

# Temperature Uniformity and System Accuracy

Temperature uniformity is defined as the maximum temperature deviation in the useful space of the furnace. There is a general difference between the furnace chamber and the useful space. The furnace chamber is the total volume available in the furnace. The useful space is smaller than the furnace chamber and describes the volume which can be used for charging.

## Specification of Temperature Uniformity in $\Delta K$ in the Standard Furnace

In the standard design the temperature uniformity is specified as the relative, maximum deviation from a defined reference temperature within the useful space in the empty furnace at dwell time. Temperature uniformity is defined as  $\Delta T$  in K. If, for example, a standard temperature uniformity of  $\Delta T$  10 K at 750 °C is specified, it means that the actual temperature in the furnace can vary between 740 °C and 750 °C or between 750 °C and 760 °C.

## Specification of the Temperature Uniformity in +/- °C as Additional Feature

If an absolute temperature uniformity at a reference temperature or at a defined reference temperature range is required, the furnace must be calibrated appropriately. If, for example, a temperature uniformity of +/- 5 °C at a set temperature of 750 °C is required, it means that measured temperatures may range from a minimum of 745 °C to a maximum of 755 °C in the useful space.

## System Accuracy

Tolerances may occur not only in the useful space, they also exist with respect to the thermocouple and in the controls. If an absolute temperature uniformity in +/- °C at a defined set temperature or within a defined reference temperature range is required, the following measures have to be taken:

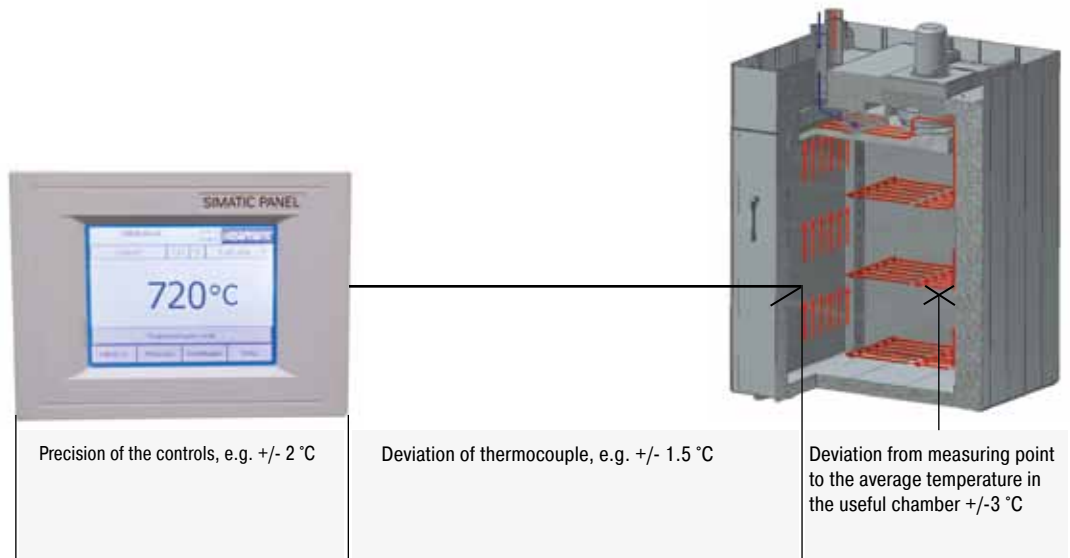
- Measurement of total temperature deviation of the measurement line from the controls to the thermocouple
- Measurement of temperature uniformity within the useful space at the reference temperature or within the reference temperature range
- If necessary, an offset is set at the controls to adjust the displayed temperature at the controller to the real temperature in the furnace
- Documentation of the measurement results in a protocol

## Temperature Uniformity in the Useful Space incl. Protocol

In standard furnaces a temperature uniformity is guaranteed as  $\Delta T$  without measurement of temperature uniformity. However, as additional feature, a temperature uniformity measurement at a reference temperature in the useful space compliant with DIN 17052-1 can be ordered. Depending on the furnace model, a holding frame which is equivalent in size to the charge space is inserted into the furnace. This frame holds thermocouples at 11 defined measurement positions. The measurement of the temperature uniformity is performed at a reference temperature specified by the customer at a pre-defined dwell time. If necessary, different reference temperatures or a defined reference working temperature range can also be calibrated.



Holding frame for measurement of temperature uniformity



The system accuracy is defined by adding the tolerances of the controls, the thermocouple and the useful space