

# SOLUTIONS

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Second of two parts:

## Successfully testing steam traps with high-frequency ultrasound

**W**hen using high-frequency ultrasound, the main question is where the sensitivity should be set to conduct the test. If the testing instrument is set to too high a sensitivity, all the steam traps will test as failed; using too low a sensitivity will indicate that all steam traps are operating properly.

The solution is to use a field-proven comparison method, which will provide an accurate test on each steam trap. The comparison method uses three or more test points on the steam trap station. Two of the test points are the sensitivity baseline settings on the ultrasound unit, and the third is for testing the steam trap. The comparison method allows the steam trap station assessor to establish a base reading to filter out any competing ultrasounds that can be generated upstream or downstream of the steam trap. Without using the comparison method of testing, it is very difficult to assess the steam trap's performance because the assessor will not know the correct sensitivity setting. Each steam trap will be in slightly different installations and situations in the steam system, so the comparison method is the most accurate method for setting the ultrasound sensitivity.

With the stethoscope module, contact each point on the steam trap station, as shown in Figure 1. The steam and condensate line

should have baseline test points that are between 6 in. and 10 in. (these estimated values will vary depending on the piping) upstream or downstream of the steam trap that is being tested. More test points can be taken to establish a baseline, but at least two need to be done for each steam trap location.

### Using the high-frequency ultrasound

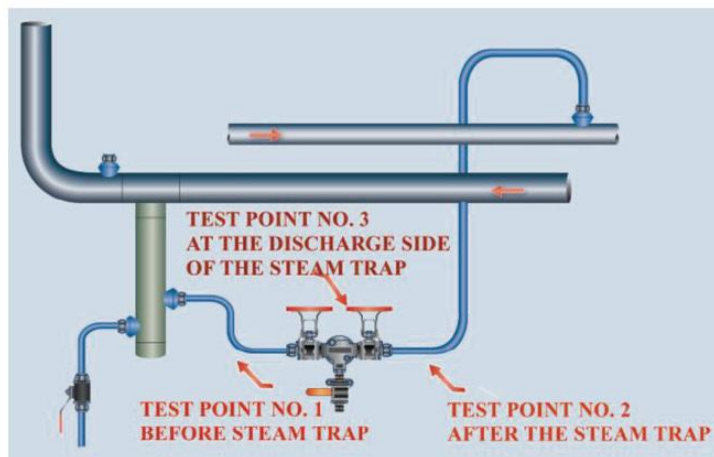
The ultrasound unit needs to be set at 25 kHz to provide the highest clarity for high-frequency ultrasound generated by steam or condensate passing through an orifice in steam trap.

Pull the trigger to turn on the ultrasound unit. If the instrument is within sensitivity range, the decibel (dB) indicator (A in Figure 2) will blink. The dB reading should be set to 20 dB.

The kHz (frequency) indicator must be steady and not blinking (B in Figure 2). If the kHz is blinking, then it is in the adjustment mode for frequency. Adjust it to the correct frequency level and push in the sensitivity knob to return to the sensitivity adjustment-setting mode.

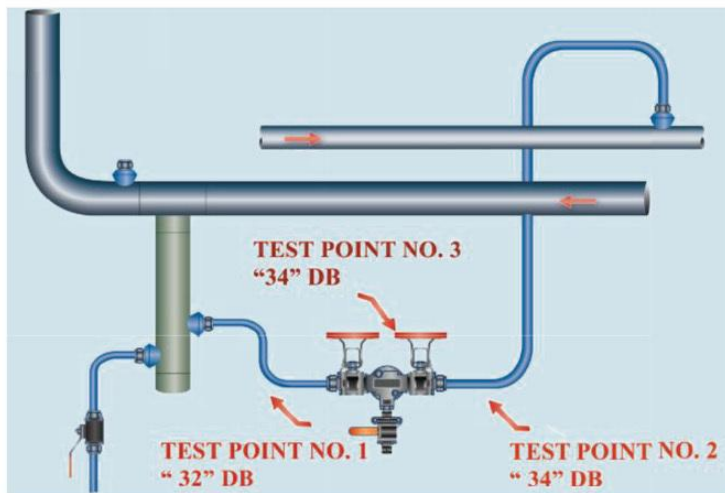
Once in the sensitivity mode, turn the sensitivity control dial clockwise to increase the sensitivity and counterclockwise to decrease the sensitivity.

