

INDUSTRY STEWARDSHIP
REFRIGERANT/ENVIRONMENTAL SAFETY (R-410A)

Emerson Climate Technologies™ Flow Controls HMI White Paper

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Indications Without Insight Aren't Really Indications at All.

Moisture indicators on HVACR systems have been billed as critical early-warning components in the fight to cut the long-term effects of water damage and reduce repair and maintenance costs. But do they truly live up to their billing? And even more important, are they the answer to the changing demands the coming HFC refrigerants will place on systems?

Traditionally, moisture indicators have been green/yellow wafers that said the system was either “dry” (green) or “wet” (yellow). But, this simply does not go far enough. Here's why.

All moisture indicators share one common objective: to sense and report just how much water is in the system's circulating refrigerant. A paper wafer in a sight glass changes color as the moisture content reaches potentially damaging levels. Those traditional green/yellow indicators do not, however, show percentage increases along the way; that is, they do not provide any true insight into the ongoing increases in moisture content. They simply announce, for example, that the system is “wet.” And by the time this “wet” indication is made, it may be too late to avoid damage to the compressor or other system components.

There are other shortcomings as well. The green/yellow moisture indicators work only at higher levels of moisture, about 10% relative humidity (RH). Paper indicators are susceptible to damage from brazing during installation. And their color can actually wash out under wet conditions, leaving behind a useless piece of blank paper.

More Colors Mean More Insight.

That's why Emerson Climate Technologies™– Flow Controls division designed and developed the Hermetic Moisture Indicator (HMI), the most sensitive indicator on the market. Instead of the old green/yellow papers, the HMI features a tri-color molded disk wafer dial with blue (dry), purple (caution) and pink (wet) indications.

The addition of the purple caution color alone gives the HMI a critical advantage over previous indicators. It alerts technicians early on to rising moisture levels, allowing them to take corrective action before any damage occurs. And as the colors continue to change as moisture content rises, the HMI allows those same technicians to determine conditions more accurately, taking the guesswork out of their monitoring activities.



But the real benefit to the HMI is its ability to read moisture at levels far below current industry standards. The HMI actually begins to change color at 2% RH – a “very dry” indication. At 3% RH, the purple caution color begins to appear. Competitive indicators, on the other hand, do not even begin changing colors until about 7% to 8% RH.

That early detection capability was not as important with old HCFC and CFC refrigerants. But it will be vital with the coming HFCs. That's because HFCs utilize polyol ester (POE) oils. And because POE oil can attract and hold up to 20 times more moisture than mineral oil used by older refrigerants, the systems will require closer monitoring than ever before to detect contamination.

It’s All Relative.

The Hermetic Moisture Indicator works by utilizing a unique salt that holds more water than a traditional green/yellow indicator salt. This salt also changes through a wider color range than the green/yellow salt. Additionally, the indicator itself is thicker, and together these attributes allow for a wide range of rich colors that enhance the ability to better understand the amount of water in the refrigerant.

In addition, the HMI, along with all other moisture indicators, does not simply sense parts per million (ppm) of water in a system. Instead, it measures relative humidity. This is a significant distinction. Why? Because, for example, a reading of 50 ppm in R12 is extremely dangerous, while 50 ppm in R-410A is not. The difference is in the refrigerants. The new refrigerants, along with their POE oils, can physically hold more water; and since they operate at low ppms, this translates into extremely low relative humidity levels, in the 2% to 7% RH range.

Relative Humidity (%)

PPM	R-22	R-134a	R-404A	R-410A
25	2.0%	2.1%	3.1%	1.7%
50	4.0%	4.2%	6.3%	3.4%
75	6.0%	6.3%	9.4%	5.0%
100	8.0%	8.3%	12.5%	6.7%

There is a misconception across the HVACR industry that 10% RH moisture detection is sufficient. That’s an assumption that can lead to a dangerous – and expensive – false sense of security. At 3% RH in many HFCs, a green/yellow indicator will show a green color, pronouncing the system is still “dry.” In fact, it is actually at risk of acid formation from the breakdown of the POE oil. At 10% RH moisture detection, the system has already been contaminated with moisture and acids, and will need to be cleaned. That could mean anything from replacing the filter-drier and exchanging some or all of the oil in the system, to replacing a compressor or multiple compressors.

Actually, the old green/yellow indicators show a “dry” reading as high as 7% RH. And a 7% RH reading in R-410A means there are nearly 300 ppm of water present. Emerson Climate Technologies’ studies have shown that acid begins forming at approximately 75 ppm, when water starts to turn POE oils back into acid. That means the newer refrigerants, with their high moisture content, see severe problems to the lubricant at 100 ppm.

Any acid formation can be a problem, of course. So detecting moisture content as soon as possible is crucial to protecting the life of the system. Again, traditional green/yellow indicators fall short. By the time the indicator goes off, damage is already occurring to the lubricant. So it’s an indication that doesn’t actually indicate anything.

The HMI Difference

The HMI even differs from moisture indicators that use similar technologies. For starters, the HMI is currently the only sight glass on the market that is UL-listed with a 680 psig maximum working pressure, making it acceptable for use in R-410A. Also, it has a larger viewing window for easier visibility and charging. It is resistant to “wash out” from water and can withstand brazing temperatures up to 450°F. (The green/yellow paper wafer of traditional indicators can be damaged at temperatures as low as 350°F.)

The HMI’s fully hermetic design includes a corrosion-resistant, all-brass body with no o-rings or knife seals that are likely to leak. The indicator also features solid copper fittings for easy, universal replacement or new installation.

Conclusion

Effectively monitoring an HVACR system for water content is already a critical step in assuring a long and useful life for the system. But it's a step that cannot be taken if the view to the system – the moisture indicator – does not provide timely, accurate readings of the moisture level in the refrigerant. And as new refrigerants emerge, today's traditional green/yellow solutions will fail to offer the insight and innovation needed to keep pace with the systems of tomorrow.

About Emerson Climate Technologies

Emerson Climate Technologies, a business of Emerson, is the world's leading provider of heating, ventilation, air conditioning and refrigeration solutions for residential, industrial and commercial applications. The group combines best-in-class technology with proven engineering, design, distribution, educational and monitoring services to provide customized, integrated climate control solutions for customers worldwide. Emerson Climate Technologies' innovative solutions, which include industry-leading brands such as Copeland Scroll™ and White-Rodgers®, improve human comfort, safeguard food and protect the environment.

About Emerson Climate Technologies - Flow Controls division

Emerson Climate Technologies - Flow Controls division is a leading manufacturer of valves, controls and system protectors commonly applied in air conditioning and refrigeration systems worldwide. The company continues to pioneer the control of refrigerant flow through innovative, high performance components, such as thermostatic expansion valves and filter driers. Emerson Climate Technologies - Flow Controls division is headquartered in St. Louis. For more information, visit Emersonflowcontrols.com