Nozzle Design Layout

Part 1: Land Applications—Machinery Spaces, Industrial Hazards, Combustion & Gas Turbine Enclosures, Light & Ordinary Hazards

Fogex Nozzles

Fogex water mist nozzles are selected for a risk area having regard to the fire hazards requiring protection and dimension criteria of the risk area. The water fog nozzles are positioned to provide uninterrupted water fog momentum, maximum spray coverage and impingement. Fogex nozzles are supplied with in-built 316 grade stainless steel filters to prevent blockage.

Fogex nozzles are manufactured of high quality aluminium bronze. Stainless steel nozzles are also available. The nozzles are fully serviceable and interchangeable. They are engineered to yield optimal flow rates, water spray flux densities, spray patterns and spray momentum. Fogex nozzles do not have any moving or rotating parts that may malfunction and are therefore extremely reliable, efficient, manufactured of high quality materials and are corrosion resistant. Fogex nozzles produce a very fine atomised water mist (or fog) pattern encompassing a Class 1 water mist. They have been environmental tested in accordance with IMO Guidelines MSC/Circ. 668/728 Test Protocols by Factory Mutual (USA), project identifier No. 3007879, Class 5560.

Fogex for Land Applications:

<table>
<thead>
<tr>
<th>Nozzle Type</th>
<th>FMRC Design Pressure</th>
<th>Water Flow Rate L/min @ 100 bar</th>
<th>K-Factor</th>
<th>Nozzle Coverage (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOGER F20</td>
<td>100 Bar</td>
<td>6.4</td>
<td>0.64 L/min/bar⁻¹</td>
<td>≤17</td>
</tr>
<tr>
<td>FOGER F27</td>
<td>100 Bar</td>
<td>5.3</td>
<td>0.53 L/min/bar⁻¹</td>
<td>≤17</td>
</tr>
<tr>
<td>FOGER F11</td>
<td>100 Bar</td>
<td>10.0</td>
<td>1.00 L/min/bar⁻¹</td>
<td>≥17</td>
</tr>
</tbody>
</table>

FA automatic nozzles have the same respective flow as their open deluge counterparts.

Nozzle Spacings – Land Applications:

<table>
<thead>
<tr>
<th>Nozzle Type</th>
<th>Nozzle Spacings (metres)</th>
<th>Water Flow Rate L/min @ 100 bar</th>
<th>Nozzle Heights (metres)</th>
</tr>
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<tbody>
<tr>
<td>FOGER F20</td>
<td>3 x 4</td>
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<td>5.0</td>
</tr>
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</tr>
<tr>
<td>FOGER F11</td>
<td>4 x 4</td>
<td>10.0</td>
<td>11.1</td>
</tr>
<tr>
<td>FOGER FA20</td>
<td>3 x 4</td>
<td>6.4</td>
<td>5.0</td>
</tr>
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<td>FOGER FA27</td>
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<tr>
<td>FOGER FA11</td>
<td>4 x 4</td>
<td>10.0</td>
<td>11.1</td>
</tr>
</tbody>
</table>

Nozzle Spacings and Location

The maximum horizontal spacing between nozzles is as per listings and/or manufacturer specifications. The nozzle spacings and ceiling heights should not be exceeded by more than 15% of their listed designs. Room hazard geometries are rarely symmetrical and a very small discretion in nozzle spacings is permitted, however, the Authority Having Jurisdiction (AHJ) and/or the manufacturer must be consulted first where it is anticipated that nozzle spacings may slightly exceed their Listing requirements.
**Total Flooding Applications:**

Fogex F20 & 27 nozzles are used for Total Flooding applications in land applications under NFPA 750 Standards and product approval Listings. The maximum grid spacing is 3 metres by four metres (3m x 4m). The maximum ceiling height for the Fogex F20 & F27 nozzles is 5.0 metres.

Fogex F20 multiple orifice full cone nozzles have a 35° spray angle to provide adequate spray coverage and penetration from a 5.0 metre ceiling height. Each Fogex F20 multi-orifice full cone spray nozzle provides an area of coverage of approximately 17 square metres of space at optimal spray pattern and flux density.

The minimum system operating pressure for land installations as per product Listings is 100 bars.

**Door Screen Nozzles:**

The Fogex F27 nozzles are door screen nozzles. They may be installed at ceiling level two metres apart and one metre away from and above door openings. The Fogex F27 nozzles are used to screen the oxygen from entering into the fire hazard areas. Installing Fogex F27 nozzles is an optional requirement and should be considered after a risk analysis of the fire hazard enclosure has been conducted. However, where large open access ways are encountered exceeding 4.0m² in opening, then Fogex F27 door screen nozzles must be installed to screen-off any possible free oxygen from entering the fire hazard enclosure. Generally, for doorways up to 1.0m wide, one Fogex F27 nozzle shall be installed; for doorway openings up to 2.0m width, two Fogex F27 nozzles are installed and so on.

