Dry Sprinkler Installation

By Jeff Hugo, CBO

In several cases, sprinkler protection needs to be extended into spaces subject to freezing and a complete, separate, dry pipe or anti-freeze system is cost-prohibitive to install. Balconies, decks, freezers and small loading docks are locations where perhaps only a small number of sprinklers are needed. The most common example, besides freezers in a grocery store, is the requirement that stems from the International Building Code (IBC). The IBC, in Section 903.3.1.2.1, requires that all structures protected by NFPA 13R having residential balconies, decks, and patios attached or used by a dwelling unit are required to have sprinkler protection in Type V (combustible) construction. This requirement has been in the IBC for several editions (and overrides the statement about balconies not needing sprinklers in NFPA 13R). Note that in the 2009 edition, the section has changed to permit sprinklers to be omitted when a roof or deck is not above the balcony.

The dry sprinkler connected to the wet system is the ideal device to cover small areas that are subject to freezing temperatures. The dry sprinkler is a device that has a typical sprinkler attached to an extended barrel that attaches to the wet system. The barrel is a hollow tube with a sealed end that stops water from entering until the sprinkler fuses. The mechanics of these barrels vary from manufacturer to manufacturer, and the lengths vary depending on the distance needed to extend from the freezing area to the conditioned space containing the wet pipe system. Dry sprinklers are available as dry-pendent, dry-upright, and dry-sidewall sprinklers to meet a variety of different needs.

The length of that barrel is often called into question. At times the barrel length has been too short, resulting in freezing of the wet pipe system. This is related to a couple of design oversights by either the architect not providing the space needed to extend the barrel into the heated space, poor sealing around the dry sprinkler at the exterior wall, poor insulation, or the installation of a barrel that is too short. It seems the most common scenario of these mishaps are in dwelling units (single family homes, condos, timeshares) where the owner departs for warmer climates in the winter or property managers who turn down the heat in units that are not sold or rented.

NFPA 13, Section 8.4.9.1, states that where dry sprinklers are installed, they must comply with the manufacturer's requirements on the length of the dry barrel sprinkler. However, not all manufacturers publish consistent barrel length installation criteria. Presently, NFPA 13 does not have any further direction (besides the requirement for the penetration at the exterior wall to be sealed) applicable to all dry sprinkler barrel lengths, but that will hopefully change with the 2013 edition.

From the research data of the UL/FM/NFSA Liaison Group (a combination of representatives from the manufacturers and the listing labs organized by the NFSA to standardize requirements) that studied the issue, the NFSA's Engineering and Standards (E&S) Committee is submitting a proposal to the 2013 edition of NFPA 13 to clarify and standardize the installation of dry barrel sprinklers. The proposed text allows the user to coordinate the exterior ambient temperature to the interior ambient temperature to come up with a correct minimum barrel length.

The user must first identify the coldest ambient temperature that the sprinkler will be exposed to. For sprinklers on the exterior of a building, this will be the coldest expected outside temperature. One reasonable way to determine the coldest outside temperature is to use the lowest one-day mean temperature as determined by the U.S. Weather Service. This information is shown in Figure 1 for parts of the United States and Canada and is also printed in NFPA 13 as Figure A.10.5.1.

