SINTEF	Approval Test	IMO MSC/Circ. 668/728	Fire Extinguishing Test
SINTEF	Approval Test	IMO MSC/Circ. 913	Fire Extinguishing Test
RIME	Specification Test	Generator, Motor, Panel	IP22 – Impingement Test

APPROVALS

	Bureau Veritas	FIXED WATER BASEDLOCAL APPLICATION FIRE FIGHTING SYSTEMS COMPONENTS FOR USE IN CATEGORY “A” MACHINERY SPACES – IMO MSC.1/CIRC 1387
	MED Bureau Veritas	FIXED WATER BASEDLOCAL APPLICATION FIRE FIGHTING SYSTEMS COMPONENTS FOR USE IN CATEGORY “A” MACHINERY SPACES – IMO MSC.1/CIRC 1387
DNV	**DNV**	APPROVED FOR USE AS A FIXED WATER BASED LOCAL APPLICATION SYSTEM FOR MACHINERY SPACES OF CATEGORY A - IMO MSC.1/CIRC 1387
Lloyd's Register	**Lloyd’s Register**	FOR USE IN MACHINERY SPACES OF CATEGORY A OF VOLUME GREATER THAN 500M3 FOR PROTECTION OF LOCAL HAZARDS - IMO MSC.1/CIRC 1387
CCS	**CHINA CLASSIFICATION SOCIETY**	FIXED WATER-BASED LOCAL APPLICATION FIRE FIGHTING SYSTEM - IMO MSC.1/CIRC 1387
ClassNK NIPPON KAIJI KYOKAI	**CLASS NK**	NOZZLE FOR FIXED LOCAL APPLICATION FIRE FIGHTING SYSTEM - IMO MSC.1/CIRC 1387
	USCG	WATER MIST FIRE EXTINGUISHING SYSTEM – LOCAL APPLICATION WATER MIST NOZZLE - IMO MSC.1/CIRC 1387
	RINA	LOCAL APPLICATION FIRE FIGHTING SYSTEM FOR HIGH FIRE RISK AREAS IN MACHINERY SPACES OF CATEGORY A - IMO MSC.1/CIRC 1387

NOTE: Approval status may be subject to change. Please consult GW Sprinkler for actual status.





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