

Keeping Your Pipes from Freezing

Recent research has revealed some surprising findings on pipe freezing and bursting. If you would like your own copy of the report, you can write to the School of Architecture, Building Research Consul, University of Illinois, Urbana-Champaign, 1 East St. Mary's Road, Champaign, Illinois 61820, and request Research Report 96-1, "An Investigation into Freezing and Bursting Water Pipes in Residential Construction," by Jeffrey Gordon. There is a nominal cost for the fifty-one page report and analysis. Some of the report's findings:

1. Ice forms in pipes in two distinct phases. The first ice formed is "soft ice," which doesn't create problems. "Hard ice" forms at significantly below freezing, generally about 20 degrees. This is the ice that creates pipe bursting problems.

2. Pipes burst due to the water pressure of the liquid water trapped between solid ice blockages inside the pipe. The pressure at which pipes burst is in the range of 5,000-6,000 lbs. per square inch!

3. Insulating and covering pipe can make a huge difference in rate of heat loss. An exposed pipe in an environment where it is subject to wind will lose heat at 15 times the rate of an even modestly insulated pipe.

4. Pipe bursting events progress through several phases. The average time from full ice blockage to deformation of the pipe is about 3 1/2 hours. To reach pipe bursting generally takes about another hour.

What can you do to minimize or eliminate burst pipes?

1. Keep pipe out of exterior walls. Always put them on the warm side of the insulation.

2. Keep pipes out of any unheated areas, such as attics.

3. Insulate all pipe, hot or cold, with minimum insulation of R6 to R8. This will buy time. In an emergency, the old wives' tale about letting a faucet drip can be an effective method of preventing burst pipes. Although moving water does retard the formation of hard ice somewhat, it is the actual release of pressure due to the open end of the faucet that ultimately provides the protection, even after ice forms in the pipe.

4. If you can't insulate in extreme conditions, heat tape can be used.

5. Drain your water system to provide absolute protection against pipe freezing.

The study found that providing air chambers, such as those used to prevent water hammer in residential piping systems can be an effective method to allow for expansion of the liquid water between frozen blockages. Remember, it is the increased pressure in this liquid water that actually causes the burst pipes. When water freezes, it increases in volume about 8 percent. During freezing, the rupturing of a pipe occurs when there is a complete ice blockage in a closed down stream outlet or a second ice blockage. As additional ice forms, it compresses the remaining liquid water between the blockages. When pressure exceeds the allowable range of the pipes (4,000-6,000 lbs. per square inch, depending on diameter and type of pipe), it will break. Usually, the breakage occurs in a portion of the pipe where there is little ice formation.

One possible result of this study may be the development of plumbing fixtures which contain pressure relief mechanisms within them.

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