**Figure 1: Typical steam trap station indicating the required three test points for baseline information and testing. All images courtesy: Kelly Paffel**



**Figure 2: High Frequency Ultrasound Unit Information; "A" is the dB reading and "B" is the KHz setting.**

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**Figure 3: Ultrasound dB test measurements at Test Point 3 is equal or less than Test Points 1 or 2 – steam trap is operating properly.**

|               |       |
|---------------|-------|
| Test Point 1: | 32 dB |
| Test Point 2: | 34 dB |
| Test Point 3: | 34 dB |

If a steam trap is operating properly, the ultrasound level at Test Point 3 will not be higher than at Test Points 1 or 2.

The reading at Test Point 3 will be equal or less than the readings at Test Points 1 or 2. The high-frequency ultrasound readings, in addition to a temperature measurement that is appropriate for the system pressure, will indicate a properly operating steam trap.

If the ultrasound reading at Test Point 3 is higher than the readings at Test Points 1 or 2, wait for 45 seconds to ensure the steam trap was not in a cycle mode. During the cycle mode, the ultrasound reading at Test Point 3 will be higher, which is the proper operation of a steam trap with on/off discharge cycle.

## Steam traps: four test points

The float and thermostatic steam trap has two orifices: one for discharging the condensate and the other for the air vent mechanism that discharges air and non-condensable gases.

The four test points are as follows:

- Upstream of the steam trap station
- Downstream of the steam trap station
- At the discharge side of the steam trap condensate orifice
- At the discharge side of the steam trap air vent.

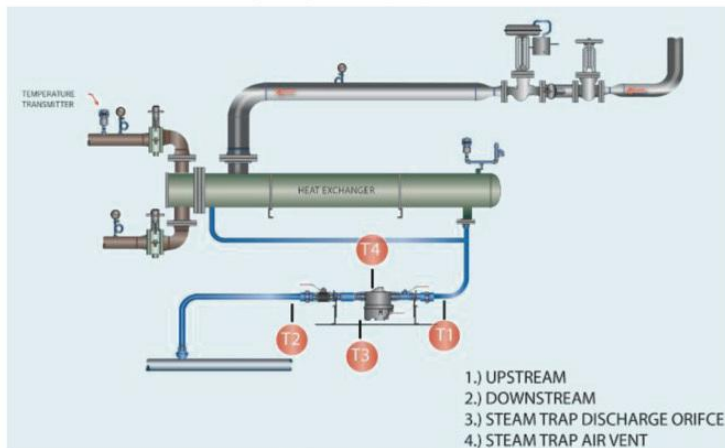
The sensitivity control dial increases or decreases the sensitivity of the instrument simultaneously with the sound level in the headphones. The instrument needs to be in range for accurate testing.

If the sensitivity is too low, a blinking arrow pointing to the right will appear, and no numeric dB level will be visible in the display panel. If this occurs, increase the sensitivity until the arrow disappears. (In low-level sound environments, the arrow will blink continuously, and it will not be possible to achieve a dB indication until a higher intensity level is sensed.)

If the sensitivity is too high, a blinking arrow pointing to the left will appear, and no numeric dB value will be visible on the display panel. Reduce the sensitivity until the arrow disappears and the numeric dB value is shown.

Comparison testing: Testing methods and results Proper Operation (PO)

**Figure 4: Float and thermostatic steam trap requires four test points. The fourth test point is the thermostatic air vent mechanism.**



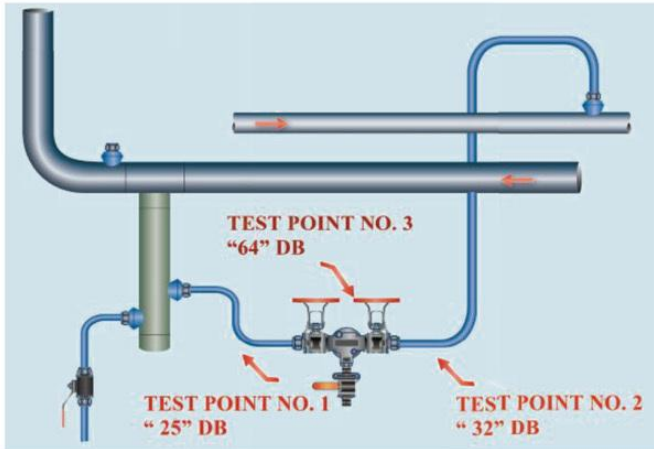
If the air vent is operating properly, the ultrasonic level at Test Point 4 (T4) should be equal to or less than Test Point 3 (T3). If T4 is higher than T3, then the air vent mechanism has failed.

