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Service Matters

Technical information for the Institute of Refrigeration Service Engineers' Section

Welcome to this issue of Service Matters

Welcome to this issue of Service Matters, in this edition we are looking at leak detection methods. Please don't switch off, leak reduction is still a major issue in our industry and will figure high on the agenda over coming months with the introduction of more legislation such as F Gas and quite rightly so!

What you have to consider is the two major effects on our environment of refrigerant leakage. The first being the direct effect on the environment through ozone depletion and/or global warming. The second is the indirect effect of the system efficiency dropping due to the refrigerant loss and the increased power consumption as a result.

I am not going to labour the point of environmental damage or legislation current or forthcoming but we must all adopt a far more responsible attitude to routine leak testing, it is very important and a system that doesn't leak is far more reliable!

Stephen Benton

Refrigerant leak detection

The chart below shows the most common groups of refrigerants we use. With the wide variety of refrigerants now available we have to ensure that the type of leak detector we are using is both suitable and SAFE to use with the refrigerant in the system. Most electronic leak detectors are suitable for CFC, HCFC and HFC's. Caution should be taken to use suitable electronic leak detectors with HC's which are flammable. We must not forget soapy water as a very effective leak detector. Many people discount it, but for finding leaks it is possibly the most effective method and I have certainly used it to successfullly find some very small leaks.

CFC	Chlorofluorocarbon e.g. R12, R502, R11
HCFC	Hydrochlorofluorocarbon e.g. R22, R409A, R408A, R411B
HFC	Hydrofluorocarbon e.g. R134a, R404A, R407C, R410A
HC	Hydrocarbon e.g. R600a, R290, CARE

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The below table gives an overview of leak detectors and their suitability for different types of refrigerant. Extra care should be taken when selecting an electronic detector for Hydrocarbon (HC) refrigerants. If in doubt don't use an electronic detector - use soap and water.

	HCFCs	HFCs	HCs
Electronic leak detector	Yes	Yes	??? - Check
Infra-red leak detector	Yes	Yes	??? - Check
Halide leak detector	Yes	No	No
Fluorescent additives	Yes	Yes	Yes
Ultra sonic leak detector	Yes	Yes	Yes
Soapy water	Yes	Yes	Yes

1. Electronic leak detectors: -

For the most part, there are just four types of electronic leak detectors.

- Corona discharge
- Heated diode
- Infrared
- Ultrasonic

Corona discharge detectors pull air through an electrical field (corona discharge) around a wire. The presence of refrigerant or other gases in the air changes the current in the wire and triggers an alarm. The problem with this is that it's not compound specific so any substance the leak detector senses could give false alarms including cleaning chemicals. Not HC suitable!

Heated diode detectors use a heated ceramic diode. The diode generates an electrical current when it comes into contact with halogenated gas which the electronics convert into an alarm. The heated diode sensor is sensitive to contamination, especially from moisture or oil and will need replacement after approximately 100 hours of operation. This type of detector is much less likely to give false alarms and works especially well with R134a. The more expensive models have their own built in sensitivity check mode to ensure the sensing head is actually working. Not HC suitable!

Infrared detectors have an optical bench that the refrigerant passes through. The refrigerant absorbs IR radiation. The bench senses this and converts it into an alarm dependant on the amount of IR absorbed. The technology is very accurate and less prone to contamination. It has only been recently deployed in small hand held technology but has been widely used in larger fixed environmental detectors for many years. Check with manufacturer before using with HC's.

Ultrasonic detectors work on sound waves emitted when gas or vacuum escapes through a small orifice (leak). The sound is well above the frequencies sensitive to the human ear. The electronics pick up these frequencies and amplify them into an audible output that we can hear. The technology isn't new but has only recently become cheap enough to use in hand held leak detectors. The notable benefit of this type of detector is it will detect any gas or vacuum leak including nitrogen and HC refrigerants. Service Matters will cover this type of technology in a later issue. Suitable for HC's.
An alternative that can prove very useful for locating pin holes in areas such as evaporator tube ends is either a medical stethoscope with the diaphragm removed or a length of nylon tube held close to the ear; this simply amplifies the noise source of the leak.

2. Other leak detectors: -

Halide detectors were very popular for use with CFC and HCFC refrigerants. The detector was normally powered with butane and worked in a similar way to a Bunsen burner. The air was channelled into the flame via a rubber tube connected below the flame. As air with refrigerant passed through the flame the chlorine element turned the flame from normal to green through to bright blue dependant on the refrigerant content of the air. Be aware that the by-products of burning refrigerants are highly toxic. DO NOT USE this type of leak detector with HFC's or HC's!

Fluorescent (UV) detectors use an additive which is added to the oil in a system. It travels around with the oil and can be detected using ultra violet (UV) light where it has leaked from the system. The hand held UV kits come in various forms typically consisting of a UV lamp, additive injection kits and polarising goggles. The system relies on the oil leaking from the system (with additive) though in some cases oil separators almost totally remove the additive as it leaves the pack or condensing unit rendering it useless around the remainder of the system. Almost all car manufacturers charge this additive with the refrigerant into car A/C systems and some gas manufacturers supply refrigerant with the additive included. Suitable for HC's.

Soap & Water may be used to test for refrigerant leaks. Make soap and water solution by mixing liquid soap (washing up liquid) with water into a thick consistency. Let it stand until the bubbles have dispersed, and then apply it to the suspected leak with a soft brush. A leak will cause bubbles to appear under the soap solution. Care should be taken that a system is not on a vacuum before using this method as it could be drawn into the system with obvious results. Soap and water is ineffective on suction lines operation below freezing. Leak detection spray is also widely available in aerosol cans or manual pump spray guns. Suitable for HC's.

3. Leak Detector Maintenance

Having selected the appropriate leak detector for the job it is important to be sure the equipment is working. Most of the electronic leak detectors need regular calibration and the corona discharge and heated diode types require sensor changes at regular intervals. Read the manufacturers instructions as a leak detector that is not working is not obvious to the user. DO NOT open a bottle of refrigerant over your detector head to prove that it is working - even a sensor that is spent will sense that, come to that so would you!

4. Leak Detection Technique

Having the right leak detector and checking its operation technique could mean the difference between finding a leak and missing it. I have bulleted below the main points to successful leak detection especially when using electronic leak detectors. They are not in priority order but will all add up to successful hunting: -

- Don't under estimate visual leak detection, look for oil traces – use your eyes;
- Ensure you have the correct leak detector for the job and it is operating correctly;
- Move the electronic detector sensing tip slowly over the area being tested in a constant motion;
- If you sense a leak move back and forth over the area until you zero in on the leak. If you simply point the detector at a suspected leak it will zero out and you might miss it;
- Refrigerants are heavier than air so it is always worth a quick swoop of the cold room floor or cabinet base, watch out for any water or oil though! It might give you a quick indicator if you are in the right area;
- Do not trust electronics alone. If your leak detector has indicated something use soapy water to zero in on it. Use a mix of technologies. They all work, some better than others dependant on the environment and no one technology is best!

If you have any questions on leak detection please contact us.

Happy Hunting!

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