FEBRUARY 2011

ADVANCED ADHESIVES REPORT

Your corrugating newsletter from Harper/Love Adhesives Corporation

Listen up!

The what, why and how of using ultrasonic detectors as diagnostic tools

By Rex Woodville-Price

Ultrasonic detectors can be valuable diagnostic tools in a box plant. They can be used to monitor proper functioning of steam traps and bearing lubrication, find pneumatic leaks, and check hydraulic pumps. Advances in the field have made this equipment compact, portable, and affordable.

Ultrasonic sounds are defined as any sounds that are higher in frequency than normal human ceiling of 20 kilohertz. Sound frequencies are measured in Hertz, which means cycles per second, so a 20 kilohertz sound is one that vibrates 20 thousand times per second. Since we can't hear these high-pitched sounds, an ultrasonic detector translates them to lower frequencies that we can hear.

This technology is different from the old screwdriver held to the ear trick or its modern counterpart, an electronic stethoscope, which merely magnify sounds within the audible range. A visual example of this would be to compare an electronic stethoscope to binoculars,

Log onto our web site and listen to actual recordings of steam traps cycling. www.HarperLove.com

which magnify what we can already see. Ultrasonic detection would be comparable to IR/Thermal night-vision goggles, which allow us to see the heat signature of an object, something we could not normally see, even with magnification.

Ultrasound detection should not be confused with vibration analysis, though the technologies are somewhat related. Vibration analysis usually employs dedicated equipment to monitor a specific piece of equipment, such as a large bearing, and record its vibration patterns periodically to try to predict when it will fail.

There are certain types of problems that emit ultrasonic sounds. Being able to detect these ultrasonic emissions is an obvious advantage when troubleshooting. Pneumatic leaks, leaking valves, many steam trap problems and even leaks or flow in pipes that are buried or inside concrete are much easier to detect by reading their ultrasonic signature.

As we age, we tend to lose some of our hearing, particularly at higher frequencies. This is known as presbycusis. Some of this loss is part of natural aging and some can be caused by damage, such as exposure to loud sound. Many of us who have spent time around corrugators have some measurable hearing loss in spite of having worn hearing protection regularly.

Steam or air rushing through orifices such as leaks often do not produce a lot of sound within our hearing range so this is why we need special equipment to listen to these events. Also, high frequency sounds don't travel as far as lower pitched sounds.

How they're used

An ultrasonic detector can be used with a directional microphone, which is pointed at possible leaks. Scanning back and forth and listening for an increase in amplitude, helps us quickly pinpoint the source of the leak. This has the advantage that it can be done from a safe distance. For example, arcing in electrical systems can be safely detected even while panels are energized and the machine is running since it can often be done from outside closed enclosures.

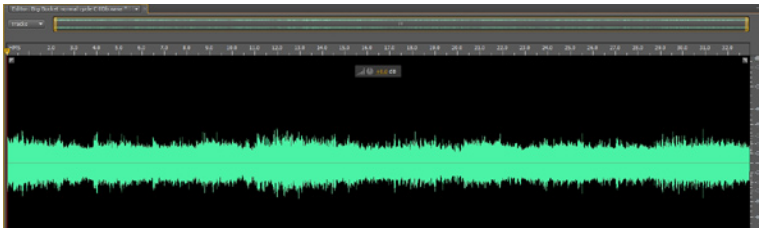
A detector with a long contact probe that isolates all background noise is ideal for checking bearings or steam systems. Even traps that have guards around them can be checked safely, without removing the guard.

next page, please

Different trap types produce different sound signatures

Steam systems are probably one of the best places in a box plant to use ultrasonic detection equipment. Troubleshooting and analysis of steam traps requires a trained ear and some experience in interpreting the results. Some knowledge of steam systems and the functioning of different types of traps is essential. For example, hearing that a bucket trap is working may not be enough. A trap that is cycling too often or somewhat violently may be undersized and may require changing to a larger trap.

Bucket and float type valves can be heard cycling periodically. As the load increases on the machine, the trap will cycle faster. When they malfunction they will sound different. They can fail in two modes, open or closed. When they fail in the closed position they will become silent, or at least much quieter, and they will lack the marked event of the trap flushing. When they fail open they sound similar

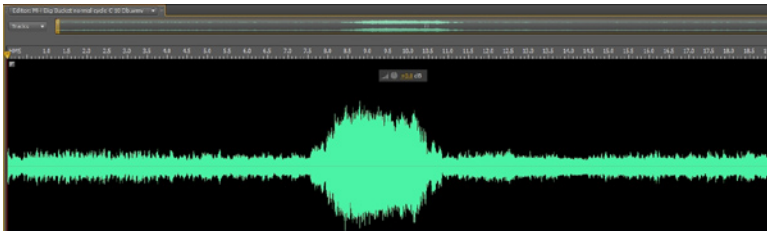


Graph of a thermodynamic trap functioning properly.

to a thermodynamic trap functioning properly, emitting a constant roar or growl. This is why it is important to be able to recognize the type of trap you are working on from its external anatomy.

