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11.09.2015

Examination of copper plumbing tubes

Your reference: Propex, Kiev

Our reference: WZL

Dear Sirs,

finally we completed the examination and may report as following:

Sample identification:

The concerned three samples are copper, dimension 15x1 and having a length of 25, 108 and 17 cm. The items are being identified as copper plumbing tubes in soft temper. The sample with 108 cm length is showing the producer marking WIELAND. An copper T-fitting was connected to one the tube by means of soft soldering.

Installation conditions:

Unknown.

Optical analysis:

To examine the sample, we firstly split it into two half shells.

Vorstand:
Harald Kroener, Vorsitzender
Werner T. Traa
Dr. Ulrich Hartmann

Vorsitzender des Aufsichtsrats:
Fritz-Jürgen Heckmann
Sitz der Gesellschaft: Ulm
Registergericht Ulm, HRB 1256
St.-Nr. 88004/76900
Ust-IdNr.: DE811147730

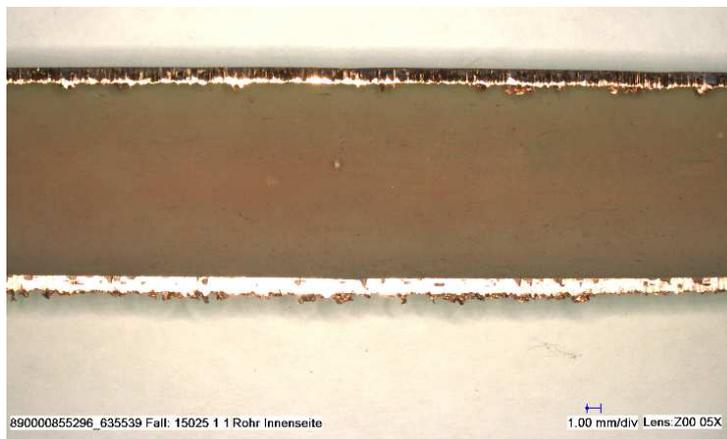
The external surface of the samples is showing a thick dark-brown oxide layer and several areas with severe, locally concentrated corrosion attack.

External surface:



The inside of the tube is showing a regular, homogenous dark brown coloured surface. The internal surface is undamaged and corresponds to the natural oxide layer being formed during use.

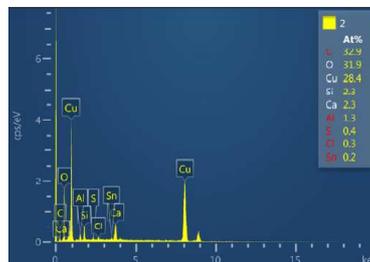
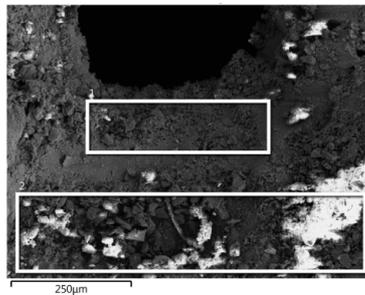
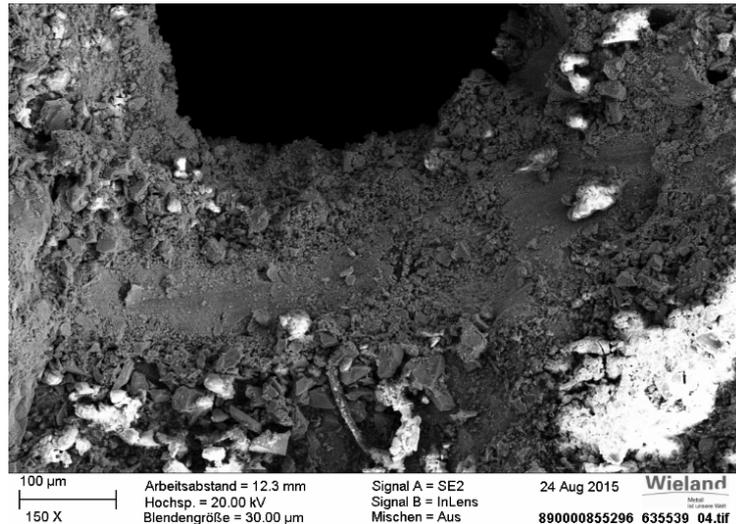
Internal surface:



The penetration started on the outside surface of the tube and penetrated the whole wall.

Chemical analysis and classification:

According to scientific literature, such a phenomenon has to be classified as external corrosion. The areas with severe corrosion attack were examined as well by means of SEM to trace back elements on the surface:



Due to the absence of sufficient quantities of corrosion products on the outside surface, it was not possible to trace back additional information about chemical influences or the trigger for the external corrosion.

Mechanical reasons did not influence the corrosion attack.

Conclusions:

A negative effect of the soldering method cannot be stated because the soldering zone does not show the same effect.

We were able to establish that the tubing complied with the standard requirements in its as-supplied condition and that failure had therefore occurred for reasons beyond our control as manufacturer.

If installed in areas with aggressive atmosphere or together with building products that may contain aggressive substances we would recommend to use coated copper tube to prevent such type of damage. This is especially important when installed in floors or ceilings.

Yours sincerely,

Wieland-Werke AG
Tube Division
Application Technology

i.V.

i.A.

P.S. : The tube samples provided have partly been used during the examination. Unless otherwise instructed, the samples will be scrapped at the end of three months.