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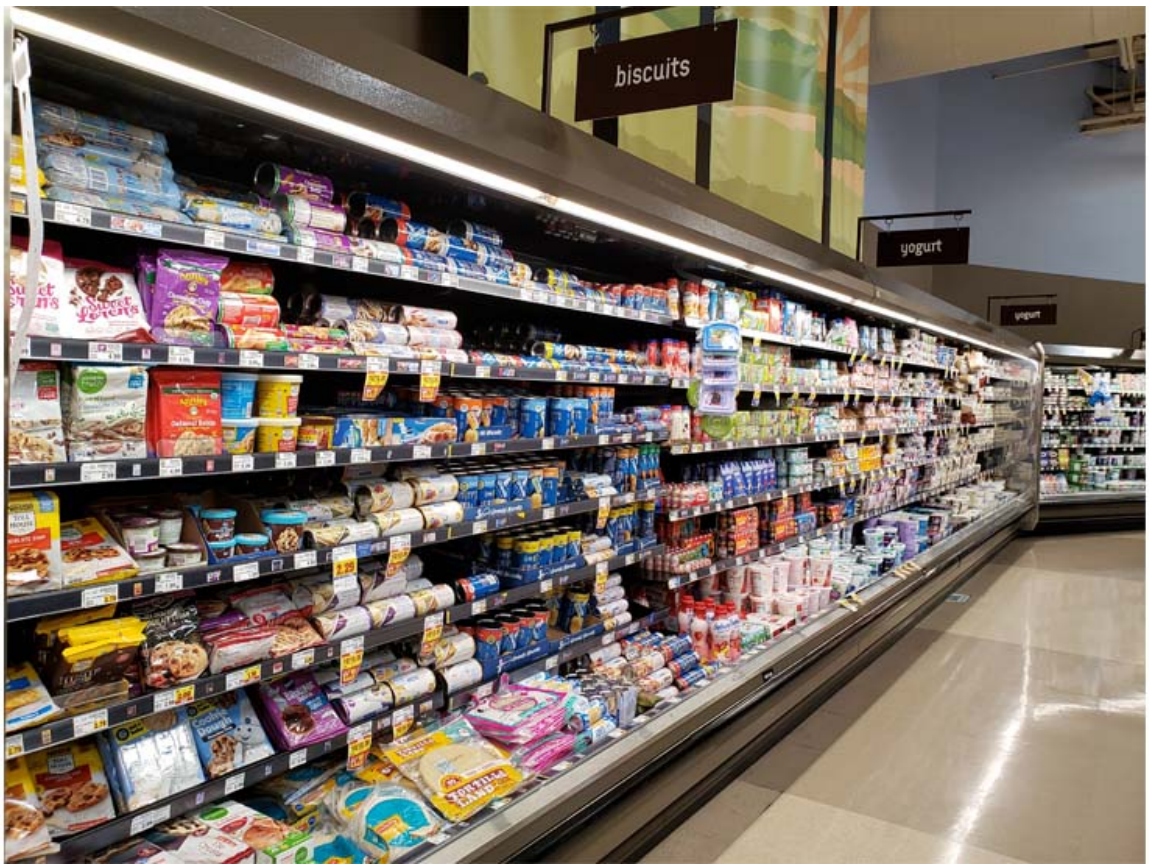
Reducing Refrigerant Leaks Is Industry Concern

Research details where leaks are usually located in refrigeration systems



LARGE BURDEN: For food retailers, refrigerant leaks represent a large financial and operational burden, which is why it is important that they be found and fixed quickly. (Staff photo)

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Refrigerant leaks in HVACR equipment — particularly commercial refrigeration systems — are a significant problem. According to the Environmental Protection Agency's (EPA's) GreenChill program, the typical supermarket has an annual leak rate of about 25%, and the average store contains about 3,500 pounds of refrigerant. Multiply that by thousands of stores across the U.S., and it's easy to see why leaks are such a big concern for end users, as well as the environment.

For food retailers, refrigerant leaks represent a large financial and operational burden, especially since the cost of refrigerants will likely be increasing in the near future due to the impending HFC phasedown. For the environment, leaks represent a large source of annual emissions; indeed, leaks in supermarkets across the U.S. may account for as much as 129 billion pounds of CO_2e each year.

The North American Sustainable Refrigeration Council (NASRC) is addressing this issue through a leak reduction initiative that is being spearheaded by six of its retailer-members. Under this initiative, retailers identified the top 10 leak issues in refrigeration equipment and are developing equipment specifications that are designed to mitigate those leaks. In its recent online summit, NASRC offered details on some of those common sources of leaks and what causes them to occur.

