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## NOTES

## GENERAL DESCRIPTION

Thank you for purchasing the TIF ZX-1 Heated Pentode™ Refrigerant Leak Detector. We are proud to offer what we believe to be the very best portable electronic leak detector available today.

The ZX-1 offers the greatest sensitivity and fastest response of any portable refrigerant detector available. This is achieved through the employment of a patent pending Heated Pentode™ sensor combined with a sophisticated microprocessor controlled circuit using patent pending technology.

In addition to the supreme performance and functional advantages, the ZX-1 offers a leading edge, unique and ergonomically designed shape to provide greater ease of use, comfort, and of course, appearance.

We are so sure of the quality and performance of this product that we have backed it with one of the best warranties ever offered in the industry.

In order to gain the fullest benefits of your purchase, please carefully read and review the information in the following pages. If you have further questions, or need additional assistance, please contact our Customer Service Hotline at 01256 460300.

## FEATURES

- o Patent Pending Heated Pentode™ sensor technology
- o Refrigerant specific detection
- o Detects ALL halogenated refrigerants at levels down to 0.1 oz/yr
- o Tri-color visual leak size indicator
- o Tactile keypad controls with one touch reset and adjustable sensitivity
- o True mechanical pump provides instant response and clearing
- o Battery test function
- o Sensor failure indication
- o Ni-Cad Rechargeable batteries
- o Revolutionary design
- o Meets SAE J1627
- o Flexible stainless probe
- o Carrying pouch and re-charger included
- o CE Approved

## PARTS AND CONTROLS

1. On/Off Key
2. Sensitivity Hi/Lo Key
3. Reset Key
4. Mute Key
5. Constant power indicator (1st LED)
6. Visual leak size indicators (2nd-6th LEDs)

7. Sensor
8. Flexible Probe
9. Probe Tip
10. Filter element (not pictured)
11. Charger input jack (underside)
12. Ni-Cad Battery pack



FIG 1

## NOTES

## NOTES

## GETTING STARTED

### WARNING: PERSONAL INJURY HAZARD

Do not use this Leak Detector in an explosive or combustible atmosphere. The ambient atmosphere is drawn through the probe and sensor which operates at a very high temperature. The resulting hot mixture of air and combustible gas could explode.

## UNPACKING

Unpack the unit from the carton and carrying pouch. Refer to the Parts and Controls section (page 3) for parts identification. You will find five (5) major components in the carrying case.

- Unit
- Instructions
- Replacement filter cartridges
- Probe
- Battery charger (located in the separate zippered compartment)

CAUTION: Batteries should only be charged in temperatures between 50°F and 104°F (10°C - 40°C). Charging batteries outside this temperature range may cause permanent damage to the batteries.

## CHARGING BATTERIES

Plug the charging unit into a wall socket and connect the charger jack to the unit (see Fig 2). When properly connected, the first LED will indicate the charging status:

- Quickly flashing orange = battery charging
- Slowly flashing green = battery fully charged
- Slowly flashing red = failed batteries, cannot be recharged



FIG 2

New or completely discharged batteries will take approximately two (2) hours to fully re-charge. When the LED indicates that the batteries are fully charged, the unit is ready for operation.

## SENSOR AND PROBE INSTALLATION

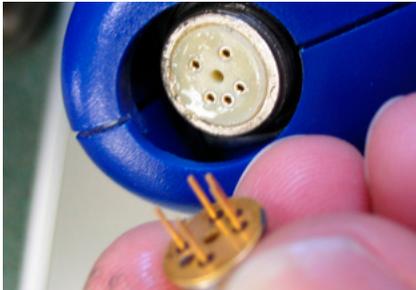


FIG 3

1. Open the bag and remove the sensor (if not already installed).
2. Hold the unit with the front end facing you and note the sensor connection inside the threaded bushing on the end of the unit. Note that there are five (5) holes corresponding to the five (5) pins on the sensor – three (3) on the left and two (2) on the right (refer to Fig. 3).
3. Grasp the sensor and align the pins with the corresponding holes. CAUTION: the sensor can only be inserted one way. When properly aligned, firmly push the sensor into the connector until the orange sponge seal at its base is compressed to half its original thickness.
4. Install the flexible probe by screwing it clock-wise onto the threaded brass bushing around the sensor until it is finger tight.

