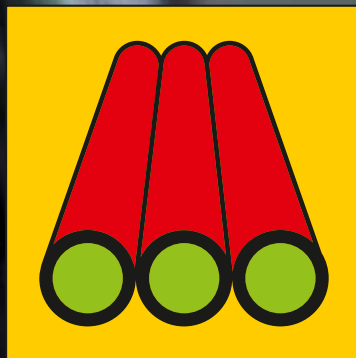


## **STAINLESS, SEAMLESS TUBES FOR HIGH PRESSURE RAILS AND PIPES**

The bright difference



# TPS QUALITY - PRECISE AND DIMENSIONALLY ACCURATE

Our future-oriented quality policy is in full compliance with a best possible customer satisfaction.

This can be achieved through optimised prices, best quality, best service, high flexibility and constant reliability.

TPS tubes are used world-wide in numerous industrial applications such as in refineries, petrochemical and

chemical plants, in the semi-conductor industry for the transportation of clean gas and, for instance, as oxygen supply pipes in hospitals.

Particularly in the Automotive industry, where very high demands on precision and dimensional accuracy are made, our TPS quality "Made in Germany" has been appreciated for years now.

Our highly sophisticated machinery and strict quality specifications and controls enable us to produce precise and dimensionally accurate tubes showing an excellent coaxiality.

This guarantees that the tubes can be processed without any difficulties!

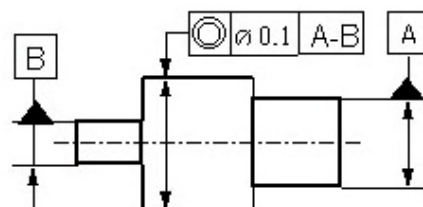
## Concentricity and coaxiality

The axis tolerance of the machined component must be within a cylinder with  $d=0.1$  mm which is coaxial to the reference axis A-B.



## Concentricity and coaxiality

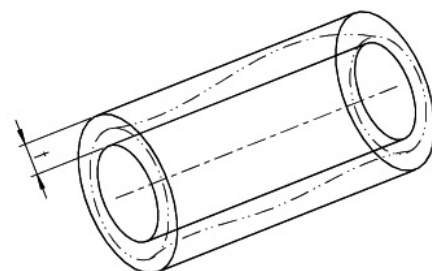
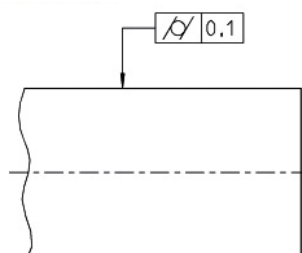
Example



## Cylindricity tolerance

The form tolerance „cylindricity“ refers to cylindrical shapes.

A cylinder with a cylindrical tolerance of value  $t$  must be completely in a tolerance range that is limited by two coaxial cylinders which have a distance  $t$ .



In this example, the lateral surface of the cylinder must be completely between two cylinders which have a distance of 0.1 mm.

## TPS QUALITY – THE BRIGHT DIFFERENCE

The formation of deposits firmly adhering to the tube surface is hindered by smooth, closed surfaces. Fissured surfaces promote the creation and the formation of those firmly adhering deposits as particles attach themselves more easily. Once deposit was formed, highly concentrated and aggressive corrosion centres can occur in and under the coat. In the short-run, this will lead to the destruction of the passive layer and consequently to the local destruction of the material.

Add to this a bad rinsing effect in connection with a fissured tube surface and deposits form within a short time. Deposits on the inside tube surface automatically lead to a restriction of the cross section and even to a complete blocking of the tube.

In order to obtain an optimal, smooth surface, TPS has developed a special **bright annealing process** which does not require the use of acids or lye.

The annealing process is performed in a closed furnace system. During the entire heat treatment process, the material

to be annealed is protected by inert gas. This guarantees that no atmospheric oxygen is present in the furnace system and prevents the creation of oxide scale or tarnish on the material to be annealed.

Compared to pickled or ground surfaces, the tendency to the creation of deposit is considerably lower when it comes to bright annealed, undamaged tube surfaces.



### THE ADVANTAGES

- No weld seam
- Excellent solderability and therefore optimal suitability for fuel rails
- Bright annealed surface reduces the creation of deposits
- Precise and dimensionally accurate
- Excellent coaxiality
- Reliable and dimensionally stable even with extreme loading and high pressures
- Processing without any difficulties
- Customized prefabrication and best suitability for boring, punching and machining.

## THE COMPARISON

The bright annealing equipment is only available to a few manufacturers in sufficient capacity.