Leak Locations

According to Morgan Smith, program and communications director at NASRC, the top 10 leak issues identified by the retailers in the leak reduction initiative are:

In cases and fixtures:

1. Evaporator leaks due to tubing failures;
2. Access valves;
3. Lines rubbing together, either through contact/vibration or through thermal expansion;
4. Electrical wiring failure, causing leaks;

In machine rooms and racks:

5. Compressor vibration relative to the rack structure, causing displacement, breaking tubing;
6. High-side lines;
7. Mechanical fitting connections;
8. Tubing isolation from similar and dissimilar metals;

In the condenser:

9. Tube sheet leaks at condensers; and
10. Fan breakage/motors falling into the coil and causing leaks.

As a response, the retailers in the initiative proposed the following best practices and are working on drafting the language for the specification:

1. Require 45 bar working pressure (Type K) in fixtures (coil and all piping) and on racks;

2. Any tubing or part that carries refrigerant cannot come in contact with any other metal;
3. Eliminate any pipe fitting with a mechanical thread;
4. Limit Rotolock fittings (ideally transition to another alternative, if not, institute quality controls);
5. Add a temporary pressure gauge or indicator to visually confirm that the system is pressurized after arriving on site; and
6. Regulating release valves.

Leia Waln, associate partner and program manager at Refrigerant Management Solutions, confirmed these major sources of leaks. She shared the details of a study of 100 supermarkets that showed that the largest number of leaks occur at the compressor racks, which accounted for 57% of all leaks. The second largest number of leaks occur within the display cases, which are out on the sales floor. These two locations comprise about 89% of leaks that occur in refrigeration systems, while 7% of the leaks occur in piping and 3% in remote condensers.

“In looking specifically at the components on a traditional compressor rack, the largest number of leaks occur on the compressors, with 28% of the overall leak locations occurring there, followed by leaks in the liquid line, suction line, receiver, and discharge line,” she said. “The highest percentage of leak locations are on the suction service valve, followed by fittings, discharge service valve, discharge piping, liquid injection valve, and flanges/couplings.”

Display cases account for 26% of the leaks, and the majority of these leaks occur in the evaporator, followed by the suction line and then the liquid line, said Waln. “If we look further into the data under the evaporator, we'd see that these leaks are mostly on the evaporator coils and the evaporator expansion devices.”

While it is sometimes difficult to determine the root cause of a leak, Waln noted that for a traditional rack system, vibration is the main cause of leaks, followed by normal mechanical wear, seal failure, corrosion, gasket failure, and physical damage. The number one cause of leaks in display cases is corrosion, followed by normal mechanical wear, and vibration.

Finding/Fixing Leaks

Finding — and fixing — leaks are key in reducing refrigerant emissions, and Clay Rohrer, director of connected solutions at Hussmann, offered the following comprehensive guidance on this subject:

- If equipped with an electronic refrigerant leak detection system:

    - Check and graph all of the different zones' ppm concentrations and test the most suspicious areas first with a portable, accurate leak detector.
    - Check fittings and piping for oil residue.
- Test the compressor room with an electronic or ultrasonic leak detector and look for signs of oil on the fittings or on the floor.
    - Use soap bubbles to help pinpoint any suspected areas. Service valves, caps, flares, control hoses, and missing clamps are all good points to check. De-energize the electrical supply before using soap on pressure switches, transducers, terminal plates, etc., to avoid a shock hazard.
    - To help minimize trouble, temporarily turn off exhaust fans to help pinpoint leak, if safe to do.
- Walk the store with an electronic or ultrasonic leak detector and place the probe in, around, over, and under all the cases and walk-in boxes. If a leak is detected, check the case bottom area for oil and possibly apply soap bubbles to any service caps and fittings in the cases or piping to pinpoint the source.
- Walk the condenser area with a detector. Check the piping, valves, pressure controls, coil tube sheet, and return bends for any signs of oil or a possible leak. Apply soap bubbles, if necessary, to pinpoint the source.
- Walk the accessible piping with the electronic detector. Check for signs of oil around fittings. Be sure to look in or around the insulation on the piping.
- If unable to locate a leak, it may be necessary to shut down the HVAC and exhaust hoods, if store management does not object and it is safe to do so. This may need to be one after hours to minimize air currents. Let the leak stratify to see if concentration increases in any specific area.
- Look in the harder-to-access areas, such as the pits, underground piping, above ceilings, and inside of walls. Look for oil or oil residue.

"It's all about using detectors and data to focus and pinpoint the area and then confirming that the leak is fixed," said Rohrer. "If you don't confirm the fix, and if you don't have any refrigerant management tools in place, you're just constantly leaking. It's critical to constantly use data to continuously improve a site's leaks."

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