A Guide to Gas Leak Detectors

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Arenas use a variety of gases for the general operation and maintenance of the facility, including the refrigerant (ammonia or CFC/Freon) and often propane. These gases are safe when used properly and with well-maintained equipment, but there is always a possibility of equipment problems or operator error that can cause leaks on occasion. Also, rinks can have air quality problems attributed to excessive levels of gases such as carbon monoxide.

Who needs a gas leak detector?
The CSA B52 Mechanical Refrigeration Code in Canada and the ANSI/ASHRAE 15 Safety Code for Mechanical Refrigeration in the United States have specific requirements for refrigerant leak detection systems. In general, systems over 100 HP, or any system required to be housed in a standard or Class T machine room, will by code require a detector.

Regardless of specific codes, the escalating costs of refrigerant, as well as concerns for safety and the environment, have led to the use of detection systems even in the smallest systems. In addition, more stringent ventilation code requirements, especially in ice rinks, have led to the increased need for both carbon monoxide and nitrogen dioxide monitoring.

How do leak detectors work?
There are five types of sensors available for leak detectors, which range dramatically in price and features. Chemical (detector tubes) are the least expensive, followed by solid state, electrochemical, infrared and ionmobility spectrometers as the most expensive. Each of these has various pros and cons.
Solid-state sensors use a heated semiconductor that changes internal resistance when in contact with the refrigerant, and can detect within a range of 50 to 100 PPM (50 to 95F/50 to 80% humidity). These sensors are not only economical, but are very reliable and have a long life expectancy. The disadvantages include sensitivity to other gases, sensitivity to moisture and temperature changes, and the special care required in the placement.
Electrochemical sensors use electrodes immersed in an electrolyte under a permeable membrane, and measure change in potential when gas permeates the membrane. These are very selective to the refrigerant and can measure levels from 0.7 to 100 PPM (-40 to 95f; 20 to 90%RH), but have a short life expectancy, can "go to sleep" without warning, and have a high replacement cost.

Infrared sensors project infrared light through a gas sample and measure the amount of light and wavelength of light absorbed. These are very specific to refrigerant and are very minimally affected by humidity and temperature, measuring from 0 to 1000 PPM (10 to 95F; 0 to 90% humidity). This would be an ideal sensor to use, but they are very expensive and require more frequent calibration.

What features should you look for in a gas detector?
The low cost and proven reliability of solid-state sensors has made them the most popular method of leak detection available for ice rinks. When purchasing a gas detector for your facility, be sure to do your homework and make sure it will suit your specific requirements.

Do not assume that all models have the same features. You will be looking for a an approved, low-cost detector that will perform reliably. Other features that should be considered equally important include:

o Remote sensor(s): The detector should be located where your staff can monitor it, but the sensor(s) must be placed at the potential source of the leak. Ammonia, which is lighter than air, requires a ceiling-mounted sensor. Halocarbons, which are heavier than air, need the sensor mounted low in the room. Detectors that come with the sensor built in are unlikely to provide the best detection capability.

o Readout of parts per million (PPM): This is important to determine the severity of the leak and what action to take in the event of an alarm. For example, your staff may safely address a low-level leak, whereas an extremely high level may indicate a serious problem that warrants professional assistance. A digital readout is preferred for this.

o Multi-gas capability: Besides your refrigerant (ammonia, R-22, etc.) you may also have the need to monitor for other gases such as carbon monoxide or propane. Purchasing a unit with multi-gas capability is the lowest-cost way to cover all of your gas detection requirements.

o Auxiliary relays: Some state or provincial codes require, or may require, that when the concentration of refrigerant vapor exceeds a certain level (c.g. 300 PPM at 70F) the detector will automatically start an exhaust fan as well as activate an audible and visual alarm. To accomplish this, the detector must have auxiliary relays to engage these other devices.

o Multi-stage alarm outputs: Similar to above, different levels of concentration should trigger appropriate alarms. A low-level alarm may simply start a fan and summon your staff to address the problem. Higher concentrations could be set up to activate more noticeable alarms.

o Future requirements: While this may be difficult to predict, you should try to take future requirements into consideration. Bear in mind that codes are always changing; consider other "wants" you have that may exceed your current budget. Try to purchase a detector that can accommodate these in the future.

Whether or not mandated by code, gas detectors are a safely item that no arena should be without. No facility should knowingly compromise the safety of its patrons or employees when affordable protection against potential hazards is available.

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