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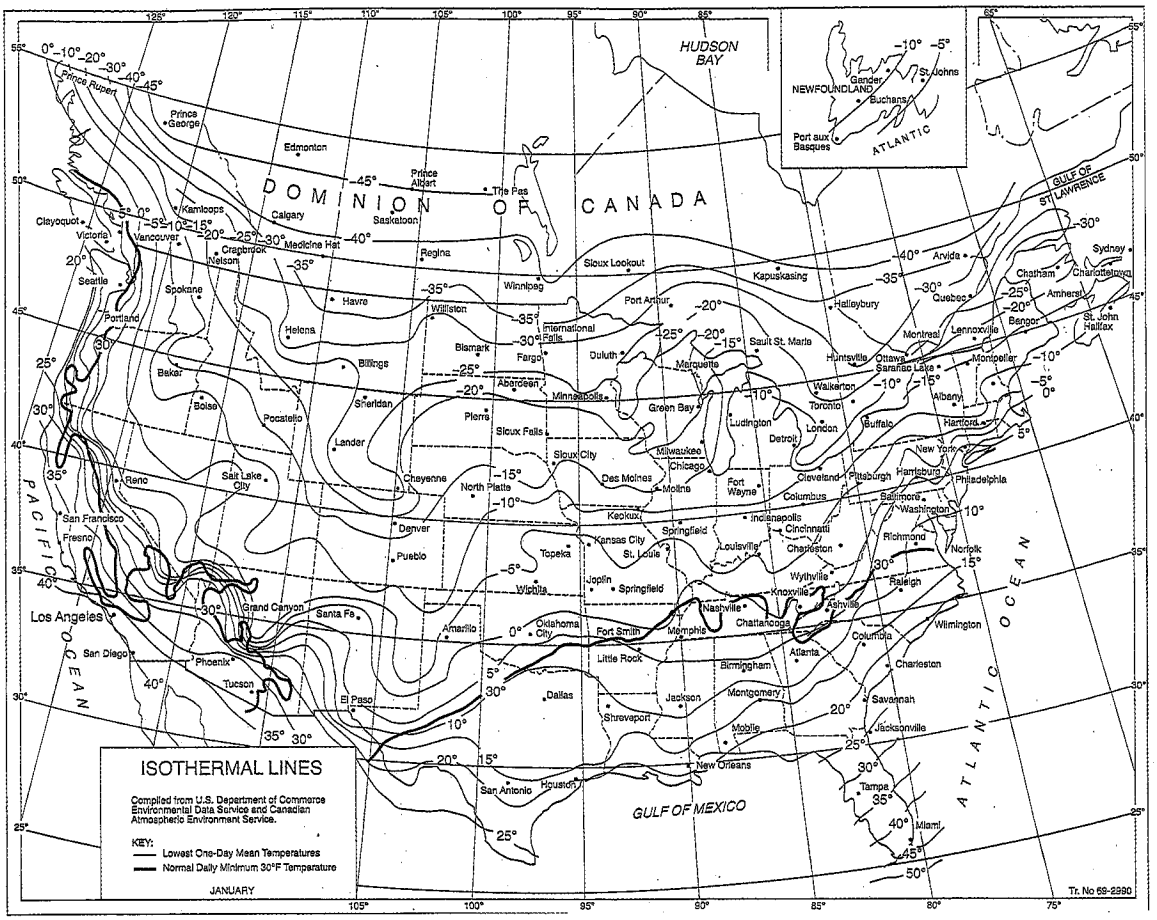

Figure 1 Lowest One-Day Mean Temperatures

Ambient Temperature Exposed to Discharge End of Sprinkler (°F)	Minimum Exposed Barrel Length when Exposed to 40°F (inches)	Minimum Exposed Barrel Length when Exposed to 50°F (inches)	Minimum Exposed Barrel Length when Exposed to 60°F (inches)
40	0	0	0
30	0	0	0
20	4	0	0
10	8	1	0
0	12	3	0
-10	14	4	1
-20	14	6	3
-30	16	8	4
-40	18	8	4
-50	20	10	6
-60	20	10	6

Table 1 Minimum Exposed Barrel Length (ft-lb units)

Ambient Temperature Exposed to Discharge End of Sprinkler (°C)	Minimum Exposed Barrel Length when Exposed to 4.4°C (mm)	Minimum Exposed Barrel Length when Exposed to 10°C (mm)	Minimum Exposed Barrel Length when Exposed to 15.6°C (mm)
4.4	0	0	0
-1	0	0	0
-6.7	102	0	0
-12.2	203	25	0
-17.8	305	76	0
-23.3	356	102	25
-28.9	356	152	76
-34.4	406	203	102
-40	457	203	102
-45.6	508	254	152
-51.1	508	254	152

