

## Why Haldenwanger ceramic tubes for temperature measurement?

1. Dimensional accuracy through extrusion – Why extrusion trumps cast tubes
2. Excellent high temperature properties – How this increases thermocouple service life
3. The right raw materials and processes – Or avoiding the vaporisation/embrittlement of noble metal wire
4. Fast lead times and custom manufacturing – Saving you money when it comes to storage and flexibility

**With more than 100 years of experience in the manufacture of ceramic tubes, Haldenwanger produces protecting tubes and insulating profiles from standardised materials such as Type C 799/Alsint 99.7, Type C 610/Pythagoras and Type C 530/Sillimantin 60 using extrusion in accordance with DIN 60672-1.**

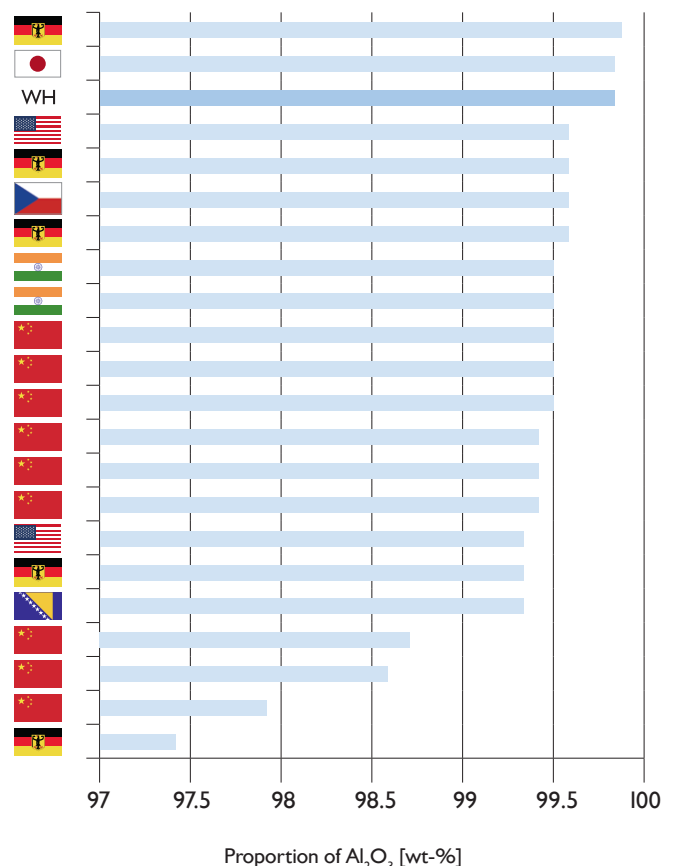
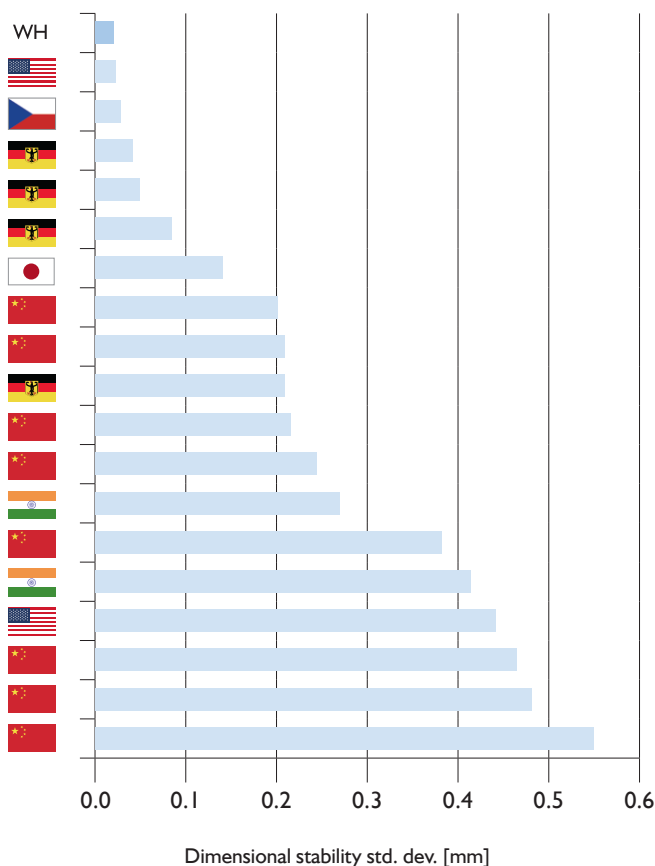
### Dimensional accuracy through extrusion

