

MODEL 9207 ULTRASONIC LEAK DETECTOR
INSTALLATION & MAINTENANCE

UltraSonic
Leak Detector)))



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INTRODUCTION

What Is Ultrasonic Sound?

Ultrasonic sound is a range of sound that is above the human hearing capacity. Typically, humans can hear frequencies from 20 Hz to 20 kHz, with sound from 20 kHz to 100 kHz being termed ultrasonic.

Turbulence created by air or a gas forced through a small orifice generates ultrasonic sound. Ultrasonic sound occurs when either a pressure vessel leaks to the outside atmosphere or when the atmosphere leaks into a vacuum vessel (Fig. 1).

Ultrasonic sound is very directional in nature. This directionality is used to pinpoint the exact origin of the sound source, the leak point.



Fig. 1

Ultrasonic Leak Detection

When any gas flows through a small opening at a rate greater than 10^{-5} atmospheric ML/second, the gas is generally understood to be in the viscous flow dominion. Generally, the greater the pressure difference across an opening, the greater the velocity. As the velocity increases, the frequency of the emitted ultrasonic sound will become higher. The general overall spectra of the emitted ultrasonic sound is white noise. White noise is a broad band emission of sound.

The velocity and volume of a leak are affected by the viscosity of the gas that is leaking. The higher the viscosity (or stickiness) of the gas, the less it will pass through an opening. Refer to the Table – “Viscosity of Gases” on Page 8.

Ultrasonic Leak Detector

The Model 9207 Ultrasonic Leak Detector is designed to locate the source of ultrasonic sound emissions. These ultrasonic sound emissions are converted by the Ultrasonic Leak Detector to a range that can be heard by humans. The sound generated by the unit is 32 times lower in frequency than the sound that is received.

Using Your Ultrasonic Leak Detector

1. Turn on the 9207 Ultrasonic Leak Detector and plug the headphones into the jack located on the front of the Receiver. Any standard set of 3.5mm jack headphones are compatible.
2. Before moving to the target area, press “+” or “-” sensitivity button to adjust signal strength sensitivity to the highest possible level where bar graph still shows either 0 or a value close to 0.
3. Scan the target area with the Microphone Sensor.
4. As you move nearer to the source of the leak, vibration or electric discharge, the signal strength will increase. This will be indicated on a screen with increasing signal strength number and level of the bar graph.
5. The bar graph is a relative measurement only, so when the signal strength reaches maximum, lower the sensitivity by pressing the “-” sensitivity button until the displayed signal strength is less than 75. Repeat this process until you have isolated the source of the ultrasound.
6. The audible sound emitted via headphones will help to verify the source of the leak, for example hissing sound of the air leak versus ticking sound of the electric discharge. The ULD screen alone will not provide an indication of the leak source.



PARTS & CONTROLS

- A. Microphone Sensor
- B. Display – Signal Strength, Sensitivity Level
- C. Sensitivity “+/-” Button
- D. Headphone Jack
- E. On/Off Button
- F. Headphone Volume “+/-” Button

Note:

- For surroundings with a high level of background noise use the Parabola (PB-1) to direct the ultrasound towards the sensor.
- For locations that you cannot point the ULD directly at the leak, the Tubular extension can be used (TE-1 with TE-2).

Miscellaneous Accessories

For cases where there is intense ultrasonic activity, you may need to further reduce the sensitivity of the instrument. You may do one of two things. First attach the Parabola (PB-1) to the sensor horn. The PB-1 will dramatically reduce the ultrasonic background noise. For further reduction, attach the TEA-1 adapter over the sensor horn and push the tubular extension (TE-2) into the adapter. These accessories can also be used to extend the sensor horn, carrying the sound from places that are too tight, too hot, or too dangerous for close human contact. For example, you should use these accessories with compressors where some fittings are close to rotating parts or hot due to compressed air.





Applications

Compressed Air Leaks

Compressing air is an expensive operation. In large installations, the cost of a small air leak may be insignificant, but many small leaks can practically blow money into the air. Finding these small leaks is just the job for the Ultrasonic Leak Detector.

In a plant where loud noise levels often exist, it is very difficult to locate leaks by merely listening for them. Most plant noises are in the normal audio range while air escaping from a small orifice will be in the ultrasonic range. The Ultrasonic Leak Detector will ignore the background noise and detect only the ultrasonic sounds that are generated.

Often the suspected leak is in a hot area and/or close to moving parts. Under these circumstances, use the tubular extension & adapter. These accessories will help you to probe into areas that are difficult to reach and/or isolate. Refer to the previous page.

One of the most dramatic demonstrations of the capabilities of the Ultrasonic Leak Detector is finding a small leak on the discharge side of a compressor where the fitting connects to the tank. Normally this area is hot, loud, and dangerous and using soap bubbles to detect the leak in this area may not work because the water tends to evaporate faster than it can form bubbles. Use the Ultrasonic Leak Detector to find the exact location of the leak. Using the tubular extension will help determine which side of the fitting leaks the most.

