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TECHNICAL BULLETIN #42 (R)

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SUBJECT: Insulation and Sprinkler Systems in Cold Climates

Automatic sprinkler systems are required in new houses in some areas now and the trend toward their use may spread. One of the first questions raised about these systems is how to protect them from freezing in climates that experience cold weather. The ideal answer would be to keep all sprinkler piping on the inside (heated side) of all the insulation. This would make it no more susceptible to freezing than the rest of the plumbing. Unfortunately, sprinkler piping in attics often runs over joists or truss bottom chords and is outside of at least a significant portion of the attic insulation. Simply surrounding sprinkler pipe will not prevent it from freezing. An insulated pipe will freeze in an area whose temperature is below freezing if the temperature stays below freezing for a long enough time. This is because insulation slows heat loss but can't stop it entirely.

To the builder and homeowner, this can be a potentially serious problem. To the insulation contractor it can be an opportunity to sell more insulation. Here's how preventing freezing may involve using more insulation:

> The temperature of sprinkler piping in an attic will depend on (a), the attic temperature and (b), the relative amounts of insulation inside and outside of the piping. To keep it simple, the table below can be used to determine the percentage of insulation that must be outside of water piping to prevent freezing at various attic temperatures. Depending on how far above the ceiling board the piping is placed, greater insulation thicknesses than would otherwise be used may be needed to prevent pipe freezing. The table is based on a temperature of 70^{o}F at the bottom of the insulation and a minimum pipe temperature of 35^{o}F.

As an example of how the table is used, let's say we're considering R-30 InsulSafe SP and that sprinkler piping is placed on top of 2 x 8 joists in an area where the temperature has never dropped below 0^{o}F. With R-30 InsulSafe SP, we'll have at least an 11 ¾”insulation thickness. Since 2 x 8's are actually 7 ¼” tall, the top of the piping will be about 8" above the ceiling board. There will be 11 ¾” - 8" = 3 ¾” of insulation outside of the piping. This is only 32% of the total insulation. The table shows that, with 32% of the insulation outside the piping, the piping can freeze when the attic temperature drops below 20^{o}F. If we want to protect the piping down to 0^{o}F, we'll need to put 50% of the insulation outside of the piping.

If the top of the piping is 8" above the ceiling board, we'll need another 8" of insulation above the piping for a total of 16". This would be just over R-42 for InsulSafe SP. It would make sense to recommend R-44 (16 ¾") of InsulSafe SP in this example. This would put at least 16 ¾" - 8" = 8 ¾" outside the piping. 8 ¾"is 52% of 16 ¾". This means that piping would be safe down to about 0°F.

If an attic were built with trusses and piping were run on top of 2 x 4 truss bottom chords, R-30 InsulSafe SP (11 ¾") would put about 11 ¾" = 4 ¼" = 7 ½" of insulation above the piping. Since 7 ½"is 64% of 11 ¾" the piping would be safe until the attic temperature went below -25°F.

A final word of caution: Outdoor temperatures occasionally drop below design temperatures - possibly by as much as 30°F. Therefore, it makes sense to protect pipes down to 5 or 10 degrees below the record low ever recorded in an area.

Lowest Expected Attic Temperature, °F	Percentage of Insulation That Must Be Outside Of Piping to Prevent Freezing
+20F	30%
+15F	36%
+10F	42%
+ 5F	46%
0F	50%
- 5F	53%
-10F	56%
-15F	59%
-20F	61%
-25F	63%
-30F	65%
-35F	67%
-40F	68%