Airconstruct IEQ
indoor environment quality

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# Is Corrosion impacting your HVAC Equipment Performance?

Let me be clear upfront, I know nothing about metallurgy nor do I hold any degree in science but I have been on and off tools in HVAC for almost 33 years so I've seen plenty of corrosion and the impact it has on reducing the life of equipment.

These are some of my observations. I might also point out that I am not much of a creative writer either, so you need to be just a bit mechanically minded like myself or you will tune out early. Apologies in advance.

What I do know for sure is protection against corrosion needs to be put into much wider practice to increase the longevity of assets as a good corrosion treatment program can help prevent expensive replacement or repair costs and in extreme cases, the accidental release of refrigerant gases. I have seen an in-service air-cooled chiller at end of life in under 6 years due to corrosion when the R.O.I. and life expectancy is often spread out to 20 years or greater. And so it should be. All equipment manufacturers will tell you they expect their kit to run for 20-25 years. And it will if its correctly maintained.

Corrosion is the process by which a metal deteriorates when it comes into contact with water or contaminants through a process called oxidation. Coil corrosion is a common problem with HVAC systems and may begin to occur within a few weeks, months or years of installation. The rate at which corrosion occurs is often determined by the environmental factors in which the equipment finds itself. Coil corroding contaminants are often formed due to the humidity, warm air, dirt, ambient moisture and machine made moisture and the worst of all is salt laden air.

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This process is also due to HVAC equipment being constructed of various types of metals to serve varying purposes. For example the base and panels of a system are made of steel sheet metal as this is durable, strong and economical. The fins of a coil are made of aluminium as its strong when it's thin and it is also lightweight. It retains strength when processed making it easy to put the thousands of small crinkles you can see into the aluminium, which are needed to make the air more turbulent as it passes over the coil thus allowing more molecules to absorb or transfer heat, and copper is used for the refrigerant piping as it has properties of high thermal conductivity. So while a lot of us shake our heads in disbelief that the manufacturing sector of our industry chooses dissimilar metals which are a contributor to corrosion by oxidation it is done this way for valid reasons. Also stainless steel is so hard on the tooling used to fabricate the metals units are often double the price, competition in the marketplace dictates price points at the end of the day and if there were only one manufacturer making non corrosive units we would have no choice but to pay and would have no corrosion issues.

Coils in particular may corrode for other reasons including low quality of copper which can be dictated by commodity prices and global demand, improper manufacturing techniques and chemical residues leftover from the manufacture of raw materials. I have seen firsthand some new equipment arrive from overseas already showing signs of corrosion just from sitting on wharves for two to three weeks due to a shipping delay.

Owners of HVAC systems who live along the coast line and in heavily populated urban areas or within direct proximity of salt-laden environmental elements are at a much higher risk of experiencing coil corrosion. While rare, exposure to chlorides and fluorides can trigger pitting of the coil while formicary deterioration is invisible to the naked eye. This makes formicary corrosion challenging to detect and resolve by preventative measures.

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Galvanic Corrosion

Formicary deterioration refers to the process of corrosion usually caused due to the corrosive action of organic acids such as acetic acid and formic acid. These acids are found in commonly used household items including cleaners, detergents, paints and adhesives. This form of corrosion attacks copper metal and its alloys which are commonly used in the manufacture of tube walls.

Formicary corrosion can cause tiny pinholes to appear on the tube walls and this in turn could result in leakage of refrigerants. The most well intended maintenance regime can be contributing to formicary corrosion if the chemicals and compounds used are not Ph balanced.

The performance of any vapour compression based (Dx) system relies on primarily on the condenser coil. Corrosion will lead to reduced coil efficiency, unsightlysurface deterioration and in extreme cases, equipment failure. This is where refrigerant loss has to be considered as a risk.

When the coil efficiency is reduced it is then in effect worked harder by the rest of system as it is still required to produce the same level of cooling for the building occupants or process application through heat rejection. Reduced efficiency of the coil through corrosion will in turn drive the compressor to run longer than before which then results in increased energy increased consumption and undue wear on the compressor. Potentially the asset service life reduces and we let this go or the sake of 3 to 4K to treat lets say, a 180 kilowatt chiller.

All of these interlinked problems which come back down to corrosion, which most of us only think of as boring old rust. The majority of HVAC manufacturers will offer some kind of corrosion protection at the time the equipment is ordered and built, but in my experience if you read the published test data on face value they are probably not getting too far past their own o.e.m warranty periods.

**It is far too subjective**

For example Carrier offer their factory applied “Superenviroshield” which is rated to 6000 hours under the ASTM-B117 Salt Spray Test. According to my math there is 8736 hour in a year, but of course the equipment is not exposed to salts at test levels for 8736 hours so it’s a bit of a random number. The 6000/10000/17000 hour ratings of various products achieved and validated as a result of salt spray testing to ASTM-B117 is difficult to pin down to the actual benefit to the equipment in service hours, and of course this will vary from location to location and the further you are from the coast the less of an issue

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corrosion becomes as it will be more of a localized problem. So my best technical advice is the higher the random number the better. I am sure there are formulae and correction factors that would come into play as this is science after all, but this would surely have to involve on site air sampling and catching rain drops and breaking them into nano-whatevers which could also be influenced by the wind of the day blowing what pollutants from this factory or that highways. Was it done at peak hour and on and on it could go.

**So keep it simple. The bigger the number under the ASTM-B117 salt spray tests the better.**

Corrosion Treatment Preperation

When it comes to Acid spray tests some corrosion treatments perform better than others. In my experience the likelihood of acid exposure is minimal and restricted to industrial corrosive environments, ironically in places that produce copper and other base metals. The compounds in these formulas tend to be more resin based and are more noxious to deal with in application, particularly if applying on site where equipment could be located near outside air inlets or can travel through over-spray. We have applied corrosion protection to 96 kilowatt packaged units located in wash-plant on a mine site and have no sign of deterioration after two years.

Facility managers, building owners and home owners should request additional corrosion protection of their HVAC contractors for a prolonged equipment service life. Corrosion protection coatings undeniably add a protective layer that will increase the life expectancy of your air-conditioning coils and therefore your plant.

If you would like to find out how our specialist **MechProtect** division can extend your asset life using world class Aeris Corrosion protection products, feel free to send an email to **david.jones@airconstruct.com.au**

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