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Residential Hot Water Heating
Association of BC.
BC Toll Free Ph/Fax:
1-866-414-0100
email:
rhwha@home.com

Non-Oxygen Barrier Piping

The concerns of home owners across Canada who have non-oxygen barrier tubing in their hydronic heating systems are expressed in a variety of ways. The most common reaction we see is disbelief and shock at the costs of remedies that are offered by any number of people who claim to have the answers to their problem.

Problems resulting from use of non-oxygen barrier tubing surface to the home owner in a number of ways—through heating system failure, continuing repair bills, repeated expansion tank changeouts or poor delivery of heat. With uninformed people creating confusion and panic by telling the home owner that plastic piping used in their heating system will make it very hard to sell their home, homeowners want their systems repaired. To top it off, estimates of the cost of repair and up grade may be given as an extreme quote of $20,000. More realistic estimates are in the range of $500 to $3500 depending on the type of repair chosen by the homeowner.

There are three basic remedies to ensure the longevity of a hydronic heating system. The first option would be to put in a heat exchanger to separate the boiler water from the heating water. What this does is isolate the boiler from the oxygen-bearing water and thereby preventing rusting the system out. The second option would be to install a new nonferrous boiler system with new pumps, expansion tank and related products. This will slow and prevent the rusting and corrosion that can and will develop in a hot water heating system. The third solution is to treat the water on a regular basis with chemicals to help stabilize the water and reduce oxidation. These options are discussed in more detail below.

Oxygen & Corrosion

In most heating systems, certain parts of the system are made of metal components—both ferrous and nonferrous. Most metals, including nonferrous ones, when put in contact with water will corrode readily. The extent and type of corrosion will vary with each material. In an hydronic heating system, the surfaces of nonferrous metal components will passivate quickly. However, due to the inherent corrosion resistance of the common nonferrous materials used in these systems, it is unlikely that these components will corrode sufficiently to fail by this process alone. However, ferrous iron components without some form of barrier—galvanizing or other plating—may, in time, corrode so severely as to fail. In most hydronic heating systems there will be at least one primary component made from ferrous material—the boiler.

One of the necessary ingredients for the corrosion of ferrous metals is oxygen. The oxygen content in the circulating water may have an influence on the corrosion rate. Oxygen can penetrate the wall of standard, non-oxygen barrier plastic tubing and ingress into a closed hydronic system. The process by which oxygen passes through the tubing wall is complicated and relatively slow. However a radiant panel heating system will utilize several thousand feet of plastic tubing providing the potential for significant oxygen ingress into a closed loop system. In response to

these failures, considerable research has been compiled on the subject of oxygen ingress into hydronic heating systems through the wall of the plastic tubing.

Process of Oxygen Ingress

The terms most commonly used to describe the leakage of oxygen through plastic are oxygen permeation and oxygen diffusion. While plastics look solid, they do in fact have tiny microscopic holes that traverse the many polymers. The size and quantity of these paths are different with the different types of plastics available. In the majority of plastics used, the holes are large enough for air to pass but not large enough for the passage of water molecules.

As oxygen is depleted in the hydronic system through the corrosion process, or through another avenue, the water has a negative saturation level. This will create a differential across the tubing wall which in turn creates the driving force to effect oxygen permeation through the tubing wall.

The most common way to slow down or eliminate the passage of oxygen across the tubing wall is to apply a thin layer of oxygen resistant polymer to the tubing. This has been accomplished in several ways including sandwiching the barrier in the middle of the tubing or applying it directly to the outside.

Solutions

The first option would be to install a heat exchanger to enable the separation of the heating water from the boiler water. There are several different heat exchangers available to do this. This option enables use of the existing boiler. With the installation of the heat exchanger, you would also need to install a new pump and expansion tank along with an independent fill valve and necessary fittings to ensure proper installation. In essence, what you get is two systems running without the mixing of water media. The benefit of this method is the saving of the cost of a new boiler. If the existing boiler is still in reasonable shape this could be a viable option.

The second method of repair can be to utilize a nonferrous boiler with all new nonferrous pumps, expansion tanks and accessories. This would be the most expensive way to go, but if the boiler is on its last legs it may be necessary. The benefit of this option is that additional pumps and expansion tanks are not required.

The third option is to treat the water chemically with the intent of stabilizing the water. The treating of water in the boiler is something that should be done on a regular basis regardless of the condition of the boiler. This can help to ensure the longevity of any heating system and also allow a qualified professional to check the system to ensure it is working to its optimal performance. The long term benefit to a heating system that has non-barrier tubing might not be huge, but it can be of benefit for short term relief.

—Nigel Webb, RHWHA Director