BY MARK EVANS

HIGH TECH LEAK DETECTION

When we think of leaks the image of the little boy with his finger in the dam would come to mind for many people. Given our industry, the fact the term leak is so closely associated with water is logical, as water is the lifeblood of our business. Building on the November/December 2003 column (page 46) which looked at some of the tools of the trade; this article analyzes some of the leak detection options for water and other fluids. Leaking fluids represent not only the possibility of system inefficiencies and economic losses, but public safety and workplace hygiene issues as well.

The obvious question is "How do you know that a leak exists?" For our purposes, let's look at how a radiant heating panel might be impacted by a leak.

The most common answer would be by finding visible and obvious signs of a leak such as water accumulation. Depending on the system, there may be odours emanating from the anti-freeze or treatment chemicals. There could also be an obvious loss of efficiency in the system as the boiler cycles unnecessarily.

Condensation build-up on the make-up water line occur as cold water constantly enters the system. A leak may cause a lack of heat in specific parts of the system.

Once the presence of a leak has been determined, the three predominant methods of leak source detection would be thermography, electro-acoustical diagnosis and gas sensitivity (helium).

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HANDS-OFF METHOD

Sir William Herschel (1738-1822) is most famous as an astronomer, largely for his discovery of Uranus in 1781. Truly a Renaissance man, this musician, philosopher and inventor is also credited with the discovery of calorific rays or infrared light in 1800. He determined that since sunlight was not only a source of light but also a source of heat, there must be calorific energy present in that light.

Using a prism, he determined that the rays of light or more accurately the electromagnetic energy beyond the visible spectrum imparted radiant energy when directed to the surface of objects. This useful discovery has been developed to the

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Photo Hemera Technologies

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point of providing a hands-off method of measuring surface temperatures.

We can look at the heat signature of radiant panels to determine concentrations of heat/cold and try to pinpoint a leak source. While somewhat rudimentary, the simplest way would be with an infrared thermometer.

With access to the original design, particularly one that was installed according to a piping layout drawing, one would work systematically from one loop area of the radiant heating panel to the next. Following the piping pattern as closely as possible, readings would be taken at fixed points across the floor and then plotted on a grid along with an overlay of the piping layout. Comparisons of supply and return temperatures for each individual loop would uncover anomalies in temperature and identify areas to focus on.

The infrared image produced by a thermal-imaging camera provides a detailed look at the heat signature of the panel. Compare the thermal image of the steam-trap installation shown at right to the naked eye view. The image you see is somewhat similar to the night shot or low light settings on many high-end digital video recorders and cameras.

Depending on the equipment, this infrared image can provide actual temperature readings in addition to the graphic representation of the installation. Diagnosis would then be significantly faster and more accurate than one made with an infrared thermometer.

Leakage from a steam trap.

Photos Hemera Technologies, FLIR Systems

ELECTRO-ACOUSTICAL DIAGNOSIS

Water is an extremely efficient conductor of many things, not the least of which are

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WEBSITES OF INTEREST

www.uulla.org
www.radiantpanelassociation.org
www.drainbrain.com
www.flirthermography.com
www.plumbersnetworkingforum.com
www.varianinc.com
www.fisherlab.com
www.instecorp.com
www.schonstedt.com

heat energy and sonic energy, especially when compared to air. Think back to your childhood and the water/sound experiments you did in the bathtub. When you tapped on the side of the bathtub and compared the relative volume with your ears above and below the water level, hopefully you would have noticed that the sound was louder when your ears were submerged. Similarly, the movement of water in the tub made different, yet, distinctive sounds, when you listened both above and below the water line.

Just as Second World War sonar technicians learned to identify the acoustic signatures of specific classes of ships and submarines, so too must the expert leak detector learn to distinguish distinctive sounds. In the earliest analog systems, this could be quite a challenge.

According to Doug Lemon of West-Am Agencies in Surrey, BC, "Comprehensive training for equipment operators is a must."

Today, new digital equipment is capable of not only filtering out background sounds, but it also focuses on specific frequency ranges that are associated with typical water leaks. The type of piping used can impact efficacy, with rigid copper tubing being more sound conductive than flexible polymer tubing.

In problem situations, air, nitrogen or another inert gas can be injected into the system to increase the escape velocity of the water leak, thus amplifying the leak noise. Once located, newer models can even predict the depth and distance of the operator form the leak source, however, there are shortfalls in this technology. Water to water leaks can be hard to identify and sound transmission can be impaired by intermediary layers of soil, carpet or wood.

SENSITIVE SNIFFERS

Helium detectors are relatively expensive but offer another effective leak detecting tool. While helium is present in the earth's atmosphere, it exists in very low concentrations averaging five-parts per million. Helium molecules are capable of passing through soil, concrete and most substrates, making it relatively easy to sample and measure the elevated helium

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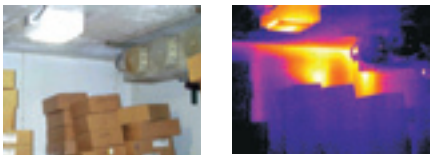
levels that would result from its escape through a leak site.

The sensitivity of the detector will determine how long the search will take and how closely you can pinpoint the leak. The prevailing wisdom here is take your time and don't try to find and fix all of the leaks at one time. The Radiant Panel Association (RPA) has published a technical note on the use of helium for detecting leaks in radiant systems. For more detail, this can be accessed from the technical papers section of RPA's website.

BEYOND WATER

Equally relevant to the mechanical industry would be the detection and remediation of:

- Hot or cold air leaks (as shown below);
- combustible gas leaks including CNG, propane, butane and methane;
- refrigerant leaks including CFC, HCFC or HFC;
- compressed air leaks; and
- vacuum leaks.



Poor insulation in a walk-in cooler.

Many of the same thermal, acoustic and "sniffer" concepts are employed in products meant to detect leaks in these types of installations.

If your business volume does not justify the purchase of some of these products, many are available on a rental basis and do warrant further investigation. HPAC

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