CAUTION: NEVER operate the unit without the flexible probe properly installed. Sensor contamination, erratic performance and other problems may occur. Additionally, the sensor will become quite hot during operation, which could be dangerous.

## TROUBLESHOOTING

Symptom	Possible Cause	Cure
Power indicator LED	Batteries not charged does not light (unit does not switch on)	Connect charger and charge, see page 13
All LEDs flash Red	1. Failed sensor and pump does not run 2. Damaged Sensor (incorrect installation) 3. Blocked probe tip and filter 4. High ambient refrigerant	Replace sensor as described on page 13. Check your sensor has been correctly installed (page 5) Unscrew the tip and clear the obstruction. Once the tip has been removed replace the filter element (page 15) Eg. in a van if bottles are present.
Audible alarm does not sound even though LEDs light	MUTE feature	De-activate MUTE feature, see page 9.
Unit behaves erratically – alarms in fresh air	Probe tip or flexible probe loose – causing disturbed airflow	Tighten tip and/or probe.
Constant Power Indicator flashes on and off.	Old Sensor Indication	Sensor may soon require replacement. Obtain replacement, but it is not necessary to replace before a Failed Sensor Indication is received, see page 14.
During battery charging, indicator goes out after 10 minutes	Batteries have failed, the charge cannot be recharged	Obtain replacement battery pack, refer to Replacement Parts section for p/n, see page 15.
During battery charging, indicator begins to flash red	Batteries have failed, the charge cannot be recharged	Obtain replacement battery pack, refer to Replacement Parts section for p/n, see page 15.

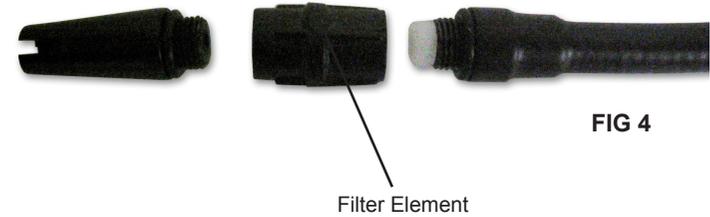
## WARRANTY

This instrument has been designed and manufactured to provide unlimited service. Should the unit be inoperative, after performing the recommended maintenance, a no-charge repair or replacement will be made to the original purchaser if the claim is made within THREE years from the date of purchase. This warranty applies to all repairable instruments that have not been tampered with or damaged through improper use. This warranty does not cover batteries, sensor, battery charger, or any other materials that wear out during normal operation of the instrument.

Before returning your instrument for repair please make sure that you have carefully reviewed the Unit Maintenance section of this manual to determine if the problem can be easily fixed. Make sure that you have either replaced or cleaned the sensing tip and tip protector and that the batteries are working properly BEFORE returning the unit. If the instrument still fails to work properly contact customer services at Advanced Engineering Ltd on 01256 460300 for further instructions.

## PROBE TIP AND FILTER

The pointed tip of the flexible probe is removable for cleaning and access to the filter element. (see Figure 4). Once the tip is removed access to the filter element is possible.



## OPERATING FEATURES

Your unit includes an array of operating features designed to increase usability and simplify user interface. Please refer to the Parts and Controls diagram on page 3 to familiarize yourself with the indicators and keypad controls as you proceed through this section.

A proper understanding of each key and its function will enhance your experience with this product and allow you to get the most from its capabilities.

## CONSTANT POWER INDICATION

The Constant Power indicator allows the user to see the battery level at all times.

The first LED (closest to the keypad) in the display is an 'intelligent' battery status indicator and will remain on whilst the unit is switched on. The LED will illuminate in one of three colours to indicate the battery voltage level.

If the LED is green, this indicates that the batteries are fully charged or have sufficient voltage for normal operation.

