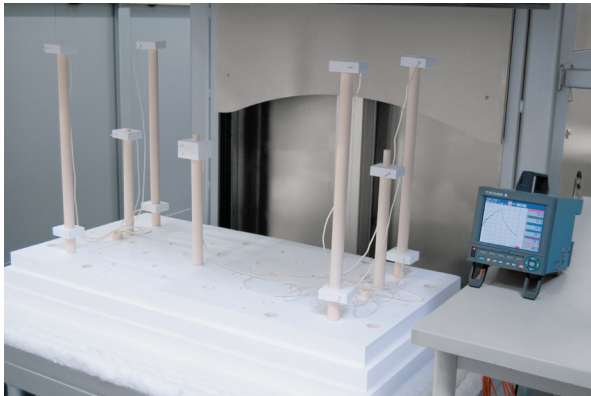


AMS2750F, NADCAP, CQI-9

Standards such as the AMS2750F (Aerospace Material Specifications) are applicable for the industrial processing of high-quality materials. They define industry-specific requirements for heat treatment. Today, the AMS2750F and derivative standards such as AMS2770 for the heat treatment of aluminum are the guidelines for the aerospace industry. After the introduction of the CQI-9, the automotive industry has also committed to submit heat treatment processes to stricter rules. These standards describe in detail the requirements applicable to thermal processing plants.



Measurement set-up in a high-temperature furnace

- Temperature uniformity in the work space (TUS)
- Instrumentation (definition of measurement and control systems)
- Calibration of the measurement system (IT) from the controller via the measurement line to the thermocouple
- Inspections of system accuracy (SAT)
- Documentation of the inspection cycles

Norm compliance is necessary to ensure that the required quality standard of the manufactured components can also be reproduced in series. For this reason, extensive and repeated inspections as well as controls of the instrumentation, including the relevant documentation, are required.

Furnace Class and Instrumentation Requirements of the AMS2750F

Depending on the quality requirements of heat treatment job the customer specifies instrumentation type and the temperature uniformity class. The instrumentation type describes the necessary combination of the applied control, recording media as well as thermocouples. The temperature uniformity of the furnace and the class of the selected instrumentation are defined based on the required furnace class. The higher the requirements are set for the furnace class the more precise the instrumentation must be.

Regular Inspections

The furnace or the heat treatment plant must be designed so that the requirements of the AMS2750F can be met and be reproduced. The standard also requires the inspection intervals for the instrumentation (SAT = System Accuracy Test) and the temperature uniformity of the furnace (TUS = Temperature Uniformity Survey). The SAT/TUS tests must be performed by the customer with measuring devices and sensors which operate independently of the furnace instrumentation.

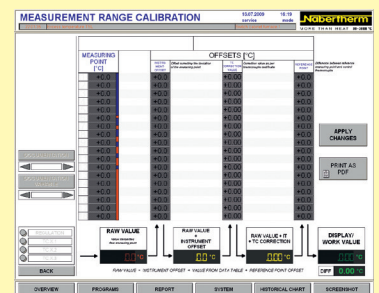
Instrumentation	Type						Furnace class	Temperature uniformity	
	A	B	C	D+	D	E		°C	°F
Each control zone has a thermocouple connected to the controller	x	x	x	x	x	x	1	+/- 3	+/- 5
Recording of the temperature measured by the control thermocouple	x	x	x	x	x		2	+/- 6	+/- 10
Sensors for recording the coldest and hottest spots	x		x				3	+/- 8	+/- 15
Each control zone has a charge thermocouple with recording system	x	x					4	+/- 10	+/- 20
One additional recording sensor, distance ≥ 76 mm to control sensor, of a different sensor type				x			5	+/- 14	+/- 25
Each control zone has an over-temperature protection unit	x	x	x	x	x		6	+/- 28	+/- 50



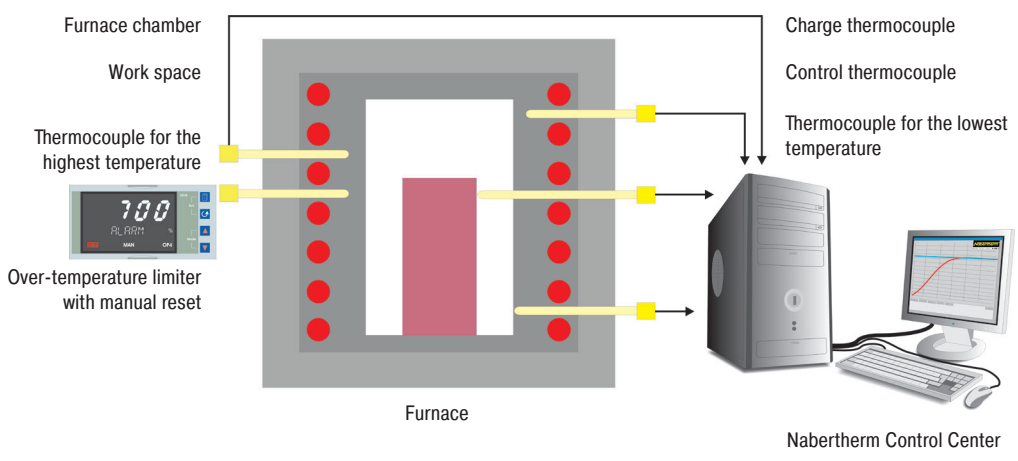
Measurement set-up in an annealing furnace