**Local Applications:**

For Local Application systems on land Fogex F11 nozzles may be used. The maximum nozzle grid spacing is four metres by four metres (4m x 4m). The minimum distance to a fire source is 2.0 metres and the maximum distance to a fire source is 10.1 metres. Design and installation of Fogex systems on land is in accordance with NFPA 750 Standards.

The uniquely designed Fogex F11 water mist nozzle has two orifice spray angles, ie one at 35° and another at 50°. This affords maximum spray pattern coverage and affords exceptional water droplet spray momentum to reach the seat of a fire to cause rapid fire extinguishment.

The minimum system operating pressure for Fogex F11 nozzles for use in Local Application systems is 100 bars. The Fogex F11 nozzles may be installed on the ceiling at 11.1 metres maximum height above the floor; or they can be installed on bulk-heads, on perimeter walls or on pipe support frames etc in either a vertical or horizontal direction, or at 45° where nozzles are mounted onto walls or supporting brackets positioned on floors around an object requiring protection.

**General Installation Requirements:**

The distance of nozzles from walls or bulk heads should not exceed one-half of the allowable distance between nozzles (maximum discrepancy should not exceed 15% depending on room symmetry). The distance of nozzles below the deck is in accordance with the listing and manufacturer specifications. Where nozzles are fitted on branch lines, or between lines that run up and down pitched or curved surfaces, the nozzles are installed in accordance with the manufacturer specifications. Wherever practicable, Fogex plumbing should be a “closed loop design” with no end of lines. For advice on nozzle location, please contact your nearest Fogex agent or manufacturer for assistance.

The Fogex water fog system is designed and installed to achieve complete mist distribution within the fire risk area. This is achieved by simultaneous operation of all “open type” nozzles in the fire risk area, or fire zone, by manual or automatic means. Where possible, Fogex nozzles are usually installed always on the ceiling of fire hazard enclosures. Wall mounted nozzles may be used for specific applications however the manufacturer and/or the Authority Having Jurisdiction (AHJ) must be consulted first.
**Land Applications:**

For installation and use in machinery spaces & cargo pump rooms, industrial hazards, combustion and gas turbine enclosures and other light and ordinary hazards on land the Fogex system minimum operating pressure is 100 bars. The Fogex system offers protection against all Class A and Class B (hydrocarbon fuel) fires including hydrocarbon fuels with the severity of concealed n-Heptane pan fires and flowing or spraying Diesel, oil or n-Heptane fires.

In combustion & gas turbine applications, Fogex F20 & F27 nozzles are not installed in such a way to cause a direct “hard” impingement onto hot turbine surfaces. Careful nozzle installation will ensure that adequate fog distribution throughout the combustion or gas turbine enclosure will be achieved without excessive fog impacting upon hot turbine components. This is to ensure that metallic turbine components may not become damaged to rapid surface cooling during fog discharge.

Fogex F20 & F27 nozzles can be placed on opposite ends of a combustion or gas turbine enclosure on the walls so that the spray momentum is diagonally opposing to each other during system activation. This will cause a “rotational fog flow” within the enclosure and prevent direct impingement onto hot turbine surfaces. Ceiling mounted nozzles can also be used simultaneously in addition to wall mounted nozzles to create a “total flooding” fog fire protection system.

In all other land applications analogous to Local Application systems where machinery spaces and industrial hazards are encountered (where specific Classification Society approvals are not required), Fogex F11 open type water mist nozzles may be used when ceiling heights are in excess of 5.0 metres. This recommendation by the manufacturer is provided based on fire testing conducted at VTT Laboratories for Local Application systems under IMO Guidelines MSC/Circ. 913 test protocols.

Fogex F11 nozzles have been tested and the minimum distance from a fire source to the nozzle is 2.0 metres and the maximum distance from a fire source to a nozzle is 10.1 metres. For installation design purposes, nozzles can be placed 3.0 metres above floor level and up to 11.1 metres above floor level using a minimum system operating pressure of 100 bars. Fogex F11 nozzles can be installed either in a vertical pendant or horizontal pendant position to cover these hazards, or a combination of both, eg ceiling mounted and wall mounted. Nozzles installed in a 45° position may be allowed provided that the manufacturer and/or the AHJ is contacted first.

**Nozzles—Spares**

It is recommended that spare Fogex nozzles be carried as part of emergency inventory for maintenance purposes. Generally, five (5%) percent is a suitable number of spare nozzles and is accepted throughout industry as standard practice. For example, a system which has 20 water fog nozzles installed, one (1) nozzle should be carried as spare. For a system with 50 nozzles installed, three (3) nozzles are carried as spare, and so on.
Part 2: Marine Applications—Machinery Spaces, Cargo Pump Rooms & Local Applications

**Fogex Nozzles**

Fogex water mist nozzles are selected for a risk area having regard to the fire hazards requiring protection and dimension criteria of the risk area. The water fog nozzles are positioned to provide uninterrupted water fog momentum, maximum spray coverage and impingement. Fogex nozzles are supplied with in-built 316 grade stainless steel filters to prevent blockage.