If the LED is orange this is an indication that the batteries have enough voltage to operate, but should be re-charged when the current usage of the unit is complete.

If the LED is red, the batteries should be immediately re-charged to prevent erratic performance and/or failure of the unit during operation.

## TRUE BATTERY VOLTAGE INDICATOR

The unit also includes a feature that will allow you to display and see the actual battery voltage at any time.

To activate the True Battery Voltage test, press and hold the  key for at least one second (do not release the key during the one second period or the unit will shut off). The display will show 1 to 6 LED's in red, orange, and green to indicate the actual battery voltage as follows:

- o 1 red = less than 4.4 volts RECHARGE THE UNIT IMMEDIATELY
- o 1 red, 1 orange = 4.4 to 4.6 volts
- o 1 red, 1 orange, 1 green = 4.6 to 4.8 volts
- o 1 red, 1 orange, 2 green = 4.8 to 5.0 volts
- o 1 red, 1 orange, 3 green = 5.0 to 5.2 volts
- o 1 red, 1 orange, 4 green = greater than 5.2 volts. Fully charged

## SPECIFICATIONS

Sensor Technology:  
(advanced heated diode).

Patent Pending Heated Pentode™

Electronic Technology:

Patent Pending microprocessor controlled circuit including constant battery and sensor condition detection.

Sensitivity:

Per SAE J1627 Criteria: 0.5 oz/yr (14 gr/yr) for R134a, R22 and R12.

Ultimate Sensitivity:

Less than 0.1 oz/year (3gr/yr) R134a, in high sensitivity; as low as 0.05 oz/yr R12 in low sensitivity.

Warm-up period:

20 seconds

Excessive refrigerant tolerance:  
page 12 for further information.

Sensor cannot be poisoned by excessive refrigerant. Refer to

Battery life:

Standard Ni-Cad battery pack – 4 to 5 hours, depending on sensor age. Optional Ni-MH battery back - 5 to 6 hours, depending on sensor age. Integral constant power indication.

Battery technology:

Ni-Cad standard, Ni-MH optional.

Battery recharge time:

2 hours, Integral charge status indication.

Failed sensor indication:

All LEDs flash red, pump off

Sensor life:

100 to 150 hours.

Operating environment:

0° to 50°C (32° to 122°F), 0 to 95% RH non-condensing.

Dimensions:

26cm L x 6.5 cm Dia. ( 10.25 " L x 2.5" Dia.)

Weight:

Approximately 452 grams (16 ounces)

## PROBE TIP AND FILTER

1. Remove the probe tip by firmly grasping both the probe and the tip and rotating the tip counter-clockwise.
2. Inspect the small foam filter element in the probe end. If any discolouration or particulate is visible, the filter element should be discarded and replaced. A replacement filter element is included with your unit. Additional filter elements may be ordered – refer to the Replacement Parts section on page 15 for the correct part number.
3. The filter element can be removed by unscrewing it from the probe.
4. A new filter element can be inserted by pinching between the thumb and forefinger and ‘twisting’ it into place in the probe.
5. If dirt, oil, grease, etc... is visible on the probe tip it can be cleaned by rinsing it in a mild solvent such as denatured alcohol. Make certain that the tip dries completely before replacing.
6. Replace the probe tip by firmly grasping both the probe and the tip and rotating the tip clockwise until finger tight.

CAUTION: NEVER operate the unit without the probe tip and filter properly installed. Filter and sensor contamination, erratic performance and other problems may occur.

### GENERAL CARE

Take care not to obstruct the charging port or speaker outlet grill (right hand side above the rubber grip) with dirt or grease. If it becomes necessary to clean the unit use only a soft cloth dampened with a mild soap to wipe down the body and probe.

The unit is a precision electronic device. Avoid extreme mechanical shock, exposure to strong magnetic fields and extreme temperatures. Never immerse the probe tip or any part of the unit into liquids of any sort.

## REPLACEMENT PARTS

Several components of the unit are consumable and will eventually require replacement. Additionally, optional accessories for the unit are available through your dealer. Always specify the part number below to ensure obtaining the correct part.

