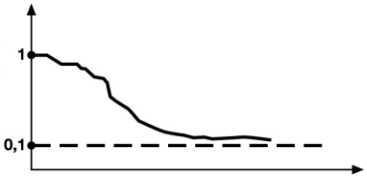
MODERN SURFACE FINISH TREATMENT FOR STAINLESS STEEL HEAT TRANSFER TUBING

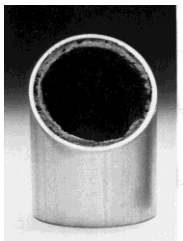
Heat exchangers have the function to convey heat energy from the medium surrounding the tube into the medium flowing inside the tube - or the other way around. The tube material of heat exchangers in the chemical, food, pulp and paper industry consists of seamless or high quality longitudinally welded stainless steel tubes in the alloy qualities EN 1.4301 (AISI304), EN 1.4404/1.4435 (AISI316L), EN 1.4571 (AISI316Ti), EN 1.4539 (904L) or similar.

Analysis of practical occurrences reveal that the determining factor for the unfavourable development of heat energy conveyance mainly lies in the increasing reduction of the heat penetration value k, which essentially influences the output of the heat exchanger system.

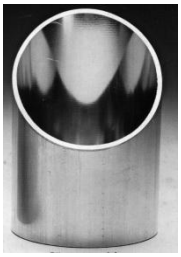


Reduction of heat penetration value k in a standard tube (mb / ground / pickled) with increasing operating time t

Tests confirm that the heat penetration value k drops drastically after only a few operating hours in conventionally treated stainless steel inner surfaces (e.g. cold drawn, annealed and chemically pickled, mechanically ground, welding seam refinished, etc.). It is not unusual, depending on the flowing medium, to find reductions in the heat penetration value k down to a tenth of the initial value.



Standard tube (mb / ground / pickled) after operating time t = 80 h in an evaporator for waste pulp liquor



HE-110®-electro-polished tube (removal rate 15 µm, surface roughness Ra = 0,20 µm / lt = 4,8 mm)

As a reason for this effect, it has been recognised that a constantly growing coating forms itself on the metal surface inside the tube as operating time progresses, consisting of deposited, mostly crystallized particles of the flowing medium (incrustation), which is obviously directly responsible for the reduction in the heat penetration value k.

In most cases there is a tendency that some tubes become fully incrusted during further operating time and that other tubes at least form a considerable coating (contractions of cross section, heat insulation layers). Whilst the reduction in the heat penetration value k and the tube cross section surface can be compensated at the outset with regard to operating continuity by increasing energy expenditure (available heat and increase of surrounding temperature, pump capacity and increase of flow), complete incrustation leads to system idle times and expenditure on cleaning

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The component's value is assured by its surface

Rev. 31.07.2014

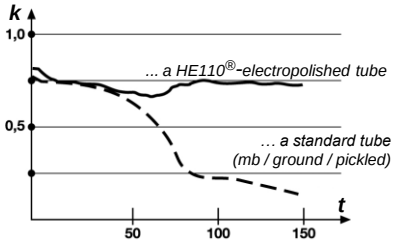
MODERN SURFACE FINISH TREATMENT FOR STAINLESS STEEL HEAT TRANSFER TUBING

Improvement of the tube surface condition by electropolishing according HENKEL-HE110

Analysis of the surfaces of a stainless steel tube which has been mechanically finished by grinding or polishing or post-treated by chemical pickling has shown that conditions are relatively poor from both geometrical and energetic points of view.

The topography of the surface resembles a sharp-edged or jagged mountain landscape. This structure encourages the anchoring of foreign particles and which further results in the formation of a coating layer on the stainless steel surface.Example of tube incrustation on a tube plate: the two incrustation-free tubes are HE110®-electropolished test tubes

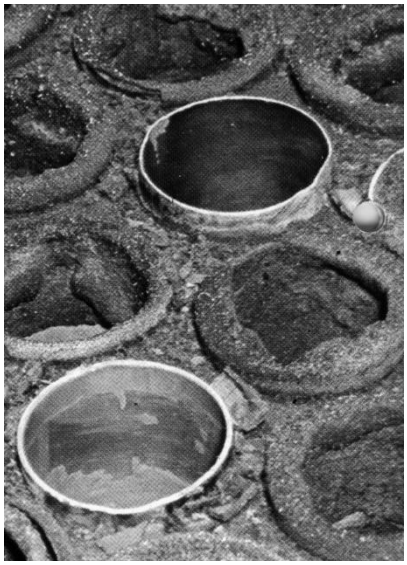
Reduction of heat penetration value k with increasing operating time t in ...



Trials subjecting HE110®-electropolished stainless steel surfaces which come into contact with media have been positive without exception. In microscopic observation (magnification times 500…3000) the topography of the surfaces (roughness Ra and Rz) proves to be ideally rounded and leveled. The mechanically damaged layer of material is removed which reduces the energy level of the surface to a minimum. The previously relatively active stainless steel surface now proves to be completely passive and shows an essentially reduced inclination to adhesion of foreign matter (from a structural as well as energetic point of view).

The practical results of HE110®-electropolishing and conditioning of stainless steel surfaces correspond to the expected theoretical consequences. There is an obvious relationship between the surface condition (level of energy and surface roughness) and the behaviour of the heat penetration value k during operating time and the formation of the coating. Due to the fact that foreign matter coating can be avoided the growth of layer is not expected, in special cases in very weak form only.

The tests have shown throughout that HE110®-electropolished stainless steel surfaces prevent, or at least strongly obstruct the formation of coatings, and therefore enable the achievement of significant savings in production costs.



Example of tube incrustation on a tube plate: the two incrustation-free tubes are HE110-electropolished test tubes

For more informationen please visit
www.henkel-epol.com

Please contact us
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SYSTEM CERTIFICATION
ISO
9001 | 14001

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