## Blowing or Completely Failed Steam Trap (BLW)

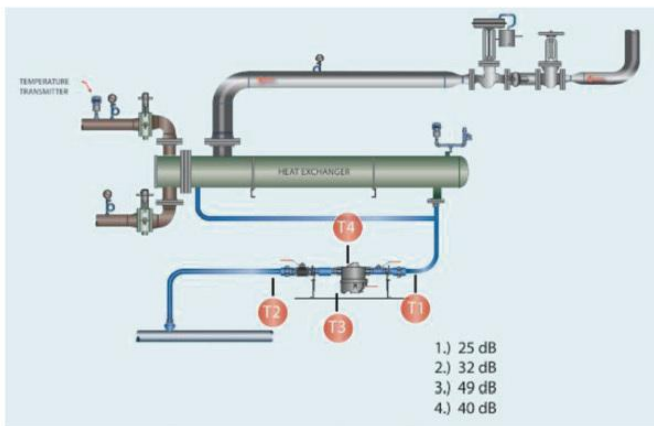
|               |       |
|---------------|-------|
| Test Point 1: | 25 dB |
| Test Point 2: | 32 dB |
| Test Point 3: | 64 dB |

A significant increase (greater than two times the base level reading) in the dB level at Test Point 3 indicates that the steam trap is failed open and allowing steam to pass. Continue to monitor the steam trap at Test Point

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**Figure 5: Test Point 3 has a higher dB reading (64) than Test Points 1 and 2. The result is that the steam trap is failed and blowing steam.**



**Figure 6: S Test Point 3 has a slightly higher dB Reading (49) than Test Point 1 and 2, result; the steam trap is failed and blowing steam.**

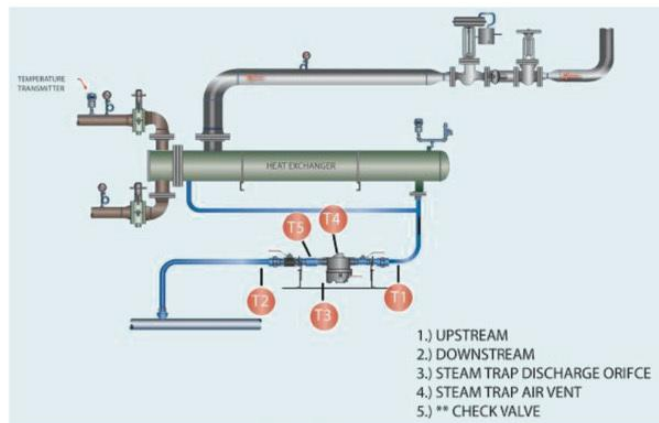
3 to see whether the steam trap cycles according to its design.

#### Steam Leakage

|               |       |
|---------------|-------|
| Test Point 1: | 25 dB |
| Test Point 2: | 32 dB |
| Test Point 3: | 49 dB |
| Test Point 4: | 40 dB |

An increase in the dB level at Test Point 3 indicates leaking steam through the steam trap. Again, if this increase

**Figure 7: Checking all steam components is required to ensure proper operation of all steam trap station components.**



is observed, take additional time at Test Point 3 to determine whether the steam trap is in the middle of a discharge cycle. If the dB level at Test Point 3 does not return to the baseline value established at Test Point 1, then the steam trap is leaking steam.

#### Competing downstream ultrasounds

|               |       |
|---------------|-------|
| Test Point 1: | 22 dB |
| Test Point 2: | 42 dB |
| Test Point 3: | 28 dB |
| Test Point 4: | 28 dB |
| Test Point 5: | 52 dB |

The above readings show that ultrasound is being produced downstream of the steam trap. Check valves can be a source of additional ultrasound in the piping system. Perform further testing at the other components in the steam trap station (Test Point 5) if the assessor determines that the check valve in the system is generating the high ultrasound levels. If the dB value is higher at Test Point 5, then there are competing ultrasounds in the system. If the value is lower at Test Point 5, conduct further examination of the piping and steam trap to determine the source of the higher ultrasound.

#### Sound characteristics using ultrasound

While using ultrasound listening devices, the tester should be made aware of a few distinct sounds that he or she may hear while testing steam traps:

**Crackling:** This sound signature is generated by condensate flowing through a steam trap with flash steam occurring after the discharge orifice of the steam trap.

**Whistling:** A whistling sound is a characteristic of steam passing through a steam trap orifice.  $\frac{1}{2}$

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