- TIF ZX-2 Replacement Heated Pentode™ Sensor
- TIF ZX-3 Battery Charger (110V, 60Hz) (North and South America)
- TIF ZX-3E Battery Charger (230V, 50Hz) (Europe, Asia, and Australia)
- TIF ZX-3J Battery Charger (100V, 50/60Hz) (Japan only)
- TIF ZX-4 Nickel Cadmium (Ni-Cad) Battery Pack
- TIF ZX-5 Soft Nylon Carrying Case
- TIF ZX-6 Charging Base (110V, 60Hz)
- TIF ZX-6E Charging Base (230V, 50Hz)
- TIF ZX-6J Charging Base (100V, 50/60Hz)
- TIF ZX-7 Nickel- Metal Hydride (NiMH) Battery Pack (optional)
- TIF ZX-15 Filter (1 pk)
- TIF ZX-9 Probe Tip
- TIF ZX-10 Flexible Probe

## AUTOMATIC CIRCUIT / RESET FEATURE

The unit features a patented Automatic Circuit and Reset function that sets the unit to ignore ambient concentrations of refrigerant.

Automatic Circuit - Upon initial power on and the completion of the warm-up, the unit automatically sets itself to ignore the level of refrigerant present at the tip. Only a level, or concentration, greater than this will cause an alarm. CAUTION: Be aware that this feature will cause the unit to ignore any refrigerant present at the probe tip after warm-up is completed and therefore the unit should only be powered on and allowed to warm-up in fresh air.

Reset Feature - Resetting the unit during operation performs a similar function; it programs the circuit to ignore the level of refrigerant present at the tip. Each time the  key is pressed (and released), the unit sets its threshold for detection to a level above the current concentration being detected. By moving closer to a large leak and pressing  each time a full detection is indicated, the user can ‘home-in’ on the source of the leak (higher concentration).

Similarly, the unit can be moved to fresh air and reset for maximum sensitivity. Resetting the unit with no refrigerant present (fresh air) causes any level above zero to be detected, i.e. sets the unit to its maximum sensitivity in the chosen sensitivity level.

To reset the unit press the  key.

Each time the  key is pressed, the LEDs will briefly light in orange to provide a visual confirmation of the reset action.

The unit provides two levels of sensitivity. When the unit is switched on, it is set to the high sensitivity position.

## SENSITIVITY ADJUSTMENT

1. To change the sensitivity, press the  key. When the key is pressed, the LEDs will light in orange from top to bottom, providing a visual confirmation and indication that the unit is in Low sensitivity mode.

2. To switch back to High Sensitivity, again press the  key. The LEDs will light in orange from bottom to top, providing a visual confirmation and indication that the unit is in High sensitivity mode.

The base beeping tone is also an indication of sensitivity level.

- In High sensitivity the unit emits two quick beeps approximately once every two (2) seconds, in fresh air.
- In Low sensitivity the unit emits only one beep, approximately once every two (2) seconds, in fresh air.

NOTE: In high sensitivity the unit is extremely sensitive to HFC compounds (e.g. R134a), responding to levels below 0.1 ounces/year (3grams/year). If searching for large leaks of HFC's, new azeotrope blend refrigerants (R400 series) or any size HCFC or CFC (e.g. R22 or R12) leaks, it is best to start your search in Low sensitivity.

## SENSOR STATUS INDICATOR

The unit's circuit has the ability to automatically diagnose and indicate the sensor's status. Whenever the unit is energized, the circuit automatically senses the condition of the sensor and can detect a failed or missing sensor.

As the sensor ages the circuit will note and indicate this to the user. Initially, an "Old Sensor Indication" is displayed by flashing the Constant Power Indicator. If this indication appears, you should immediately obtain a replacement sensor. However, it is not necessary to replace the sensor before the "Failed Sensor Indication" is received.

