Understanding the New FM Global Approval Standard for Cooling Towers

Don Dobney
Director, EvapTech Commercial Sales

Steve Benz
Director, Global Thermal Storage and District Energy
Topics of Discussion

- Who is FM Global?
- What is the “New” Standard
- Needs, benefits and challenges
  - Owner opportunities
  - Specifying FM Approval
  - Confirming compliance
Who is FM Global?

FM Global…

- US-based, 175 year old insurance cooperative
- World’s largest insurance company covering 27% of world’s commercial assets, including District Energy Facilities
  - Insures 130,000+ locations in 130+ countries
- Insures property damage and business interruption
- Believes “loss is preventable through engineering”
Who is FM Global?

FM Approvals…

- Subsidiary of FM Global
- Defines standards and conducts verification tests
- Provides independent third-party certification of building materials/products, including cooling towers
- Similar to Underwriters Laboratory

“UL certifies, validates, tests, inspects, audits, advises and educates. UL helps safeguard people, products and places in important ways, facilitating trade and providing peace of mind.”
The New Standard

Published May 2009

- Establishes a comprehensive technical design definition
- Desires to reduce the risk of exposure due to natural hazards
  - Seismic, wind, fire, ice, and snow
- Stated intention is to facilitate technological development
Qualification

Discussion centered around Field-Erected cooling towers – the most difficult type of tower to modify for compliance
FM Approval – Then and Now

Pre-May 2010
Historic Test Protocol
● Full-scale burn test
● Examination of combustible component manufacturing
● Annual quality control audits of combustible components
● Component flammability testing

Post-May 2010
New Approval Standard
● Full-scale burn test
● Examination of combustible component manufacturing
● Annual quality control audits of combustible components
● Component flammability testing
FM Approval – Then and Now

Historic Test Protocol

- No missile impact testing

New Approval Standard

- Missile impact testing of exposed components
  - Exterior walls and fan cylinders
- Large and small missile tests
  - 9 lbs, 2”x4” @ 50 fps
  - 2g steel balls @ 130 fps
Objective

- Confirm fan cylinder deflection will not result in contact with an operating fan
- Less than 10% air leakage of cylinder and casing
FM Approval – Then and Now

Historic Test Protocol

- No missile impact testing
- No air pressure testing

New Approval Standard

- Missile impact testing of exposed components
- Static & cyclic air pressure testing of wall panels
  - 60s static up to 120 psf windward
  - 60s static up to 168 psf leeward
  - 9,000 cycles per configuration
Hurricanes Tracks - 1851 to Present
Pressure Testing

Objective

- Zero cracking or signs of failure
- For exterior installations, shall be tested both undamaged and after damage from missile impact testing
<table>
<thead>
<tr>
<th>Historic Test Protocol</th>
<th>New Approval Standard</th>
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<td>● No air pressure testing</td>
<td>● Static &amp; cyclic air pressure testing of wall panels</td>
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<tr>
<td>● No structural evaluation</td>
<td>● Engineering definition &amp; evaluation of structural design</td>
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<td>▪ Dead and live loads including wind, seismic, snow, and ice</td>
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Design Methodology Review

- Defines enhanced design parameters (ex. I=1.25)
- Global standard (ex. addresses seismic design in Non-ASCE 7 areas outside of USA)
- Requires the tower to remain "Intact and Operational" following an event
Is “Intact and Operational” Important?

Wind Exposure Damage
Design Methodology Review
Historic Test Protocol

- Redundancy: N + 1 cell tower arrangement or thermally oversized cells
  - Based on FM Property Loss Prevention Data Sheets

New Approval Standard

- Redundancy: Remaining tower must provide at least 75% of design capacity after a fire event

“Approved For Use without a Fire Protection System”
# FM Approval - Fire

Designing to Achieve 75% Capacity After Fire Event

<table>
<thead>
<tr>
<th>Multi-Cell Category</th>
<th>Design Cell Qty.</th>
<th>Minimum Thermal Capacity Required</th>
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<tr>
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<td>One</td>
<td>150% (2* @ 75%)</td>
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<td>Two</td>
<td>150% (2@75% or 3@50%)</td>
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<td></td>
<td>Three</td>
<td>112.5% (3@37.5% or 4@25% ➔ 100%)</td>
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<td>Four and Over</td>
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*Cannot Build a Single Cell Tower that is Approved in the Multi-Cell Category!!!
**FM Approval - Fire**

**Designing to Achieve 75% Capacity After Fire Event**

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<td>100% (2 @ 50%)</td>
</tr>
<tr>
<td></td>
<td>Three</td>
<td>100% (3 @ 33.3%)</td>
</tr>
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<td>Four and Over</td>
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Multi-Cell Approval Fire Test

Objective

● Contain fire damage from spreading beyond the cell of origin

● Cannot go “over, under, through, or around” perimeter
# FM Approval - Fire

**Designing to Achieve 75% Capacity After Fire Event**

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*Cannot Build a Single Cell Tower that is Approved in the Multi-Cell Category!!!*
Single-Cell Approval Fire Test

Objective

● Retain 75% thermal capacity in cell of origin

BEFORE
Owner Opportunities

FM Approved Products Serve

- Owners insured by FM Global
- Owners that do not want fire protection systems
- Owners concerned about damage due to fires and natural hazards
- Owners that cannot tolerate interruption to operations
District Energy Owner Benefits

Reliability Improvements …

…Assurance of 75% minimum capacity after fire

…Improved/Expanded structural design standards

…Exposure tested exterior tower systems

…Reduced down time from natural hazards

…Elimination of fire protection systems

…Quality-audited cooling tower system
Suggested Text

Cooling tower shall be FM Approved, designed and constructed per the Approval Standard for Cooling Towers, dated May 2009.

Demonstration of Compliance

Approval Date Must be After May 31, 2010
Designers: How to Specify

- Specify appropriate thermal capacity and quantity of cells

- Multi-cell approved units (below 4 cells) require 75% capacity with one cell out of service
  - Specify design capacity based on colder supply/return water temperatures (reduced approach)
  - Specify alternate capacity (temperatures and flow) based on one cell out of service

- No redundancy required for single cell towers, but must be approved under the Standard’s single cell guidelines
The New FM Approval Standard for Cooling Towers …

- Improves reliability through enhanced equipment design standards and hazard exposure testing
- Helps mitigate owner losses from exposure to fire and other natural hazards
- Advances the state-of-the-art for cooling tower design
- Offers the only independent third party review of cooling tower design and manufacturing