Fogex nozzles are manufactured of high quality aluminium bronze. The nozzles are fully serviceable and interchangeable. They are engineered to yield optimal flow rates, water spray flux densities, spray patterns and spray momentum. Fogex nozzles do not have any moving or rotating parts that may malfunction and are therefore extremely reliable, efficient, manufactured of high quality materials and are corrosion resistant. Fogex nozzles produce a very fine atomised water mist (or fog) pattern encompassing a Class 1 water mist. They have been environmental tested in accordance with IMO MSC/Circ. 668/728 Test Protocols by Factory Mutual Approvals in the USA, project identifier No. 3007879, Class 5560.

**Fogex Nozzles for Marine Applications – Total Flooding & Local Application:**

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<tr>
<th>Nozzle Type</th>
<th>IMO Design Pressure</th>
<th>Water Flow Rate L/min @ 100 bar</th>
<th>K-Factor</th>
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<tr>
<td>FOGEX F20</td>
<td>110 Bar</td>
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**Nozzle Spacings and Location**

The maximum horizontal spacing between nozzles is as per listings and manufacturer specifications. The nozzle spacings and ceiling heights should not be exceeded by more than 15% of their listed designs. Room hazard geometries are rarely symmetrical and a very small discretion in nozzle spacings is permitted, however, the manufacturer and/or the Authority Having Jurisdiction (AHJ) must be consulted first where it is anticipated that nozzle spacings may exceed slightly their Listing requirements.

**Total Flooding Applications:**

Fogex F20 & 27 nozzles are used for Total Flooding applications in marine applications under IMO MSC/Circ. 668/728 Regulations. The maximum grid spacing is 3 metres by four metres (3m x 4m). The maximum ceiling height for the Fogex F20 & F27 nozzles is 5.0 metres.

Fogex F20 multiple orifice full cone nozzles have a 35° spray angle to provide adequate spray coverage and penetration from a 5.0 metre ceiling height. Each Fogex F20 multi-orifice full cone spray nozzle provides an area of coverage of approximately 17 square metres of space at optimal spray pattern and flux density.

The minimum system operating pressure for marine installations as per IMO Regulations is 1600psi (110 bars).
Door Screen Nozzles:

The Fogex F27 nozzles are door screen nozzles. They may be installed at ceiling level two metres apart and one metre away from and above door openings. The Fogex F27 nozzles are used to screen the oxygen from entering into the fire hazard areas. Installing Fogex F27 nozzles is an optional requirement and should be considered after a risk analysis of the fire hazard enclosure has been conducted. However, where large open access ways are encountered exceeding 4.0m² in opening, then Fogex F27 door screen nozzles must be installed to screen-off any possible free oxygen from entering the fire hazard enclosure.

Local Application:

For Local Application systems on board marine vessels under the IMO Regulations, Fogex F11 nozzles are used. The maximum nozzle grid spacing is four metres by four metres (4m x 4m). The minimum distance to a fire source is 2.0 metres and the maximum distance to a fire source is 10.1 metres.

The uniquely designed Fogex F11 water mist nozzle has two orifice spray angles, ie one at 35° and another at 50°. This affords maximum spray pattern coverage and affords exceptional water droplet spray momentum to reach the seat of a fire to cause rapid fire extinguishment.

The minimum system operating pressure for Fogex F11 nozzles for use in Local Application systems under IMO Regulations MSC/Circ. 913 is 1450psi (100 bars). The Fogex F11 nozzles may be installed on the ceiling at 11.1 metres maximum height above the floor; or they can be installed on bulkheads, on perimeter walls or on pipe support frames etc in either a vertical or horizontal direction, or at 45° where nozzles are mounted onto walls or supporting brackets positioned on floors around an object requiring protection.

General Installation Requirements:

The distance of nozzles from walls or bulk heads should not exceed one-half of the allowable distance between nozzles (maximum discrepancy should not exceed 15% depending on room symmetry). The distance of nozzles below the deck is in accordance with the listing and manufacturer specifications. Where nozzles are fitted on branch lines, or between lines that run up and down pitched or curved surfaces, the nozzles are installed in accordance with the manufacturer specifications. Wherever practicable, Fogex plumbing should be a “closed loop design” with no end of lines. For advice on nozzle location, please contact your nearest Fogex agent or manufacturer for assistance.

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Nozzles—Spares

It is recommended that spare Fogex nozzles be carried as part of emergency inventory for maintenance purposes. Generally, five (5%) percent is a suitable number of spare nozzles and is accepted throughout industry as standard practice. For example, a system which has 20 water fog nozzles installed, one (1) nozzle should be carried as spare. For a system with 50 nozzles installed, three (3) nozzles are carried as spare, and so on.