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Eventually DIN standard will have to be accepted here

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AN OXYGEN diffusion test method for plastic tubing has been developed by the University of Wuerzburg, Germany, to determine the amount of oxygen penetrating any given tubing. The chemically bound oxygen (no visible air bubbles) entering the system water through the pipe walls creates an extremely aggressive water condition, corroding not only ferrous but also non-ferrous materials.

The test revealed that the rate of oxygen diffusion is directly related to the system water temperature (see Jan., p42): the higher the water temperature, the higher the rate of diffusion.

The standards, DIN 4726, have determined that an oxygen diffusion rate of 0.1 mg/liter/day or less at a water temperature of 104°F (40°C) in plastic tubing is considered a safe level to prevent corrosion.

By comparison, a diffusion rate of 5 mg of oxygen per liter per day through the pipe walls is equivalent to completely draining the heating system and refilling it with fresh water every other day during the heating season.

To eliminate serious problems of oxygen diffusion in closed loop plastic pipe heating systems, an oxygen diffusion barrier is applied to the pipe, usually to its exterior. Each pipe manufacturer has its own method and process for applying the barrier. The main criteria for these barrier application techniques are the operating water temperatures of the intended pipe usage.

An acceptable DIN alternative to oxygen diffusion barriers is to separate the plastic distribution system from the boiler and other ferrous components with stainless steel heat exchangers.

A diffusion rate of 5 mg of oxygen per liter per day is equivalent to draining the system and refilling it with fresh water every day.

Another alternative is to treat the water with oxygen-absorbing chemicals. This method is virtually nonexistent in Europe; it's difficult to determine proper doses and appropriate chemicals, and it requires constant monitoring.

What's more, the chemical method is limited to newly installed systems. Field experiences show that if chemicals are added to systems which have already been exposed to some form of corrosion and light sludge formation, results can be disastrous. Small particles of sludge on internal component walls can loosen and break off, thus removing protective oxidation layers and corrosion inhibitors on small spots of internal walls. The result is accelerated pit corrosion not only on ferrous components but also on tubing walls and brass and copper components.

The tubing in 95% of all European floor heating systems is protected by carefully applied exterior diffusion barriers made from EVOH (ethylene vinyl alcohol) or aluminum foil barriers sandwiched within a multilayer polyethylene pipe suitable for operating temperatures of up to 200°F. The remaining installations use system-separating heat exchangers.

Unfortunately, no American standards organizations or approval agencies have addressed this issue. (The Hydronics Institute adopted DIN 4726 in Fall 1992). In time, though, either an American standard will be developed or the DIN Standard in whole or modified for the U.S. market will be adopted. Either ASTM (American Society for Testing & Materials) or PPI (Plastics Pipe Institute, an arm of the Society of the Plastics Industry) are most likely organizations to deal with this issue.

Until we have our own industry standard, we logically ought to utilize the 15 years of European industry experience with hundreds of millions of feet of plastic tubing installed in concrete.

Most floor heating systems in the U. S. that utilize plastic or rubber tubing without an oxygen barrier have been installed only within the past three to five years. U. S. contractors who have installed these systems already have experience system component failures and sludging problems.

Until reputable U. S. testing labs are equipped to accurately measure diffusion rates on plastic and rubber tubing everybody in the industry ought to carefully examine diffusion rate claims made by any manufacturer. Request proper documentation and certified diffusion test reports from them.

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