

**OPERATING INSTRUCTIONS**  
for  
**AMPROBE**

**Ultrasonic Leak Detector**



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**Model**  
**ULD-300**



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## SPECIFICATIONS

### ULD-300 ULTRASONIC LEAK DETECTOR

**Operating Temperature:** 32°F to 100°F (0°C to 38°C)

**Storage Temperature:** -40°F to 150°F (-40°C to 66°C)

**Weight**

4.5 Ounces (128 Grams) without Battery

6.3 Ounces (180 Grams) with Battery

**Dimensions:**

Height: 1.0 Inches (25.40 mm)

Width: 2.5 Inches (63.50 mm)

Length: 7.3 Inches (185.40 mm)

**Frequency Response:** 35kHz to 45kHz +6db

**Power Consumption:** 22mA at 9 Volts DC

**Battery Life:** 33 Hours with 9 Volt Alkaline Battery  
(Duracell #MN1604)

**Minimum Leak:** See Page 14

**Performance:** Meets the ASTM Standard

**Battery Test:** Led Color indicator: Green-Good / Red-Replace

**Case:** High Impact ABS Plastic

### UT-300 ULTRASONIC TRANSMITTER

**Operating Temperature:** 32°F to 100°F (0°C to 38°C)

**Storage Temperature:** -40°F to 150°F (-40°C to 66°C)

**Weight:**

4.5 Ounces (128 Grams) without Battery

5.7 Ounces (176 Grams) with Battery

**Dimensions**

Height: 25.40mm (1.00 Inches)

Width: 63.50mm (2.50 Inches)

Length: 165.00mm (6.50 Inches)

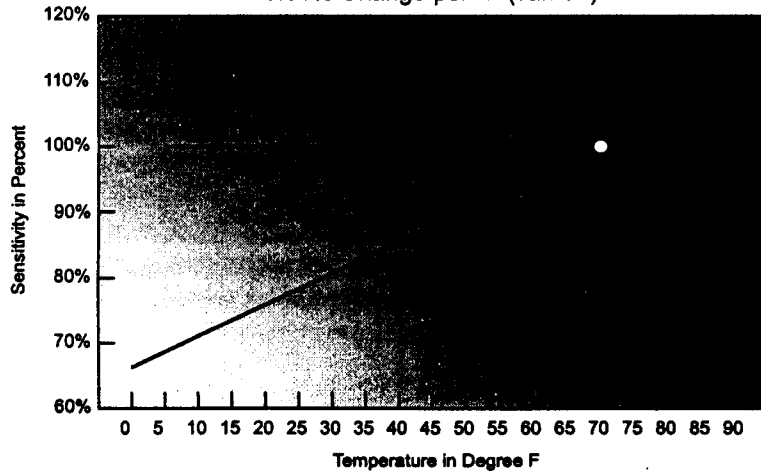
**Frequency:** 40kHz

**Power Consumption:** 8.5mA at 9 Volts

**Battery Life:** 60 Hours with 9 Volt Alkaline Batteries  
(Part# - MN1604)

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

**Effect of Temperature on ULD-300**  
0.61% Change per °F (Jan 91)



### 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, NEVER, 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

### LIMITED WARRANTY

Congratulations! You are now the owner of an AMPROBE® instrument. It has been quality crafted according to the highest standards of quality and workmanship. This instrument has been inspected for proper operation of all its functions and tested by qualified factory technicians according to the long-established standards of AMPROBE®.

Your AMPROBE® instrument has a limited warranty against defective materials and/or workmanship for two years from the date of purchase provided that the seal is unbroken or, in the opinion of the factory, the instrument has not been tampered with or taken apart.

*Should your instrument fall due to defective materials, and/or workmanship during the two-year warranty period, return it along with a copy of your dated bill of sale which must identify instrument by model number and manufacturing number.*

**IMPORTANT:** For your protection, please use the instrument as soon as possible. If damaged, or should the need arise to return your instrument, place it in a shipping carton packed with sufficient packing material. It must be securely wrapped. Amprobe is not responsible for damage in transit. Be sure to include a packing slip (indicating model and manufacturer number) along with a brief description of the problem. Make certain your name and address appears on the box as well as the packing slip.

Ship prepaid via Air Parcel Post insured or U.P.S. (where available) to:

Service Division  
 AMPROBE®  
 630 Merrick Road (For U.P.S.)  
 P.O. Box 329 (For Parcel Post)  
 Lynbrook, NY 11563-0329

Outside the U.S.A. the local Amprobe representative will assist you. Above limited warranty covers repair and replacement of instrument only and no other obligation is stated or implied.

