

What Causes Formicary Corrosion & How Is It Stopped?

What is formicary corrosion?

It is corrosion that occurs in copper based alloys. Due primarily to appearance, and the fact that it appears like ant nests in the copper under magnification it is often referred to as ants nest corrosion. If you see corrosion it is probably not formicary corrosion, because it is not generally visible without magnification. A second nickname for formicary corrosion is pinhole corrosion due to the small size of the actual holes in the copper. However, you may see some gray, black, or blue discoloration on the copper's surface where the corrosion is found. Your professional contractor will be able to verify the type of corrosion found, but may need to have the original equipment manufacturer's (OEM) lab examine the coil before a final determination of cause can be made.

What causes it and how common is this?

Formicary corrosion is caused by a chemical reaction requiring three parts: oxygen, water, and an organic acid. If any of the three parts are removed there can't be any further formicary corrosion. Formicary corrosion only occurs in copper based alloys and HVAC coils are often made of copper. According to studies formicary corrosion is only responsible for approximately 10% of early copper coil failures in the HVAC industry.

How can an OEM tell that formicary corrosion damaged my HVAC coil?

The coil needs a magnified inspection to be sure. Then, based on whether the "ants nesting" started on the inside or outside of the copper tubing, the location of the organic acids can be determined.

Formicary corrosion can attack from inside of the coil if there are manufacturing problems with the copper that allows an organic acid into the closed and pressurized HVAC system. However, in 90% of the cases where formicary corrosion is found, coil damage is caused by organic acids in the air that is cooling or heating your home.

Where do the organic acids come from?

Organic acids like formic and acetic are found in many household products. The EPA regulates volatile organic compounds (VOCs) in the air outside. However, the EPA has found that exposure in homes can be greater than what is recommended for safety. VOC producing products can be as diverse as building materials like plywood and caulk to normal household cleaning solvents, vinegar, and even makeup. A list of common household products that can contain organic acids linked to formicary corrosion was included in one industry research report as follows: adhesives, cabinets, countertops, foam insulation, laminates, oil based paints, paneling, particle board, plywood, silicone caulking, wallboard, wallpaper, vinyl flooring, latex paint, vinegar, cosmetics, disinfectants, deodorizers, tobacco smoke, wood smoke, and cleaning solvents

That sounds like everything, can the source be narrowed down?

Maybe. Look for organic acid sources from the lists in the previous question's answer, especially near the HVAC's return opening. When searching for the most likely source, don't forget the obvious; are any of the items on the list used regularly? If so, the labels should be checked for organic acids. There may not be one main source.

Unfortunately, according to Department of Energy sponsored research done by the Lawrence Berkeley National Laboratory on newly constructed homes: there were elevated levels of formaldehyde, acetic acid, and acetaldehyde present in the homes. The good news is the effect of the off gassing in the construction related products may decrease over time. The bad news is it is suspected that tighter home envelopes that increase energy efficiency may be making the problem worse.

Will formic and acetic acid off gassing hurt humans or pets that breathe it?

Yes, in amounts over 5 parts per million parts in the air you or your pets may experience irritation of the nose, eyes, throat, and upper respiratory tract. Higher concentrations can cause central nervous system effects and damage to the lungs and eyes.

If I can't remove the source of the formicary corrosion what other options do I have?

One solution would be to have your professional HVAC contractor, install a heat recovery ventilation system (HRV) or an energy recovery system (ERV) with a designed outside airflow exchange rate. It is still scientifically unproven that increasing the number of air changes aids in stopping formicary corrosion. However, the EPA recommends increasing ventilation when using VOCs. Additionally, it seems obvious that continuously removing and replacing the air would help reduce the quantity of organic acids whenever the outside air has a lower level. Once there is enough fresh air brought in, to achieve 5 parts per million of organic acids in the air or less, it will be deemed safe to breath by OSHA standards.

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