Measuring protocol



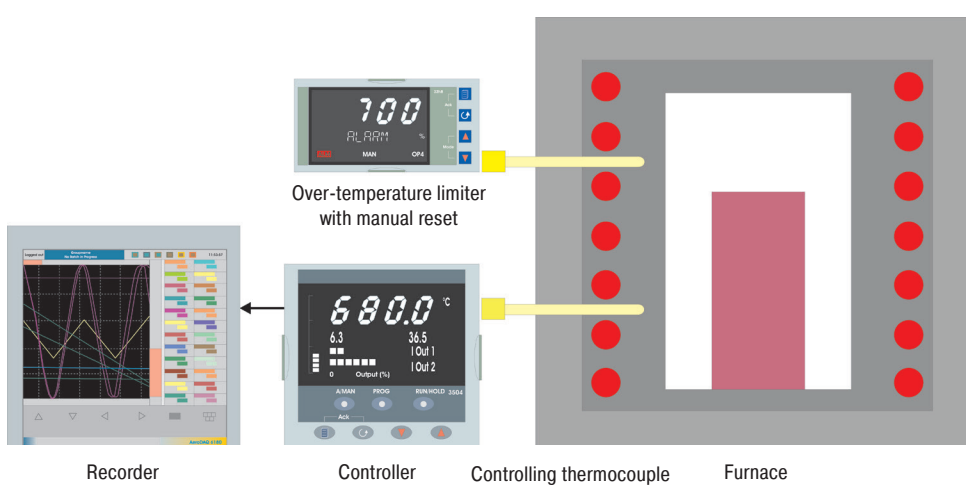
Measurement range calibration



Example of a design with Type A Nabertherm Control Center

Alternative Instrumentation with Temperature Controllers and Recorders from Eurotherm

As an alternative to instrumentation with the Nabertherm Control Center (NCC) and PLC controls, instrumentation with controllers and temperature recorders is also available. The temperature recorder has a log function that must be configured manually. The data can be saved to a USB stick and be evaluated, formatted, and printed on a separate PC. Besides the temperature recorder, which is integrated into the standard instrumentation, a separate recorder for the TUS measurements is needed (see page 12).



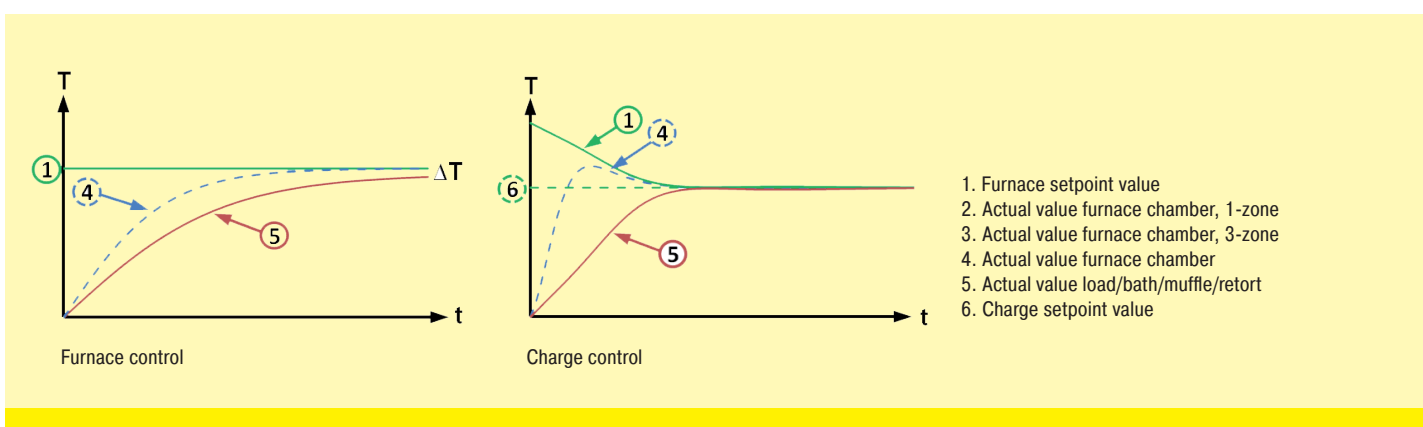
Example of a design containing Type D Eurotherm instrumentation

Furnace Chamber Control

Only the furnace chamber temperature is measured and controlled. Regulation is carried out slowly to avoid out-of-range values. As the charge temperature is not measured and controlled, it may vary a few degrees from the chamber temperature.

Charge Control

If the charge control is switched on, both the charge temperature and furnace chamber temperature are measured. By setting different parameters the heat-up and cooling processes can be individually adapted. This results in a more precise temperature control at the charge.



1. Furnace setpoint value
2. Actual value furnace chamber, 1-zone
3. Actual value furnace chamber, 3-zone
4. Actual value furnace chamber
5. Actual value load/bath/muffle/retort
6. Charge setpoint value