In recent years, formicary corrosion has wreaked havoc on the heating and cooling industry. As the No. 1 cause of evaporator-coil leaks, formicary corrosion has gotten worse for a host of reasons: Chinese-manufactured drywall, tighter home construction, different materials used in insulation and carpeting, new adhesives and more. The list of blame goes on and on. Regardless of the cause, HVAC manufacturers have been quick to address the problem with fast fixes, such as coatings and different lubricants, as well as long-term product changes such as all-aluminum coil construction.

**What is formicary corrosion?**
Formicary literally means “ants’ nest.” So, formicary corrosion, as it relates to evaporator coils, is referring to small wandering pits that resemble the tunnels in an ants’ nest. This corrosion attacks copper and copper alloys exclusively, and is prevalent in southern climates with high humidity.

Four components are necessary for formicary corrosion to happen: copper, moisture, oxygen and an organic acid (from such items as adhesives, cabinets, countertops, foam insulation, laminates, oil based paints, paneling, plywood, silicone caulking, latex paints, cosmetics, disinfectants, deodorizers, wallboard and other common household/construction products). In areas such as the southeastern Unites States, all four of these components are commonly found inside the central A/C system. But if one component can be eliminated, so can the corrosion—and the resulting leaks.

**History of micro-channel**
The automotive industry shares many of the same manufacturing challenges faced in HVAC: cost, size and weight. In the early 1990s, the automotive industry had a significant challenge relative to air-conditioning systems—the industry had to transition from R-12 to more environmentally friendly R-134a, a refrigerant that operates at slightly higher condensing pressures.

Faced with these issues, the automotive industry investigated alternative coil technologies to improve the performance of their systems while maintaining or reducing size and weight. The answer was all-aluminum micro-channel coil...
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technology. It became the industry standard, and now, 20 years later, this technology is being used in residential heating and cooling systems.

Overview and benefits
Micro-channel coils are aluminum-extruded channels that are mechanically brazed to aluminum fins. The coil has three basic components: micro-channel tubes, aluminum fins and two manifolds. All three components are brazed together in a hydrogen/nitrogen brazing furnace. The lack of oxygen and water vapor in the brazing process ensures a robust reliable braze joint. Additionally, the product quality is further amplified due to one homogeneous braze joint as opposed to more than 300 braze joints typically found on standard copper-tube/aluminum-fin coils.

The two manifolds facilitate a two-pass process. In the first pass, the high-pressure superheated refrigerant is de-superheated and condensed into a liquid. The second pass subcools the liquid refrigerant below its saturation temperature prior to entering an expansion device.

This construction provides a coil that is typically 50% lighter and uses, on average, 50% less refrigerant when compared to a copper-tube/aluminum-fin coil design. Heat transfer is also enhanced, leading to smaller, more-efficient coils. Additionally, the all-aluminum uniform design provides a structurally robust coil. The biggest benefit, however, is relative to formicary corrosion.

What technicians need to know
Many online HVAC forums are filled with misinformation about installing and maintaining micro-channel evaporator coils. The coils are not more complicated than traditional copper-tube/aluminum-fin coils, but they are more sensitive to accurate charging. If technicians have questions about
installing or servicing these coils, they should go directly to their distributor or the manufacturer, as other online answers may be incorrect.

**Installation**

The installation of micro-channel evaporator coils follows the same process as a traditional fin-in-tube coil. The installer will need to:

- Braze with nitrogen;
- Install a liquid-line filter-drier;
- Follow the triple evacuation method; and
- Weigh in the additional charge.

These are the same practices that should be followed when installing any HVAC component or system. Installers should always refer to the manufacturer’s installation instructions for the proper size or metering device. Some micro-channel coils may have dual applications and may need a piston or TXV change. The installation of these metering devices is very similar to a copper-tube/aluminum-fin coil, and no special tools are required. In most cases, brazing is not necessary when installing a TXV.

It is best practice to have a small flow of nitrogen when brazing in any lineset, but it is critical with micro-channel coils. If the installer brazes without nitrogen, oxidation flakes can form on the inside of the copper and can clog the narrow micro-channels inside the coil. In many cases, the evaporator coil has a filter screen at the inlet of the metering device that also can become clogged by oxidation flakes. Always install the liquid-line filter-drier as close to the evaporator as possible. This will catch any debris or moisture before entering the metering device.

When evacuating the system, technicians should use the triple evacuation method and always use a micron gauge to determine if the correct vacuum is reached. Do not rely

>> A traditional copper coil showing formicary corrosion. Field failure in this particular coil occurred just two months from manufacture date.
One of the benefits of micro-channel coils is that they require less refrigerant. However, this means there is also less room for error when charging the system, as technicians need to be within ounces of the correct charge, not pounds.

Charging
One of the benefits of micro-channel coils is that they require less refrigerant. However, this means there is also less room for error when charging the system, as technicians need to be within ounces of the correct charge, not pounds. When charging a micro-channel system, any additional charge should be weighed in with a refrigeration scale. Technicians should not use a bathroom or fish-type scale, as they do not have the accuracy of the refrigeration scale. When adding on a gauge set alone to determine if the correct vacuum is reached.

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The Triple Evacuation Method

1. First vacuum: Pull the system down to 1,500 microns.
2. Break the vacuum with nitrogen; release nitrogen.
3. Second vacuum: Pull the system down to 1,500 microns.
4. Break the vacuum with nitrogen; release nitrogen.
5. Third vacuum: Pull the system down to a minimum of 500 microns.
6. Charge the system.

charge to dial in the system, add small amounts of refrigerant at a time. It is also necessary to allow the system to level out in between adding refrigerant. Wait a minimum of 10 minutes between each addition.

To ensure accuracy, gauge sets should use the shortest hoses possible—not a hose that is as long as the technician is tall. Since micro-channel systems use less refrigerant, the trapped liquid in the high-side hose can affect the charge levels in the system. Always use some type of low-loss fittings on your gauge set, and meter the trapped refrigerant in the high-side hose back into the system through the low-side hose. Remember to meter the refrigerant during this process.

If there are any questions regarding the charge levels in a micro-channel system, it might be necessary to remove the entire amount of refrigerant and weigh it back into the system.

Repair

If a micro-channel evaporator coil needs a repair, the technician should refer to the specific manufacturer’s installation instructions. Repair kits using epoxy do exist, but in many cases, a coil replacement might be a better or preferred option.

While providing much greater resistance to formicary corrosion, micro-channel evaporator coils are not more difficult to install or service if the technician follows standard industry practices and the manufacturer’s instructions. Obtaining the correct system charge can be accomplished efficiently and within a reasonable period of time. 

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