If the circuit detects a failed or missing sensor, the 2nd through 6th LEDs will turn red and flash quickly. The 1st LED will continue to display the battery status as described above. Additionally the internal pump will be shut down to prevent unnecessary battery drain. If this indication appears refer to the Maintenance Section on page 13 for service instructions.

## AUDIBLE / VISUAL ALARMS - MUTE

The unit features two primary alarm indications – an internal speaker that produces a multiple frequency tone, and a series of Tri-color LEDs that will provide an incremental indication of leak detection and proportional leak size.

You may choose to activate both the audible and visual alarms, or solely the visual alarm. Upon power on, the unit will activate both. If you wish to cancel the audible alarm, or "Mute" the unit -

Press the  key.

This will mute the internal speaker, and a detection will be indicated solely by the LED display.

Press the key again, at any time, to reactivate the internal speaker.

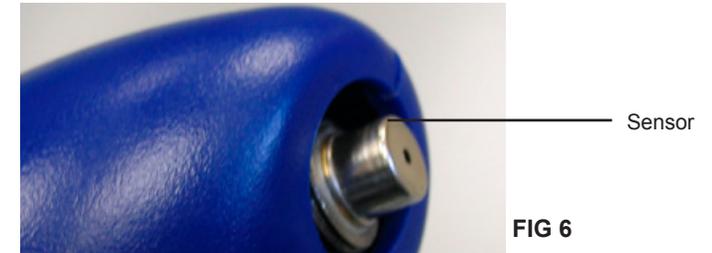
The LEDs provide a tri-color, proportional indication of leak intensity. The 2nd through 6th LEDs are used for this indication, while the 1st LED always remains an indication of battery strength.

See figure 5.

As described above in the Operating Features section, the unit's circuit will automatically diagnose and indicate the sensor's status.

If an "Old Sensor Indication" is received, you should obtain a new sensor as soon as possible. Ensure that you have a replacement sensor (see the Replacement Parts section on page 15 for the correct part number) before proceeding. If a failed or missing sensor indication is received:

1. Remove the flexible probe by firmly grasping it and rotating counter-clockwise. This will expose the sensor in the end of the unit (see Fig 6). Verify that the sensor is installed.



A. If a sensor is present proceed to step 2.

B. If no sensor is present, skip ahead to step 3.

CAUTION: The sensor is heated to high internal temperatures during operation and consequentially, the sensor case becomes hot. Use caution when removing the sensor – it is preferable to switch off the unit and leave it for at least 5 minutes before removing the sensor.

2. Remove the old sensor by firmly grasping under the flange and pulling straight away from the unit. Discard the old sensor.
3. A new sensor comes packaged in a hermetically sealed foil bag. Open the bag and remove the sensor.
4. Hold the unit with the front end facing you and note the sensor connection inside the threaded bushing on the end of the unit. Note that there are five (5) holes corresponding to the five (5) pins on the sensor – three (3) on the left and two (2) on the right (refer to Fig. 3).
5. Grasp the sensor and align the pins with the corresponding holes. CAUTION: the sensor can only be inserted one way. When properly aligned, firmly push the sensor into the connector until the orange sponge seal at its base is compressed to half its original thickness.
6. Install the flexible probe by screwing it clock-wise onto the threaded brass bushing around the sensor until it is finger tight.

CAUTION: NEVER operate the unit without the flexible probe properly installed. Sensor contamination, erratic performance and other problems may occur. Additionally, the sensor will become quite hot during operation, which could be dangerous.

## BATTERY MAINTENANCE

The unit is equipped with a standard Nickel-Cadmium (Ni-Cad) battery pack. An optional Nickel-Metal-Hydrate (Ni-MH) battery pack is available which will provide extended service - refer to the Replacement Parts section on page 15 for details. The following instructions apply strictly to the standard Ni-Cad batteries. Charging and care instructions for the optional Ni-MH batteries are included with these products.

### Charging Batteries

**CAUTION:** Batteries should only be charged in temperatures between 50°F and 104°F (10°C - 40°C). Charging batteries outside this temperature range may cause permanent damage to the batteries. Whenever the Constant power indicator LED appears Red, and/or the True battery voltage indicator shows only the Red LED, the batteries must be re-charged.