Simply pointing the Ultrasonic Leak Detector at a fitting, union, or wherever a leak is suspected, makes the testing of complete installations fast, efficient, and thorough.

Leaks In Refrigeration and Air Conditioning Systems

The Model 9207 Ultrasonic Leak Detector can be used to detect pressure leaks in refrigeration and air conditioning installations. Depending on the size of the leak, a system may overheat, consume abnormal amounts of energy, or release harmful refrigerants into the atmosphere. You will be able to find the location of leaks when the system is pressurized by refrigerant. This capability is impossible with conventional halogen-type leak detectors. A leak will emit an ultrasonic sound as the refrigerant escapes the unit. The Ultrasonic Leak Detector can be used to pinpoint the exact location of the leak by "homing" in on this sound.

The Ultrasonic Leak Detector is reliable when you operate it outside. A light breeze will not reduce the readings to zero as with conventional halogen detection systems.

Note: If there is significant background noise, you may need to further reduce the sensitivity of the Ultrasonic Leak Detector by using the tubular extension and adapter accessories to hear the actual leak. In very noisy environments, use the stereo headphones and Parabola (PB-1) to hear the converted ultrasonic sound.

Bearing Problems

Bearing analysis requires prior knowledge of the sound that a "healthy" bearing makes. A log that notes the date, location of the test area, sensitivity setting, and LED display panel reading should be available for regular inspection of bearings.

A bearing will emit ultrasonic sound even when it is "healthy". When the bearing system begins to deteriorate, the ultrasonic sound will change long before problems are detectable through the heat of vibration monitoring systems.

Using the Ultrasonic Leak Detector to analyze bearings on a regular basis will deter major problems. You may use the tubular extension & adapter.

Leaks In Heating Systems

The Ultrasonic Leak Detector can detect dynamic leaks in pipes and ducts.

An improperly seated valve will allow ultrasonic sound to go through any cracks or holes that exist. The Ultrasonic Leak Detector will find these leaks without the operator having to disassemble the pipe line to find the leak source.

Note: The ULD is not a flammable gas detector. When you suspect a flammable gas leak, contact your local public service company or fire department immediately.

Brake Systems

Air brakes in trucks can be a source of many problems. This is particularly true when a leak is small enough that it cannot be heard over the sound of a running engine, but is large enough to empty the air tanks overnight.

By tracing the air supply lines and all of its couplings, the Ultrasonic Leak Detector can accurately isolate a leak in a fraction of the time normally needed.

Tire And Tube Leaks

Tubeless tires are, for the most part, trouble-free. However, problems can occur when they leak around the rim. You can easily verify a leak around the rim without the traditional immersion rituals. Just use the Ultrasonic Leak Detector and trace it along the rim area to inspect for leaks. Remember to check the valve stem area.

The Ultrasonic Leak Detector is invaluable when you have to find a leak in a big inner tube, such as those used on trucks and tractors. To isolate a large inner tube leak, fill the tube with air and lay it flat. With the Ultrasonic Leak Detector, walk around the tube and "listen" for the leak.

Engine Seals

To check the condition of the valve seats and/or rings, the cylinder will need to be pressurized with 10 - 20 PSI of compressed air.

The tubular extension and adapter accessory will increase the efficiency of the Ultrasonic Leak Detector for this procedure (See page 4.). Remove the manifolds and be sure the cylinder being tested for tightness is at the top dead center in the compression cycle.

(**Note:** Be careful when pressurizing the cylinder. Too much air will cause the piston to move. Attach the tubular extension and adapter to the horn of the Ultrasonic Leak Detector and insert it through the head port of the valve that is being tested for compression. If the valve seal is leaking, pressurized air will escape and the Ultrasonic Leak Detector will detect the breach.)

Radiators

Radiators can be tested with the Ultrasonic Leak Detector by using air pressure instead of immersing the radiator in a water tank. Inject pressurized air into the radiator, making sure you do not exceed the pressure capacity of the radiator. By checking one area of the radiator at a time, you can detect any leaks that exist in the radiator.

Electrical

In electrical applications, the prior knowledge of the sound a healthy circuit makes is vital to make useful comparisons. Expensive equipment is not needed to check the conductivity of insulators when the Ultrasonic Leak Detector is used. In areas that are close to high voltage insulators (such as switch yards), the tubular extension and adapter is the appropriate tool to use with the ULD. This accessory is particularly useful when checking insulators because the circuit does not need to be interrupted.

Electrical Arcing And Discharges

Electric arcing and discharges can be detected with the Ultrasonic Leak Detector; however, **caution must be exercised in this environment.**

Arcing produces a high ultrasonic spectrum that is quite noisy. You will be able to detect loose connections, circuit breaker and transformer problems, high voltage corona discharge, etc.

