MPS™ Best-in-Class Refrigerant Detector

Summary of Findings from 2020 AHRTI Report, *"Refrigerant Detector Characteristics for Use in HVACR Equipment-Phase I"*

Report Summary

Emerging global HVAC regulations require the implementation of low-global-warming (LGW) refrigerants, many of which are flammable (A2L).[1] As such, new standards require the use of sensors for detecting refrigerant leaks to prevent the possibility of flammable gas conditions or explosions.

In March 2020 the Air-Conditioning, Heating and Refrigeration Technology Institute, Inc. (AHRTI) published *Refrigerant Detector Characteristics for Use in HVACR Equipment-Phase I* (Report No. *9014*). This independent study assessed "currently commercially available refrigerant detectors (or prototypes under development)." The detector technolgies assessed were (1) Micro Machined Membrane (MMM) (the Molecular Property Spectrometer, MPS, is the only sensor in this category); (2) Nondispersive Infrared (NDIR); (3) Thermal Conductivity (TC); (4) Metal Oxide Semiconductor (MOS); and (5) Speed of Sound (SS).[2]

The study determined each technology's capability "to meet the requirements of the major refrigerating system safety standards." The Phase I analysis focused on response time, as well as "related issues such as upper detection limits, accuracy and calibration, drift over time, sensitivity to environmental conditions (temperature, pressure, humidity and vibration)." Phases II and III will assess reliability and robustness.

A total of 26 sensor manufacturers were invited to participate in Phase I. Eleven sensors were submitted. Having reviewed the manufacterers' specifications, six sensors were selected as valid candidates for further, empirical assessment of response time. Sensors were assessed against a total of 28 requirements, taken from the five major refrigeration system safety standards. Table 1 provides a summation of the results.

- The MPS A2L Refrigerant Sensor met all of the requriements—the only perfect score in this assessment.[3]
- The MPS had the second fastest sensor response of all sensors tested—with a total time to 63.2% of response of 4.75 seconds.

Letter Code	Sensor Type	% of Requirements Passed	Ave. time delay, θ [sec]	Ave. time constant, τ [sec]	T63.2 = θ + τ [sec]
A	MMM (MPS™)	100 %	4.5	0.25	4.75
B	NDIR	96 %	1.6	15.8	17.4
C	TC	86 %	0.0	0.1	0.1
D	NDIR	79 %	0.1	13.7	13.8
E	MOS	75 %	Cannot be determined.		
F	MOS	64 %	Cannot be determined.		

Table 1 – Compilation of study results, including experimentally measured sensor response times.

The time delay, θ, measured in seconds, is defined as the time between the introduction of gas and the sensor's first rising response. The time constant, τ, measured in seconds, is the additional time (after the time delay, θ) until the sensor output reaches 63.2% of its total response to the gas. T63.2 is the sum of these. Faster response times make for a safer sensor because the flammable condition is reported sooner; faster response times also enable sensor integrators to implement higher alarm set points in their systems to reduce nuisance alarms and false positives.

For more information about the MPS A2L Refrigerant Sensor from NevadaNano, visit:
https://nevadanano.com/mps-a2l-refrigerant-gas-sensor/

[1] A2L is a sub-class of A2 (i.e., lower flammability) refrigerants, per ASHRAE Standard 34-2010.
[2] A 2017 AHRTI Report (No. 9009) ruled out both Electrochemical Cell (EC) and Catalytic (Pellistor) sensors for this application.
[3] The original published report erroneously reported that the MMM did not meet the requirment: "If there is a defined life, sensor should have end of life indication meeting the requirements." The MMM *does* meet this requirement, as confirmed by the study's author, Creative Thermal Solutions (CTS), Inc. Contact CTS for additional information.