Fire Test Protocols for Water Mist System
Protection of Non-Storage Occupancies,
Hazard Category 2 (HC-2) and Hazard
Category 3 (HC-3)

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• **FM Global Property Loss Prevention Datasheet 3-26, Fire Protection for Nonstorage Occupancies**
  - Document includes protection recommendations for Nonstorage Occupancies
  - Design tables included for sprinkler design demands for each hazard category including HC-1, HC-2, and HC-3
  - Includes protection recommendations for water mist systems with reference to FM Approved water mist systems for the protection of Nonstorage occupancies, hazard category 1 (HC-1)
  - Currently water mist systems are not recommended (or FM Approved) for HC-2 and HC-3
### Table 1. Hazard Categories Based on Predominant Occupancy

<table>
<thead>
<tr>
<th>Hazard Category</th>
<th>Predominant Occupancy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HC-1</strong></td>
<td>Areas with light overall combustible loading with limited combustibles used in processes, or operations of low hazard. This includes combustible furnishings that are typically noncontinuous in well-subdivided areas. This hazard category does not include any incidental storage of plastics, or plastics used in the construction of walls and/or ceilings. Examples include residential, offices, noncombustible manufacturing, and hospitals.</td>
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<tr>
<td><strong>HC-2</strong></td>
<td>Areas with moderate continuous combustible loading with combustibles in processes, or operations of moderate hazard due to limited quantities of plastics or ignitable liquids. Examples include manufacturing, such as machine shops, woodworking, and electronic assembly, as well as retail, theatres, and food production.</td>
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<tr>
<td><strong>HC-3</strong></td>
<td>Areas with generally continuous heavier combustible loading with limited quantities of ignitable liquids and/or heavier amounts of plastics. Examples include plastic manufacturing, vehicle manufacturing and assembly, and printing plants.</td>
</tr>
</tbody>
</table>

- Reference FM Global Data Sheet 3-26
- For further specific examples of occupancy classifications refer to Tables 4 & 5 in 3-26
• Develop water mist system test protocols for Nonstorage Occupancies, Hazard Category 2 and 3 (HC-2 and HC-3)
Fuel Packages

Class 2 Commodity (EUR Commodity Category I)

FM Global HC-2 Fire Hazard:
Class 2 commodity storage up to 3.05 m high

Cartoned Expanded Polystyrene (CEP) (EUR Commodity Category IV)

FM Global HC-3 Fire Hazard:
CEP commodity storage up to 1.52 m high
HC-2 Fuel Array
HC-3 Fuel Array

Plan View

Two half igniters

9.60 m

Elevation View

2.29 m

1.68 m
HC-2 Fuel Array
Anticipated Fire Test Scenarios

• *All tests conducted at maximum ceiling height specified by the manufacturer in 5 ft (1.5 m) increments*
  – Ignition under one nozzle – maximum spacing
  – Ignition between four nozzles – maximum spacing
  – Ignition under one nozzle – minimum spacing

• *Minimum ceiling height limit to be verified by spray overlap at minimum height based on spray coverage assessment*
Ignition Under One Nozzle
Ignition Between Four Nozzles
Additional Notes

• *If multiple temperature ratings are requested tests will be required at both minimum and maximum operating element temperature*
  – Quick Response (QR) will be required

• *Target arrays will be added to both the HC-2 & HC-3 fuel packages to evaluate potential fire spread.*
Acceptance Criteria

- All tests will be conducted for 30 minutes followed by manual extinguishment
  - The main fuel array cannot burn to either end
  - The target fuel array cannot burn through nor burn to either end
  - Temperatures of steel angle, installed at ceiling level above ignition, cannot exceed 538°C
System Design

- *Design area (or # of nozzles) to be based on worst case nozzle operations during testing with a 50% SF*
- *Design area for HC-2 & HC-3 each based on their own scenarios or…*
- *Manufacturer can elect to use HC-3 design for HC-2 (less tests but lose ability to optimize for HC-2)*
- *All nozzle specifications and locations used during testing will be “you get what you test.”*
Still Being Discussed…

- If HC-2 and/or HC-3 testing is passed in open area scenarios with automatic nozzles the protection can be used in enclosed areas using deluge protection (open nozzles)

- Possibility to conduct HC-2 and HC-3 testing in an enclosure using a deluge system to optimize performance for smaller enclosed protection areas
  - Fuel packages would need to be based on footprint of enclosure
  - Opening size and location would need to be determined
Still Being Discussed…

• Water mist system availability

  – Water mist system availability study is being conducted to understand the availability of various water mist systems
  – Intent is to compare to traditional sprinkler system availability
  – Important to understand with water mist being used as sole protection for higher hazard occupancies
HC-2, 6.1-m Ceiling, Ignition Between Four
HC-2, 7.6-m Ceiling, Ignition Between Four
**Video Test Specifications**

- Deluge Protection w/ 4 nozzles
  - Flow released when “dummy” nozzles located 2.16 m (7.1 ft) radially from ignition at ceiling level operated
- Ceiling Height: 9.1 m (30 ft)
- Nozzle Spacing: 3.05 by 3.05 m (10 by 10 ft)
- Total Flow: 300 lpm (80 gpm)
- Nominal Application Density: 8.1 mm/min (0.2 gpm/ft²)
Fire Test Examples (Development)
• Water mist system fire test scenarios for nonstorage occupancies, hazard category 2 and 3 (HC-2 & HC-3) have been developed.

• A bit of further work on some finer details remains to be done.

• The intent is the new test protocols will be published in the next revision of FM Approvals Standard, Class 5560, Water Mist Systems which is expected end of 2020/early 2021.
Thank you for your attention!