## 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).

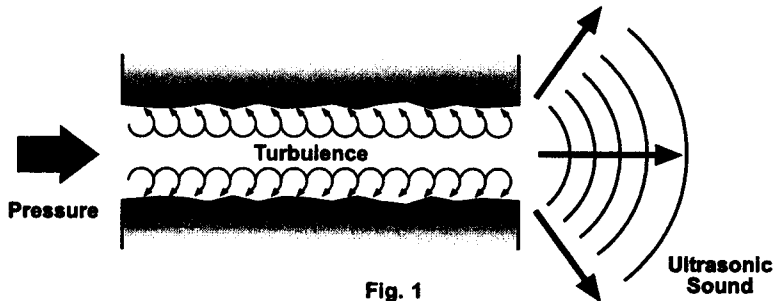


Fig. 1

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

### 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 of Viscosity of Gases on Page 13.

### ULD-300 ULTRASONIC LEAK DETECTOR

The ULD-300 Amprobe 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.

**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 to increase the sensitivity. Minimum leaks are 120 ounces per year under ideal conditions and 0.6 ounces per year with water.

**Roof Leaks** - You can put the transmitter inside the attic and use the ULD-300 on the roof or just use the ULD-300 in the attic if there is water dripping. The water dripping creates a lot of ultrasound.

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

**Underwater Diving Suits** - Place the transmitter inside the suit, then inflate suit with air. Use the ULD-300 to quickly find the leak. Also works great for underwater camera cases.

**Vehicle Exhaust Leaks** - Force compressed air into the outlet, then use the ULD-300 to find even the smallest of leaks. This will prevent the small leak from corroding into a much larger opening later.

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

TABLE OF VISCOSITY OF GASES		
Gas	Temp. F°	Viscosity (Micro Poises)
Air	70	183
Carbon Dioxide	70	150
Freon R12	70	117
Helium	70	194
Hydrogen	70	88
Hydrogen Sulfide	70	124
Neon	70	311
Nitrogen	70	175
Oxygen	70	202
Propane	70	80
Water (vapor)	212	125
Xenon	70	226

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

## USING YOUR UT-300 ULTRASONIC TRANSMITTER

In areas where leaking gases are not sufficiently pressurized, there is no ultrasonic sound for detection. Such areas can be "pressurized" with sound waves created by the UT-300 Amprobe Ultrasonic Transmitter. This instrument will allow the ultrasonic detection of cracks and openings where it would not normally be possible.

The light on the front of the unit will come on when the ON/OFF switch is moved to the "ON" position. If this light does not come on, check the battery voltage. The light also indicates that the unit is emitting ultrasonic sound.

Turn the unit off by moving the ON/OFF switch to the "OFF" position. Always turn the unit off when it is not in use to prolong the life of the battery.

By using both the Ultrasonic Transmitter and Ultrasonic Leak Detector, a wide spectrum of applications are available.

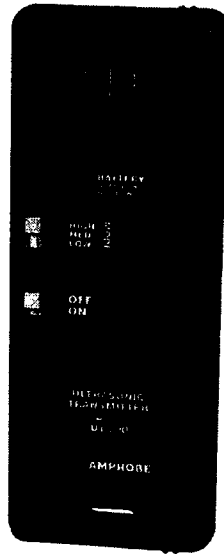
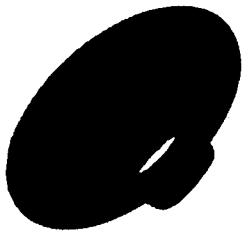


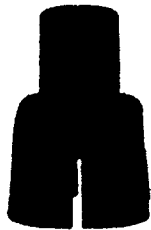
Fig. 3

## MISCELLANEOUS ACCESSORIES

In some 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 or second attach the TEA-1 adapter over the sensor horn and push the 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 (Fig. 4).



PARABOLA (PB-1)



ADAPTER (TEA-1)

Fig. 4



TUBULAR EXTENSION (TE-2)

Inspecting these locations will help you decide which areas are "bad" leaks and which leaks are tolerable. Keep a ledger noting the strength and locations of leaks. This action will help establish a baseline for any area that you may wish to monitor over a period of time.



Fig. 7

## RELAY ARCING

Arching 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.

## WATER LEAKS IN ROOFS

Flooding a roof with water to find a leak is messy and in some cases, inadequate. To isolate and locate where the leak originates, use the ULD-300 Ultrasonic Leak Detector with the UT-300 Ultrasonic Transmitter. Even when it originates in one area and tunnels through to another location, as in cases where the roof is sloped.

