Definitions of corrosion rates, YCR/ AYCR and thresholds.

Can a Risycor really protect an installation from corrosion? Surely corrosion has already had to happen before you can measure it? Risycor is an early warning system that sounds the alarm in time if the corrosion rate becomes too high. But how can it do that?

Definitions

- **Corrosion** is the electrochemical reaction in which metal oxydises with the help of oxygen and causes the formation of metal oxides such as magnetite. In heating systems this leads to unwanted sludge formation.
- **Corrosion damage** is the result of corrosion that limits the functionality of a material, its environment or the technical system. (e.g. due to sludge deposition)
- **Corrosion failure** means the loss of functionality of a part or the entire system (e.g. blockages or leaks)

Early warning is about **preventing corrosion damage and eliminating corrosion failure**.

A healthy installation

During filling, corrosion is unavoidable. The good news is that the corrosion process dies almost immediately thereafter because of a lack of oxygen, resulting in so-called “dead water”. A healthy system therefore relies on preventing oxygen ingress, which will be monitored by the Risycor. Risycor continuously measures the corrosion rate (YCR) and stores that data. It raises the alarm as soon as the preset threshold value is exceeded (default 24µm/year).
(TT17 explains how the measurements and warnings of the Risycor should be interpreted)
In addition to the recommendations in TT17 it is recommend that the data recorded in the Risycor’s memory is checked once a year to see the long-term corrosion trend of the installation.

Measuring units

YCR (Yearly Corrosion Rate) is the speed at which corrosion takes place, expressed in µm/yr (micrometer per year). It shows the decrease of the coupon at the tip of the Risycor over time. YCR is an “instant/actual” value, varying with oxygen ingress (comparable to speed in km/h). To monitor the reliability and lifetime of a system, AYCR (Average Yearly Corrosion Rate) is a useful parameter to avoid corrosion damage from sludge over a longer period of time, for example months or years. AYCR in µm/yr can be compared to average speed over a given distance.
Imperial units use mpy (mil penetration per year: 1 mil = inch/1000). 1 mpy = 25.4 µm/yr

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What do standards and guidelines say?

As also explained in the Risycor Application Guideline, occasional spikes in corrosion rate (YCR) are usually not a problem. As far as we know, very little research has been done on corrosion rates in closed heating systems. This is possibly due to the fact that until now there has never been a practical, economical and accurate measuring method. Based on the extensive experience gained with thousands of Risycors in real installations, RESUS currently use:

Average Yearly Corrosion Rate (AYCR)		
< 7 µm/yr	**7 - 21 µm/yr**	**> 21 µm/yr**
Risk of Corrosion Damage		
Low	Medium	High
Result in the long term		
little chance of corrosion damage	corrosion damage probable	serious chance of corrosion failure

Worst case scenario

In the most unfavourable case, a Risycor would measure just below the 24µm/year default alarm threshold so that in 1 year there will be 23µm (0.023 mm) of iron converted into corrosion sludge. Given the usual wall thickness's in heating systems is several mm, this can't possibly be called serious damage. However, the problem is the sludge formation that results from the corrosion process. It is impossible to estimate how much sludge can be formed, because the complex relationship between oxygen entry in the installation water, corrosion rate, corrosion pressure and available corrodible steel surface is different for each installation.

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