This is why some manufacturers often use the term "solution annealed, scale-free" instead of "bright annealed". This gives the impression of a scale-free surface which, however, does not

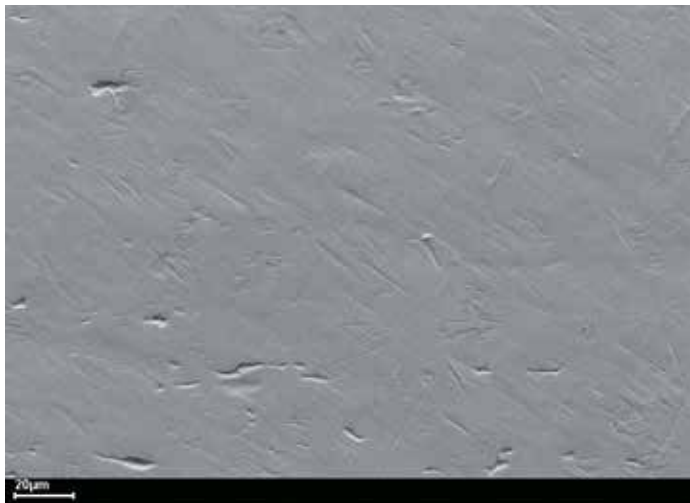
necessarily have to correspond to a reflecting, bright annealed surface.

Instead, many manufacturers descale the tube surface through a pickling process after the heat treatment. This surface promotes the creation of firmly adhering scaling.

The difference to our TPS quality can be demonstrated via a scanning electron microscope.



### TPS QUALITY ROLL POLISHED, BRIGHT ANNEALED



roll polished  
Roughness Ra max. 0.8 µm  
500-fold magnification

### QUALITY OF STANDARD TUBES ANNEALED, CHEMICALLY DESCALED, PICKLED



pickled inside surface  
Roughness Ra. approx. 2.5 µm  
500-fold magnification



# INTERGRANULAR CORROSION ON STAINLESS STEEL TUBING FROM CHEAP IMPORTS

Not least due to the liberalisation of the global trade, the number of "cheap imports" of stainless steel tubing has grown.

At the same time, an increased occurrence of intergranular corrosion on a large percentage of these tubes was observed. This particularly concerns seamless tubes in smaller dimensions. Unfortunately, not every customer has the technical opportunity to detect this

type of corrosion on the tubes which should actually no longer occur according to our current quality standard.

A simple visual inspection of the outside tube surface is usually not sufficient as intergranular corrosion is mostly present on the inside tube surface. Thus, this type of corrosion can visually only be detected when cutting the tube longitudinally in half.

In this respect, there are in fact many "time bombs" ticking (also on the shelves) as - depending on the end use of the tubes - it might take months until the intergranular attack has progressed so far that the damage is visible and technical problems occur.

Hence, short-term cost savings through cheap imports can be negated due to necessary repairs and low durability.

## Annealed, pickled:

At first glance, hard to distinguish from the outside.

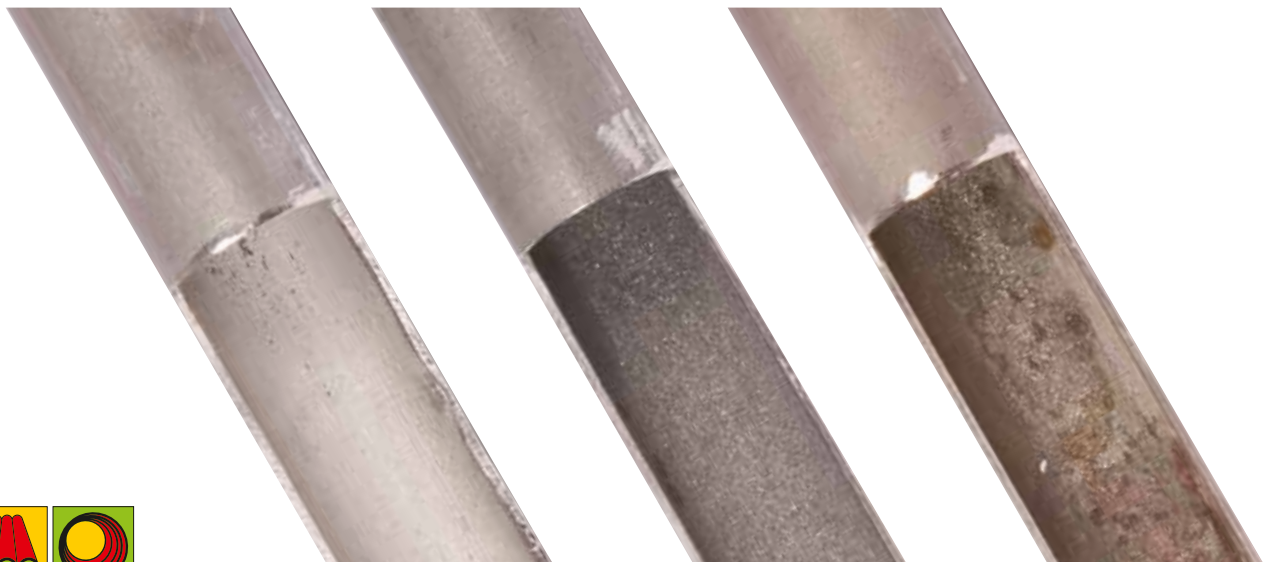


## The difference can be found inside:

inside: pickled

inside: IGC attack

inside: IGC attack, heavy corrosion







Headquarter



Project Office



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Mill 2

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