Physical Water Treatment

The Association of Heating, Refrigeration and Air Conditioning Engineers, ASHR.AE, conducted research project 1155-TRP to evaluate the effectiveness of Physical Water Treatment devices (PWT) in applications to control hard water calcium scaling.

The study measured the performance of permanent magnets, solenoid coil devices, and a high-voltage electrode device.

The following highlights key findings of the study.

Permanent magnets, which have a fixed magnetic field were found to be greatly affected by the velocity of the water flow through the magnetic field. A velocity of b meters/sec (18+ ft/sec) was determined to be optimal, with lower and higher flow rates both being significantly less effective.

The optimal flow velocity for magnets is a very high flow rate compared to velocities experienced in virtually any working system. This can explain many of the past "failures" of magnetic devices in practical applications.

A single permanent magnet tested at optimal flow conditions reduced scale by 57%.

Multiple configurations of magnets were shown to be far more effective that a single magnet device. Scale removal was 80% with magnetic arrangements that passed the water through fields of reversing polarity.

Solenoid coil devices simulate multiple magnetic field configurations by rapidly changing the strength and polarity of the magnetic fields generated by the electrical coil.. Performance of solenoid coils increase with current strength and with higher frequencies. The coil is driven by an electronic wave generating circuit board.

Also, scale prevention using solenoid coils is independent of fluid velocity. The ASHRAE test was done at 1 meter/sec.

PWT devices changed the calcium carbonate crystal to aragonite in preference to the more common calcite (limestone). Aragonite is a more soluble and less adhering form of calcium carbonate and stays in colloidal suspension. The aragonite is a less stable crystal and will change back to calcite in about 3 days. Any scale deposits formed, however, were soft and easily removed as opposed to the hard to remove deposits formed when calcite precipitates directly on a surface.

The PWT devices reduced the surface tension of the water by 8%.