

Finding Refrigerant Leaks with the ChemPro100i

The ChemPro100i is a great sniffer for halocarbon refrigerants, often generically referred to as “Freon” because of its multiple sensors and broad sniffing capability. As refrigerant sniffers are only carried by a small subset of first responders, the ChemPro100i can fill the role for those that don’t have a refrigerant sniffer. As a bonus, if someone suspects that it may be a refrigerant leak, and it turns out to be something else, the wide range of detectable gases and vapors seen by the ChemPro100i means that it will most likely find the unexpected gas/vapor too.

The ChemPro100i’s Sensors

The ChemPro100i uses a suite of seven sensors including an aspirated Ion Mobility Spectroscopy (IMS), five metal oxide sensors and a field effect sensor to detect, characterize, and even identify, some gases and vapors.

Using this suite of sensors, the ChemPro100i can find halocarbon refrigerant leaks using its “Trend” or “sniffer” screen. As one gets closer to the refrigerant leak, the trend line will increase. This is a non-quantifiable reading that does not directly correlate with parts per million (ppm), but the fast response of the ChemPro100i to refrigerants provides one with the means of quickly finding a refrigerant leak.

The ChemPro100i does not have the ability to further characterize refrigerant in any of its detection libraries. So, it will never display a “Refrigerant” alarm. However, at high concentrations it is possible to get a “Chemical Detected” alarm on the ChemPro100i.



Using other Sniffers for Refrigerants

Most dedicated refrigerant detectors use a Metal Oxide Sensor (MOS) that is doped to be relatively specific to the halogenated hydrocarbons (halogens) that are the hallmark of most refrigerants. MOS sensors are non-linear and not suitable for quantification of refrigerants, but they provide sensitive and fast response to halocarbon refrigerants. However, they are not suitable sniffers for non-halocarbon compounds.

Flame Ionization Detectors (FIDs) may also be used to sniff for halogenated refrigerants because they are primarily halogen (typically chlorine or fluorine) substituted short chain saturate hydrocarbons. Essentially hydrogens (H's) have been changed out for Cl's and F's in methane, ethane and propane. For example, the classic “Freon” called “R-12” is Dichlorodifluoromethane or CCl₂F₂.

Because carbon atoms are still at the center of these halocarbons they will “burn” in the FID and give some signal. However, when burned, the halocarbons will release their halogens which can damage the delicate FID sensor. Because of this, frequent FID use on refrigerant leaks is not recommended.

Photoionization Detectors (PIDs) are another very popular sniffing technology. But all the halocarbon refrigerants have ionization potentials significantly higher than the highest PID lamp, so they will all go unseen by PIDs.

ChemPro100i Testing on Refrigerants

Environics performed sniff tests on the following refrigerants and the ChemPro100i Trend screen was found to respond extremely well to all of them.

- R-22 (Methane Series)
- R-401A*: a blend of R-22, 152a (Ethane Series), 124 (Ethane series)
- R-404A*: a blend of R-125, 143a, 134a (all Ethane series)
- R-407C*: a blend of R-32 (Methane series), 125 (Ethane series), 134a (all Ethane series)

*Note that when a blend has the same number but a different letter at the end, it has the same blend of refrigerants but differing ratios. It would be expected that the ChemPro100i would have similar sniffing performance for other blends in the series.

Chemical Name	Synonym	CAS	Seen on ChemPro100i Trend
Chloro-1,2,2,2-tetrafluoroethane (1-)	HCFC-124, R-124, R124	2837-89-0	Yes
Difluoroethane (1,1-)	HFC-152a, R-152a, R152a	75-37-6	Yes
404A	SUVA 404A refrigerant (mixture of HFC-143a, 125 & 134a)	NA	Yes
Trifluoroethane (1,1,1-)	HFC-143a, R-143a, R143a	420-46-2	Yes
Pentafluoroethane	HFC-125, R-125, R125	354-33-6	Yes
407C	SUVA® 407C refrigerant (mixture of HFC-134a, 125 & 32)	NA	Yes
Difluoromethane	HFC-32, R-32, R32	75-10-5	Yes
Chlorodifluoromethane	HCFC-22, R-22, R22	75-45-6	Yes
R-401A	Suva® MP39 refrigerant, replaces R-12 (mixture of HCFC-22, 124 and HFC-152a)	NA	Yes
Dichlorodifluoromethane	CFC-12, R-12, R12	75-71-8	Yes
Tetrafluoroethane, 1,1,1,2-	HFC-134A, R-134a, R134a	811-97-2	Yes
Tetrafluoromethane	CFC-14, R-14, R14, Carbon tetrafluoride	75-73-0	Yes

Using the ChemPro100i on Refrigerant Leaks

Supermarket Refrigeration Leak

"Our call was a refrigerant leak at a supermarket. The leak was in a mezzanine level mechanical room that was well ventilated. We had two crews trying to secure the leak. The only meter that we had that picked up anything was the ChemPro. Prior to having this meter, the only way we could estimate the concentration of this (refrigerant) gas would have been to use a 4 gas meter and calculate it by the oxygen depletion. We currently have the meter on our hazmat truck, which must be specially requested to respond on calls. I plan on relocating it to our heavy rescue..." While the ChemPro100 did not classify or identify the refrigerant, it did detect it using the Trend screen.

"Gas" Leak

"Units were alerted for an inside gas leak in a single-family dwelling. The first arriving unit entered the home with a standard four gas meter (containing oxygen, combustible gas, carbon monoxide and hydrogen sulfide sensors) and checked all levels...They found no odor of natural gas and there were no changes in atmospheric readings on any of the sensors in their four-gas meter. After investigating the dwelling, the crew members exited and two of them began complaining of dizziness and headaches. At that time a hazardous materials (HazMat) response was requested alerting our special operations team. Based on the symptoms the members were describing, and a report from the homeowner that a loud pop and hissing sound were heard coming from the basement utility room, we suspected a possible refrigerant leak. The only tool in our arsenal useful for detecting any of the refrigerant blends is the ChemPro.

Two of our members entered the basement using the ChemPro and a PID. The ChemPro, in trend mode, led our guys right to the a/c unit in the basement utility room where they found a leak coming from the copper supply line going into the coil. The PID didn't show any change in response. We continued to check the atmospheric conditions in the basement while using forced air ventilation to clear the refrigerant. The Trend screen on the ChemPro allowed us to gauge the effectiveness of our ventilation efforts, and finally to determine when the atmosphere was safe for the residents to return home."

This example demonstrates how one can respond thinking that one gas may be leaking but an entirely different gas was leaking that the first-in sensors did not see. It also shows how by comparing the ChemPro's Trend screen reading from inside the structure to that found outside the structure, one can gauge the effectiveness of one's ventilation efforts. When the Trend screen in the structure matches are nearly matches the readings found outside of the structure, then ventilation is complete.

The ChemPro100i provides the versatility to see both the gases or vapors that you expect, and those that you don't expect. In addition to its ability to classify and identify many common Toxic Industrial Chemicals (TICs) and Chemical Warfare Agents (CWAs), the ability of the ChemPro100i to sniff for and locate refrigeration leaks is a great bonus that keeps it out of its case and in the hands of responders.