Human Hearing range

Subsonic	*0-60 hertz*
Sonic	*60-20,000 hertz*
Ultrasonic	*20,000-200,000 hertz*



Graph of a bucket trap. Note the marked change in the middle of the graph when the trap cycles.

Ultrasonic technology is also useful for determining if a valve has closed completely or if it is still allowing any degree of flow. This would include things like solenoid valves that are part of a bank of valves or if a check valve is really doing its job. A fully closed valve produces no sound.

Recording and analysis

We are now able to record and analyze these sounds on a computer. The recordings are stored for later comparison or analysis, for example to set a baseline for bearings to determine changes as they wear and try to predict when they require replacement. Some equipment and software can perform frequency analysis and display results graphically. They are also useful tools for training personnel to diagnose steam trap problems.

Latin and Central America team meets in Miami

Harper/Love Adhesives recently held a technical symposium in Miami for employees and agents who serve the company's large customer base in Latin and Central America.

Discussion topics included: formulating with lower solids; better bonding of highly sized and high recycled-content paper; paper, adhesive and wet strength test methods appropriate for the Latin American market; and advances in treatment of wastewater and other reuse water.

The group also explored formulating with polymer additives to increase board strength and the implementation of the 5S training programs in the region.

Participating in the Latin America technical symposium:

Row 1 *Maricruz Springer, Luis Lozano (Colombia), Lou Cuccia, Gonzalo Galaz (Chile)*
Row 2 *Elaine Marker, Luis Chamorro (Mexico), Bill Kahn*
Row 3 *John Kohl, Jorge Romero (Ecuador), Roberto Vilchis (Central America), Carlos Vargas (Mexico)*
Row 4 *Bill Gerard, Augusto Cavallini (Regional Manager Latin America), Rex Woodville-Price*

Steam traps: a good place to look (and listen) for energy-saving opportunities

by John Kohl

Energy costs are a large portion of the operating cost of a corrugated box plant. Even with the recent drop in oil prices, a plant must strive constantly to control energy usage and waste.

One of the best ways to reduce energy costs is to maintain and upgrade the steam system for the corrugator. This can be accomplished in many ways, including the installation of a high-pressure, high-temperature, condensate return system. These systems can pay for themselves in a short period of time and continue to save on energy costs in the long term. By returning the condensate to the boiler at a higher temperature than the ambient makeup water there is less energy consumed to heat the water back into steam and there are additional savings by eliminating the need to treat the makeup water with chemicals.

Steam supply and condensate return lines should be insulated to reduce heat loss due to radiation. A typical 4" diameter steam line supplying 150 psig steam, loses 850 MBtu (1,000 Btu) per year per 100' of pipe. If a box plant has 250' of 4" supply and return lines uninsulated, the energy loss is substantial. Even small section of missing insulation will add up to additional energy costs. The annual cost of 250' of uninsulated steam lines can be calculated by:

Current cost of steam = $4.50/MBtu

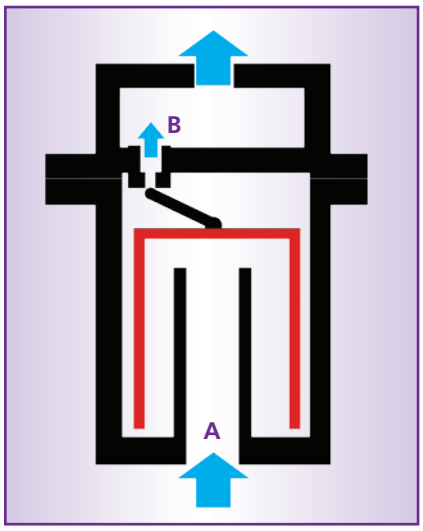
250 ft x 850 MBtu/ yr per 100 ft = 2125 MBtu/yr

2125 MBtu x $4.50/MBtu = $9,562 per year

Steam traps are one of the most frequently overlooked opportunities for energy savings and corrugator efficiency in a box plant. If the traps are not functioning properly, steam may not remain in the vessel long enough to transfer its heat energy to the vessel, and subsequently to the liners. Condensate can act as an insulator inside a steam vessel. A trap that isn't cycling properly may leave the vessel waterlogged and cause a lack of heat transfer. This, in turn, may cause poor bonding and lower corrugator speeds.