### To recharge the batteries:

1. Plug the charging unit into an appropriate wall socket and connect the charger jack to the unit (see Fig 2, page 5).
2. When properly connected, the first LED will indicate the charging status:
  - Quickly flashing orange = battery charging
  - Slowly flashing green = battery fully charged
  - Slowly flashing red = batteries failed, cannot be recharged

New or completely discharged batteries will take approximately two (2) hours to fully recharge.

3. When the LED indicates that the batteries are fully charged (slowly flashing green), the unit is ready for operation.

**NOTE:** It is recommended that whenever the unit is not in use, it be left connected to the charger in order to ensure full battery power is later available. The internal charging circuit will prevent over charging and will provide a continuous maintenance charge if and when required by the batteries.

### Storage

Even when power is off, the unit will slowly discharge the batteries over time. Before storing the unit for extended periods (over 4 weeks), the battery pack should be removed from the unit. Nevertheless, the Ni-Cad batteries will eventually self-discharge, and will require re-charging before use.

When replacing batteries take care to insert the battery in the correct fashion as described in the "Getting Started" section.



### Disposal

Ni-Cad batteries are recyclable and must be disposed of properly. Do not incinerate or expose to open flames.

### SENSOR

The Patent Pending Heated Pentode™ Sensor is a precise device that, in conjunction with the advanced circuit, provides the extreme performance of the unit.

The sensor is a consumable element and will eventually require replacement. The circuit continuously compensates for sensor aging to maintain a constant performance level; so sensitivity and response remain the same throughout the life of the sensor.

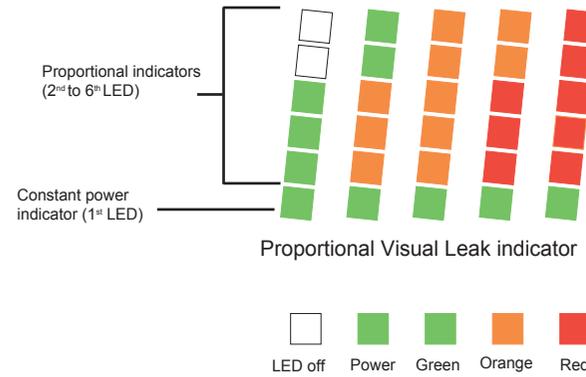


FIG 5

## OPERATION

When a refrigerant is detected, the visual indicator will light from bottom to top; first in green, then sequentially in orange, and then sequentially in red. On anything but the smallest leak, the extreme sensitivity of the unit may cause the LEDs to all light in orange or red. As each LED can appear in one of three colors – green, orange or red – this will result in 15 distinct alarm levels.

### WARNING: PERSONAL INJURY HAZARD

Do not use this Leak Detector in an explosive or combustible atmosphere. The ambient atmosphere is drawn through the probe and sensor which operates at a very high temperature. The resulting hot mixture of air and combustible gas could explode.

1. Press and release the key to switch the unit on.
2. The LEDs will begin cycling on in orange from bottom to top to indicate warm-up. The warm-up time is fixed at 20 seconds.
3. After warm-up, all LEDs will flash briefly orange, indicating that the unit is ready for use. The unit will begin beeping at a steady rate (two quick beeps approximately once every two seconds – indicating high sensitivity) and the first LED will display the battery voltage level as described in the "Constant Power Indicator" section, above.
4. Choose the sensitivity level in which you wish to start, as described in the "Sensitivity Adjustment" section, above.
5. Begin searching for leaks. Move the probe tip toward the suspected leak. The flexible probe may be shaped to provide access to hard to reach areas.

**NOTE:** If the unit has previously been in service, check that the probe tip is not obstructed with dirt, grease, etc. and check the condition of the filter as described in the Maintenance section on page 15.