Place the activated Ultrasonic Transmitter unit in the area where the leak is suspected then point the transmitter toward the suspected leak. With the Ultrasonic Leak Detector, check the roof directly above and adjacent to the area where transmitter is pointing. This will allow the detection of any leaks in that area. (Fig. 8).

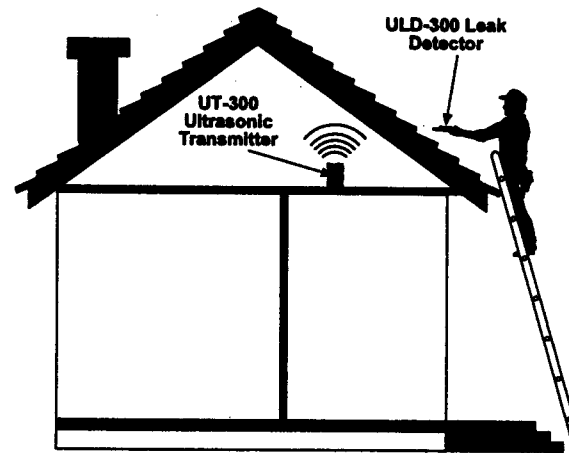


Fig. 8

## AUTOMOTIVE APPLICATION - DOOR AND TRUNK SEALS

The use of the UT-300 Ultrasonic Transmitter facilitates the discovery of leaky door and/or trunk seals. Place the activated Ultrasonic Transmitter in the vehicle pointed in the direction you wish to check. Close the door or trunk of the vehicle. Use the Ultrasonic Leak Detector to trace around the area in question, and note the spots that show leakage (Fig. 9).

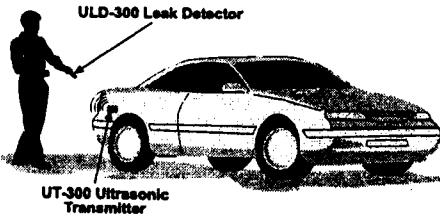


Fig. 9

## WINDSHIELD LEAKS

Using the Ultrasonic Transmitter in conjunction with the Ultrasonic Leak Detector, you can isolate the area of a windshield that leaks and make the repair without a great deal of inconvenience.

Place the activated Ultrasonic Transmitter on the dashboard pointed toward the outside of the vehicle. Shut the door to the vehicle and make sure all of the windows are tightly closed. Use the Ultrasonic Leak Detector to trace around the windshield. Mark the glass where a leak is detected (Fig. 10).

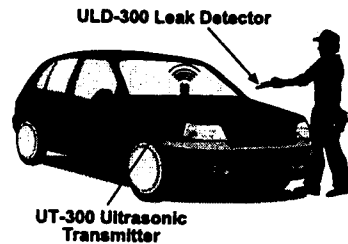


Fig. 10

## APPLICATION SUMMARY

**Air Damper Seals** - This can be done without the transmitter. The normal low level of air pressure will create ultrasound if there is a leak in the damper gasket.

**Boiler Leaks** - Place the transmitter in one side of the boiler and use the ULD-300 on the other side.

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

**Condenser System Leaks** - Use transmitter or the natural pressure difference.

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

**Door Gaskets** - Whether the gasket is on a walk-in freezer or your car door, with the transmitter you can check gaskets in seconds.

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

## USING YOUR ULTRASONIC LEAK DETECTOR

1. Plug the headphone (HP-1) into the jack located on the left side of the Ultrasonic Leak Detector. Rotate the thumb wheel clockwise to turn the ULD-300 "ON". The LED will normally be a green color. If the LED indication is red, the 9V battery must be replaced.
2. Rotate the thumb wheel counterclockwise to power the instrument. With the ULD-300 energized point the sensor horn in the direction where a leak is suspected. For surroundings with a high level of background noise use the Parabola (PB-1). The ULD-300 has three sensitivity settings of X1, X10, and X100.
3. Start the unit at the highest sensitivity setting, X100. As you near the source of the leak, the LED display panel will approach its maximum level of 10 lights. The display indicator is a relative measurement only. When the LED display panel reaches 10 lights, you are at the maximum reading of the range setting. Reduce the sensitivity by turning the thumbwheel counterclockwise or select a less sensitive range.
4. Repeat until you have isolated the leak source. Lowering the sensitivity level will also verify that you have isolated the true source of the leak and not a reflection of the true source. Generally, ultrasonic sound reflections are not as strong as the true sound source.