Proper functioning is critical

Whatever type of steam system your corrugator has, the traps must function properly to maintain vessel temperature and ensure proper heat transfer to the paper. Maintenance departments should have a planned PM schedule to check traps for proper function on a regular basis. The schedule should also include replacing or rebuilding worn traps before they fail and cause lower productivity or waste from poorly bonded board. The U.S. Department of energy (DOE) recommends traps be checked monthly and replaced every 3 to 4 years.



BUCKET TRAP
The most common type of steam trap is an inverted bucket trap. Steam and water enter at A. Initially the steam pushes up the inverted bucket (in red). When the trap fills with water, the inverted bucket will drop and the water will be blown out into a condensate line at B. The bucket then rises again and the hole at B closes. The cycle repeats itself.

With the use of ultrasonic testing a plant can identify traps that are near failure or have failed, causing lower energy efficiency and lower productivity from poor heat transfer.

A steam trap that has failed in the open position acts as a steam leak and results in wasted energy costs to a box plant. The lost energy cost can be calculated by using the volume of a steam leak multiplied by the cost of steam and the operating hours of the steam system. For a system operating at 150 psig the flow through a 1/8 orifice trap is 38 lbs per hour.

38 lbs/hr trap leak x 520 hr/mth x $10/1000 lbs steam

=38 x 520 x 10 = $197.60/month per trap

This costs doubles to $395 per month when the trap completely fails in the open position and vents 76 lbs of steam per hour into the return lines.

Don't forget to clean and replace the strainers in the steam lines frequently. They collect rust and sediment from the condensate and steam and are there to protect the traps. Inverted bucket traps are not as sensitive to dirt clogging as some of the newer, more sophisticated float or thermostatic types.

Leaders in the science
of making
good adhesives better™

Harper/Love Adhesives Corporation
11101 Westlake Drive
P.O. Box 410408
Charlotte, NC 28241-0408

800-438-3066 • www.harperlove.com
e-mail: salestech@harperlove.com

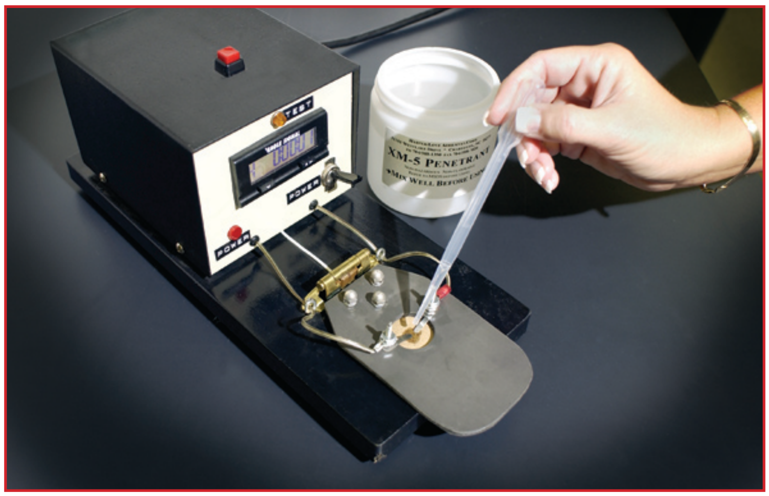
In this issue:

- ***Ultrasonic detectors for diagnosis***
- ***Steam traps: opportunities for saving energy***

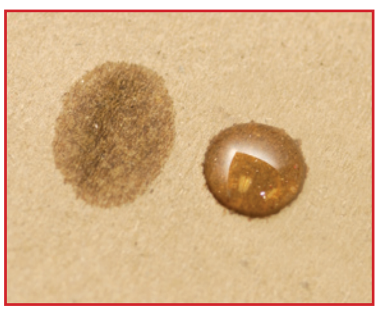
XM-5 PENETRANT

XM-5 Penetrant is a conditioning agent which facilitates adhesive release into paper substrates. By reducing surface tension, XM-5 Penetrant assists the liquid phase of starch adhesive to migrate rapidly into the paper substrates to be bonded. This third generation penetrant was developed to penetrate and assist bonding of liners coated with synthetic polymers. The chemical composition of XM-5 also allows it to penetrate even the most difficult to bond substrates, including preprinted liners with a varnish overcoat.

XM-5 also helps retain moisture in the sheet to prevent overdrying and reduce the risk of score line cracking.



Our laboratory uses an electronic timer to measure penetration of liquids through various substrates. This sample combination stopped the timer at one second.



Plain water bead on right was applied first. At the time of the photograph, it had been sitting on the paper surface for several minutes. The spot on the left shows where water with XM-5 penetrant absorbed instantly.

Benefits

- Enhanced starch adhesive penetration potential
- Helps reduce score line cracking
- Helps sheet retain moisture
- Low foaming action
- Consistent performance
- Easy to use

Features

- Very effective surface tension reduction
- Precise quality control
- Convenient drum or bucket containers are available