6. If a refrigerant is detected, the unit will begin to alarm – the audible tone will quicken and the LEDs will light. The larger the detected concentration, the greater the alarm. The LEDs provide a proportional indication of concentration –

- o Green – small concentration
- o Orange – moderate concentration
- o Red – large concentration

NOTE: The unit is NOT a measuring tool, rather it is simply a proportional detector. That is to say that the LEDs are not, and cannot be construed to be, indicative of a specific corresponding leak rate or concentration.

7. If an alarm occurs before the leak source is pinpointed, the  key may be used to “home-in” on the leak, as described in the “Operating Features” section, above. The unit may be ‘reset’ as many times as necessary to pinpoint the leak source.

## OPERATING TIPS

The following section includes several general operating tips, and the SAE J1628 recommended procedure for leak detection.

### LEAK DETECTION TECHNIQUES

1. Prior to each use, inspect the probe tip and filter element as described in the Maintenance Section on page 15.
2. Be aware that refrigerants are invariably heavier than air and will tend to ‘fall’ from, or collect below, actual leak points/sources. Searching below areas of potential leaks is invariably the most effective and reliable way of locating such a leak.
3. In areas that are heavily contaminated with refrigerant, the unit may be reset to block out ambient concentrations of gas. The probe should not be moved while the unit is being reset. The unit can be reset as many times as needed.
4. In windy areas, even a large leak can be difficult to find. Under these conditions, it is best to shield the potential leak area from wind or breezes.
5. Remember that a leak is a constant source of refrigerant and therefore when a true leak source is located it should produce a repeatable alarm each time it is approached. Intermittent (non-repeatable) alarms are often caused by accumulations of refrigerant near or around leak points.
6. If an alarm occurs, and is not repeated when the probe tip is replaced to the same point, it is unlikely that there is any significant leak present at that point. However, this may be indicative of a leak nearby – and can be used as a diagnostic aid in leak finding.

### SAE J1628 RECOMMENDED PROCEDURE

NOTE: On Automotive A/C Systems leak test with the motor engine not in operation.

1. The air conditioning or refrigeration system should be charged with sufficient refrigerant to have gauge pressure of at least 340 kPa (50psi) when not in operation. At a temperature below 15°C (59°F), leaks may not be measureable, since this pressure may not be reached.
2. Ensure that the detector probe does not get contaminated by dirt from the part being tested, as this can result in false readings. If the part is particularly dirty, or condensate (moisture) is present, it should be wiped off with a dry cloth or blown off with compressed air. No cleaners or solvents should be used, since the detector may be sensitive to their ingredients.
3. Visually trace the entire refrigerant system and look for signs of air conditioning lubricant leakage, damage, and corrosion on all lines, hoses, and components. Each questionable area should be carefully checked with the detector probe, as well as fittings, hose to line couplings, refrigerant controls, service ports with caps in place, brazed or welded areas, areas around attachment points, hold-downs on lines and components.
4. Always follow the refrigerant system around in a continuous path so that no areas of potential leaks are missed. If a leak is found, always continue to test the remainder of the system.
5. At each area checked, the probe should be moved around the location, at a rate no more than 25 to 50 mm/second, and no more than 5mm from the surface, completely around the position. Slower and closer movement of the probe greatly improves the likelihood of finding a leak. Any increase in beep rate is indicative of a leak.
6. An apparent leak shall be verified at least once as follows:
  - a) Blow shop air into the area of the suspected leak, if necessary, and repeat the check of the area. In cases of very large leaks, blowing out the area with shop air often helps locate the exact position of the leak.
  - b) First move the probe to fresh air and reset. Then hold the probe tips as close as possible to the indicated leaksource and slowly move around it until the leak is confirmed.

#### Automotive A/C Systems only-

7. Leak testing of the evaporator core while in the air conditioning module shall be accomplished by turning the air conditioning blower on high for a period of 15 seconds minimum, shutting it off, then waiting for the refrigerant to accumulate in the case for 10 minutes.

After such time, insert the leak detector probe into the blower resistor block or condensate drain hole, if no water is present, or into the closest opening in the heating/ventilation/air conditioning case to the evaporator, such as the heater duct or a vent duct. If the detector alarms, a leak apparently has been found.