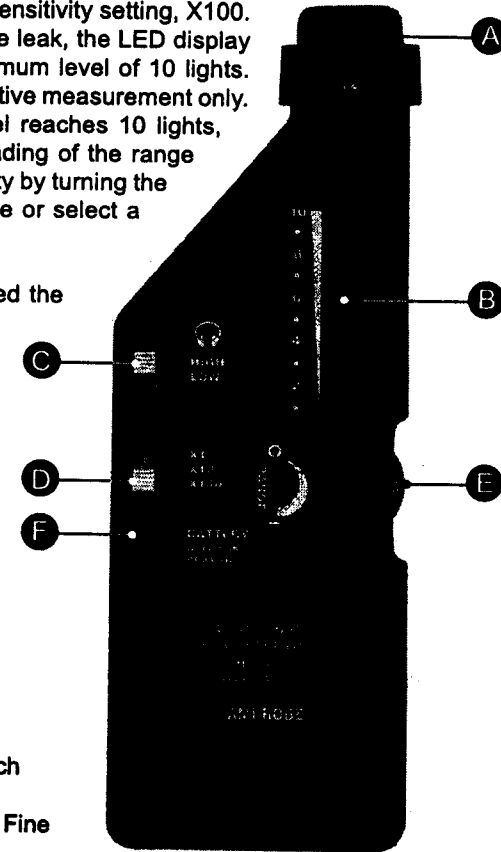


Fig. 2

## PARTS & CONTROLS

- A. Sensor Horn
- B. LED Display Panel
- C. Head Phone Volume Switch
- D. Coarse Sensitivity Switch
- E. On/Off Thumb Wheel and Fine Sensitivity Adjust
- F. Power and Low Battery LED Indicator

## **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. This accessory will help you to probe into areas that are difficult to reach and/or isolate. Refer to the Accessories section of this booklet.

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 tube accessory 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.

## **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 the Accessories section in this booklet.) 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 because 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-300. This accessory is particularly useful when checking insulators because the circuit does not need to be interrupted.

## APPLICATIONS

### ELECTRICAL ARCING AND DISCHARGES

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

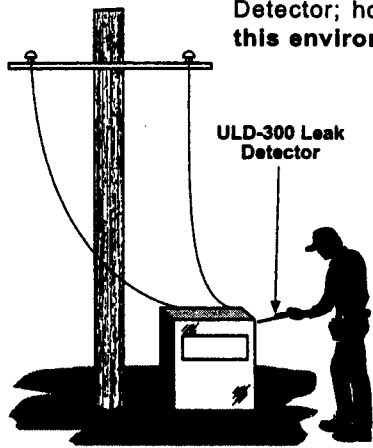


Fig. 5

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 & adaptor to extend the sensor horn of the Ultrasonic Leak Detector will enable you to safely probe the suspect electrical area (Fig. 5).

### AIR LEAKS AROUND DOOR AND WINDOW GASKETS AND SEALS

Air leaks around doors and windows usually occur when the seals have aged and lost their elasticity. Leakage also occurs when these seals are improperly installed. Improper installation can leave small gaps that are difficult to locate.

To determine where a door is not making solid contact with the seal, place the activated UT-300 Ultrasonic Transmitter behind the door to be tested. Close the door and trace around the door jamb with the ULD-300 Ultrasonic Leak Detector to determine the leak points (Fig. 6).

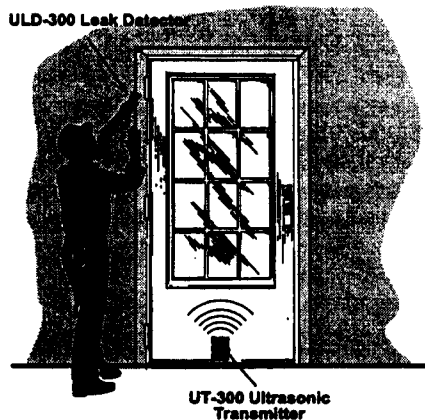


Fig. 6

To verify the seal on windows, place the activated Ultrasonic Transmitter unit on the sill of a closed window pointing in the direction you want to check. Move to the opposite side of the window and trace around the window border with the Ultrasonic Leak Detector (Fig. 7).

Place a small piece of masking tape or similar marker on all the spots where the Ultrasonic Leak Detector indicated that sound is emitting. Write on the marker the strength of the signal that is detected.

### LEAKS IN REFRIGERATION AND AIR CONDITIONING SYSTEMS

The ULD-300 Amprobe 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 ULD-300 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 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 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 ULD-300 Amprobe 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-300 is not a flammable gas detector. When you suspect a flammable gas leak, contact your local public service company or fire department immediately.