Table 2 Minimum Exposed Barrel Length (metric units)

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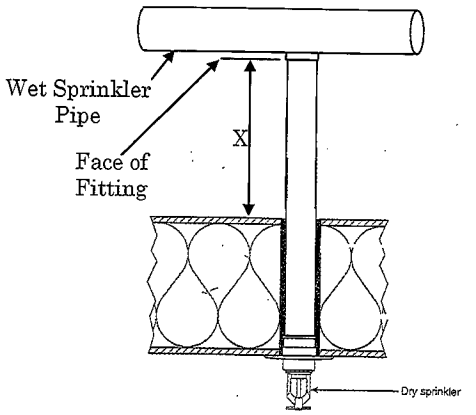
Once the coldest ambient temperature is determined, use a table prepared by the UL/FM/NFSA Liaison group and endorsed by the E&S Committee (there are actually two tables: one in metric units and one in traditional ft-lb units). Even though this is just a proposal for the 2013 edition of NFPA 13, it has been agreed to by all of the sprinkler manufacturers and the listing labs. Since the current editions of NFPA 13 reference the manufacturer's instructions for this information, and since the manufacturers have all adopted these tables, we do not need to wait for the next edition of the standard to start using them. The tables are shown here as Table 1 and Table 2.

As you can see from the tables, the user is given a choice of minimum barrel lengths based on the interior ambient temperature that the barrel will be exposed to (which will be a function of the temperature inside the building). There are three columns to choose from for the Minimum Exposed Barrel Length depending on whether the barrel is exposed to 40°F (4.4°C), 50°F (10°C), or 60°F (15.6°C). Determining the interior warm temperature to which the barrel will be exposed will need some advance knowledge of how the space will be used. For example, building codes require the heating appliance in a dwelling unit to be capable of a minimum of 68° F in habitable spaces. This might lead the designer to choose a barrel length from the 60° F column. However, if the owner vacates in the winter, then the owner may turn down the heat to around 50° F, which would make the barrel length too short and risk freezing.

The tables provide the minimum barrel length that must be exposed to this minimum temperature. This portion of the barrel is measured from the interior face of the conditioned space to the fitting of the wet pipe system. In order to get the total barrel length, you need to add the minimum exposed barrel length to the thickness of the insulation and the thickness of the exterior (or freezer) wall (or ceiling). An example of the minimum barrel length measurement is found in Figure 2.



X = Minimum Exposed Barrel Length

X is measured from the face of the sprinkler fitting to the inside surface of the freezer or insulation whichever is closer to the fitting

Figure 2 Measurement of Exposed Barrel Length for Dry-Pendent Sprinkler

Consider the example of an ice cream freezer maintained at 0°F in an existing Des Moines, Iowa supermarket. The ambient temperature of the freezer would be the actual lowest temperature of the freezer itself being 0° F. The air above the freezer is relatively warm due to the compressors, but the roof insulation is poor, so the designers take the middle column, doubting that 40° would ever be reached since more than the wet pipe system is at risk above the freezers and 60° in this application is much too high for Iowa winters when the roof insulation is taken into account. According to Table 1, the correct barrel length would be 3 inches from the top of the freezer to the wet pipe connection. The 3 inches would then be added to the actual thickness of the freezer ceiling to order from the manufacturer.

The tables may be interpolated. Taking the same scenario above, what if the customer buying the ice cream from the Des Moines supermarket lives in a second floor apartment with a balcony? From Figure 1, we see that the Des Moines outside ambient temperature is -15° F. The designers of her building may choose the same 50° F inside barrel length column if the space containing the wet sprinkler piping is below another occupied floor which would retain more heat than if exposed to an attic. The table does not have a -15°F row, so interpolating is necessary, which would result in a dry sidewall with an exposed barrel length of 5 inches (again, adding in the thickness of the exterior wall and any insulation for a total length to order).

To conclude, this NFSA E&S Committee proposal to NFPA 13 is mutually consented to by all sprinkler manufacturers and is definitely long-awaited and welcomed in the code text.