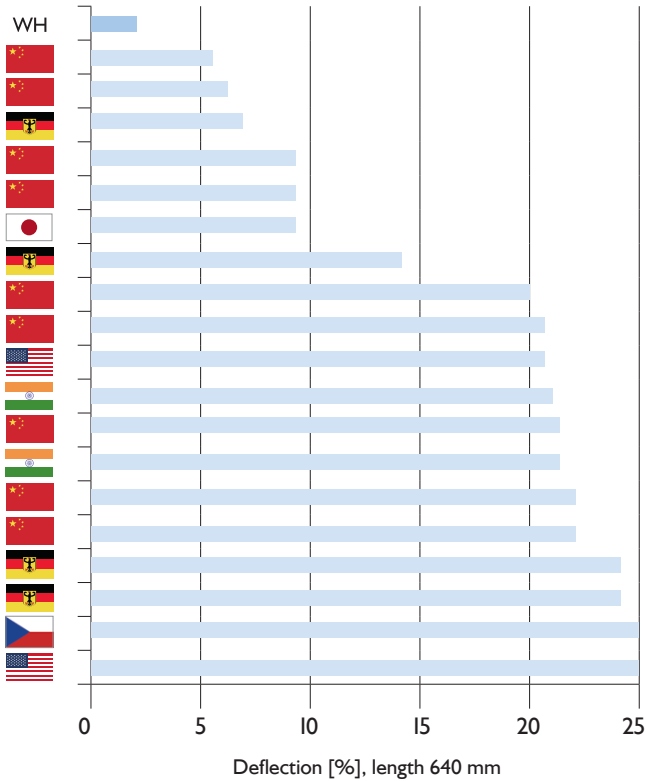
The extrusion method ensures even wall thickness and high tube concentricity, facilitating a combined protecting tube and insulating profile. Casting, an alternative production method, generates uneven wall thickness, which leads to thermal stresses in use. Production-related ovality and differences in wall thickness mean the insulating profile does not fit precisely within the protecting tube. With extrusion, you can be sure of getting the same tolerances within each batch, but also across different deliveries covering various production timeframes. Our tubes stand out thanks to the reproducible dimensional accuracy facilitated by the extrusion method and the associated reliability with which the protecting tube and insulating profile can be assembled. Using benchmarking analysis, the dimensional stability of Haldenwanger protecting tubes is compared with that of other tube manufacturers below.

Pores resulting from the casting method do not arise in extrusion moulding. The properties of a Haldenwanger extruded tube include dimensional accuracy, gas tightness, electrical insulation and dielectric strength.

### Excellent high temperature properties

Alsint 99.7 in particular boasts excellent resistance to high temperatures and refractoriness, while the smart microstructure design produces less creep deformation. In the case of tubes used for temperature measurement, we achieve this through our individual firing process with higher temperatures and a longer dwell time. The tables below explain the link between our highly purified  $Al_2O_3$  content, specially developed grain structure and resulting resistance to high temperatures in a comparison with that of other tube manufacturers.

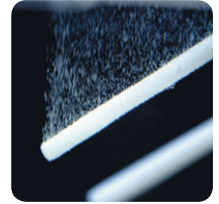
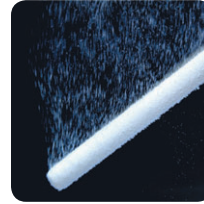
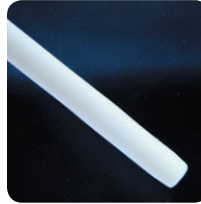




Our ceramic tubes are all 'Made in Germany'. Every one of our protecting tubes undergoes standardised leak-tightness checks. These can reliably detect leakage rates of up to  $10^{-2}$  cm<sup>3</sup>/min (corresponding to a bubble of  $\varnothing$  3 mm after 100 seconds of testing). The images below show a gas-tight Haldenwanger tube compared with a gas-permeable tube following long-term use in a leak-tightness test.

Haldenwanger tube

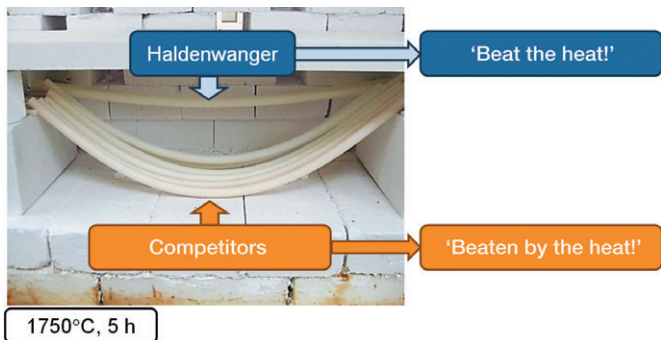
Competitor product



Our quality standards are ensured at all times as our Type C 530 to C 799 materials correspond to DIN norms. The tube labelling indicates the high quality features to customers and helps trace each individual tube.



This results in a long service life in high-temperature applications. The practical test at a temperature of 1,750°C and with an exposure time of five hours emphasises the quality on offer from Haldenwanger (see below).



### Fast lead times and custom manufacturing

Our warehouse stocks more than 7,600 tube products, which can be delivered to our customers in Germany within 24 hours and elsewhere in Europe within 48 hours. Thanks to our high production capacity, a lead time of max. eight weeks is needed for new products. This means we can guarantee you fast and reliable availability worldwide. Our Sales team would be pleased to assist you in many European languages and involve our In-House Technical Support team when needed. Of course, our processing centre can also prepare individual, custom dimensions for you.

### The right raw materials and processes facilitate reliable temperature measurement and a long service life

Due to its high aluminium oxide content, Alsint 99.7 demonstrates very good chemical resistance in corrosive atmospheres. Even after the thermocouple has been used for years at high temperatures, the noble metal wires are still well protected from contamination and embrittlement. The long-term availability of the temperature sensor is unparalleled. The positive material properties also ensure the long-term and accurate stability of the voltage reading between the thermocouple wires, essential to precise, reproducible temperature measurement.