Using the tubular extension & adapter to extend the sensor horn of the Ultrasonic Leak Detector will enable you to safely probe the suspect electrical area (Fig. 2)

Relay Arcing

Arcing in relays will reduce the life of the contact and increase its resistance. By using the Ultrasonic Leak Detector to establish the arcing level on a new relay, you will have a base range for comparing existing relay arcing.

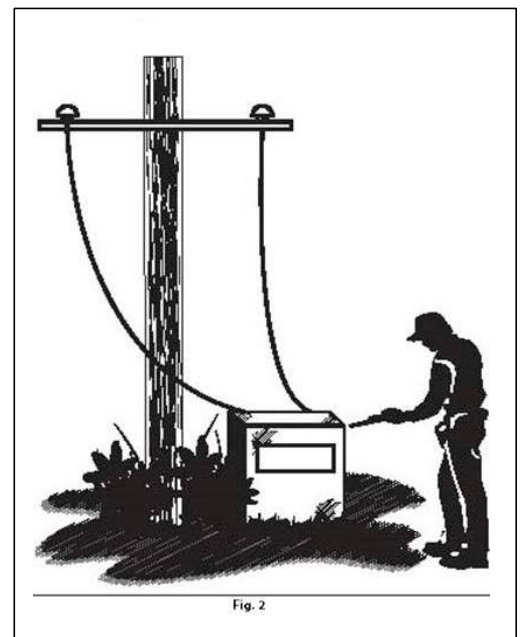


Fig. 2

Application Summary

Air Damper Seals - The normal low level of air pressure will create ultrasound if there is a leak in the damper gasket.

Circuit Breakers - Works great for locating arcing circuit breakers. They start emitting ultrasound when there is even the slightest arcing.

Cracked Rubber V-belts - Any crack in a moving rubber belt will emit ultrasound when the crack passes by the pulley.

Gas Burner Manifold Leaks - Works great even at the typical pressure of 1.25 to 3.5 inches of water.

Identify Conduit - For best results, the conduit should be of 3 inch diameter or larger and should not have any wire inside.

Refrigerant Leaks - Detects even new refrigerants. Spray water over the area you are checking to increase the sensitivity. Minimum leaks are 120 ounces per year under ideal conditions and 0.6 ounces per year with water.

Tire Leaks on Vehicles - Spray water first - then you can find the smallest tire leak without removing the tire from the vehicle.

Worn Bearing - Use the tubular extension and adapter as a contact probe or just point and listen.

Vehicle Exhaust Leaks - Force compressed air into the outlet, then use the ULD to find even the smallest of leaks. This will prevent the small leak from corroding into a much larger opening later.

Tips for using the table to the right: If an opening is leaking air, then that same opening will leak 56% more volume of Freon R12, and 6% less volume for helium.

Minimum Detectable Leak Under Ideal Conditions

Factors Governing Detectability

- A. Instrument Sensitivity
- B. Acoustic Frequency Range
- C. Viscosity of the Fluid
- D. Velocity of the Fluid
- E. Leak Size (0.0005 to 0.015 in.)
- F. Leak Configuration
- G. Sensor Location
- H. Sensor Type
- I. Acoustics of the Medium being used
- J. Ambient Noise

Never use soap detergent solution! The multitude of bubbles will attenuate the ultrasound.

Source: Materials Evaluation, October 1984, "Official Journal of The American Society for Non-Destructive Testing", Gerald L. Anderson

VISCOSITY OF GASES

Gas	Temp	Viscosity (micro Poises)
Air	70°F (21°C)	183
Carbon Dioxide	70°F (21°C)	150
Freon R12	70°F (21°C)	117
Helium	70°F (21°C)	194
Hydrogen	70°F (21°C)	88
Hydrogen Sulfide	70°F (21°C)	124
Neon	70°F (21°C)	311
Nitrogen	70°F (21°C)	175
Oxygen	70°F (21°C)	202
Propane	70°F (21°C)	80
Water (vapor)	212°F (100°C)	125
Xenon	70°F (21°C)	226

From Handbook of Chemistry and Physics, Published by the Chemical Rubber Company.

Specifications

Operating Temperature:

-4°F to 122°F (-20°C to 50°C)

Storage Temperature:

-4°F to 158°F (-20°C to 70°C)

Weight:

Approx. 0.518 lbs (0.235 kg)

Dimensions:

Height: 1.791 inches (43mm)

Width: 2.984 inches (75mm)

Length: 7.547 inches (183mm)

Frequency Response:

20kHz to 90kHz

Power Consumption:

75mA

Battery Life:

105 hours Alkaline Battery

Protection:

IP40

APO Function:

60 minutes when idle

Power Supply:

4 x 1.5 V AA (LR6) alkaline batteries

Case:

High Impact ABS Plastic

EFFECT OF TEMPERATURE ON ULD

0.61% Change per °F (Jan 91)

