

## AMS 2750 D, NADCAP, CQI-9

Standards such as the AMS 2750 D (Aerospace Material Specifications) are applicable for the industrial processing of high-quality materials. They define industry-specific requirements for heat treatment. Today, the AMS 2750 D and derivative standards such as AMS 2770 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.

- Temperature uniformity in the charge 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 AMS 2750 D

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.

Instrumentation	Type					Furnace class	Temperature uniformity	
	A	B	C	D	E		°C	°F
Each control zone has a thermocouple connected to the controller	x	x	x	x	x	1	+/- 3	+/- 5
Recording of the temperature measured by the control thermocouple	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
Each control zone has an over-temperature protection unit	x	x	x	x		5	+/- 14	+/- 25
						6	+/- 24	+/- 50



Measurement set-up in a high-temperature furnace



Measurement set-up in an annealing furnace

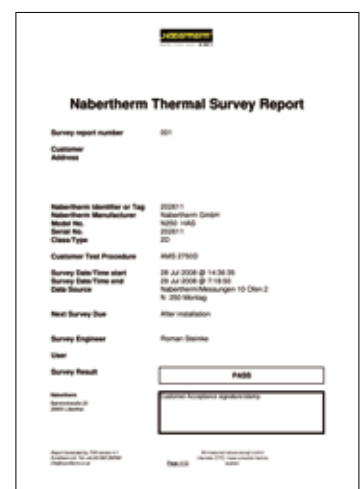
### Regular Inspections

The furnace or the heat treatment system must be designed so that the requirements of the AMS 2750 D 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.

### Nabertherm Services

The suitable furnace model for the corresponding heat treatment can be designed based on the process, the charge, the required furnace class and the type of instrumentation. Depending on the required specs, alternative solutions can be offered.

- Furnace designs, which meet standards, following customer specifications regarding furnace class and instrumentation, incl. gauge connections for repeated customer inspections at regular intervals. No consideration of requirements with respect to documentation
- Data recording devices (e.g., temperature recorder) for TUS and/or SAT measurements see page 68
- Data recording, visualization, time management via the Nabertherm Control Center (NCC), based on Siemens WinCC software see page 60
- Commissioning at site, incl. the first TUS and SAT inspection
- Connection of existing furnace systems to meet norm requirements
- Documentation of the complete process chain in line with the corresponding norm



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## Implementation of AMS 2750 D

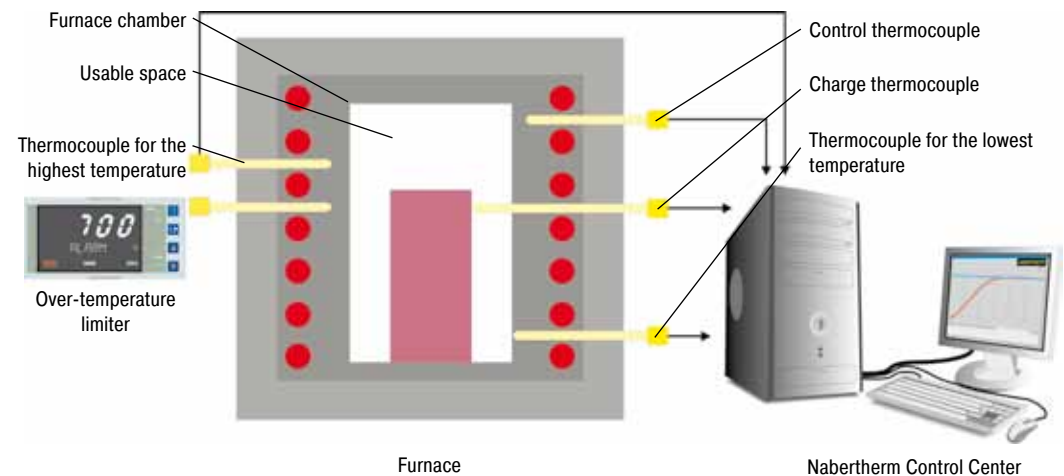
Basically, two different systems are available for control and documentation, a proven Nabertherm system solution or instrumentation using Eurotherm controllers/temperature recorders. The Nabertherm AMS package is a convenient solution that includes the Nabertherm Control Center for control, visualization, and documentation of the processes and test requirements based on PLC control.

## Instrumentation with Nabertherm Control Center (NCC) for Control, Visualization, and Documentation based on a Siemens PLC Controls

The attractive feature of the instrumentation with Nabertherm Control Center in combination with PLC controls of the furnace is the convenient data input and visualization. The software programming is structured in a way that both the user and the auditor can navigate it without difficulty.

In daily use, the following product characteristics stand out:

- Very easy to navigate and straight-forward presentation of all the data in plain text on the PC
- Automatic saving of the charge documentation at the end of the program
- Administration of the calibration cycles in the NCC
- Results of the measurement distance calibration are entered in the NCC
- Schedule management of the required testing cycles including a reminder function. The testing cycles for TUS (Temperature Uniformity Survey) and SAT (System Accuracy Test) are entered in days and monitored by the system and the operator or tester is informed in time about up-coming tests. The values of the tests are entered directly into NCC and saved as PDF files on the PC. There are no additional tasks involved in documenting the tests.
- Option of transferring the measurement data to a customer's server



Example of a design with Type A Nabertherm Control Center



The Nabertherm Control Center can be extended to enable a complete documentation of the heat treatment process apart from just the furnace data. For example, when heat-treating aluminum, in addition to the furnace, the temperatures in the quenching basin or a separate cooling medium can also be documented.

**Instrumentation for TUS Measurements as a Separate Model**

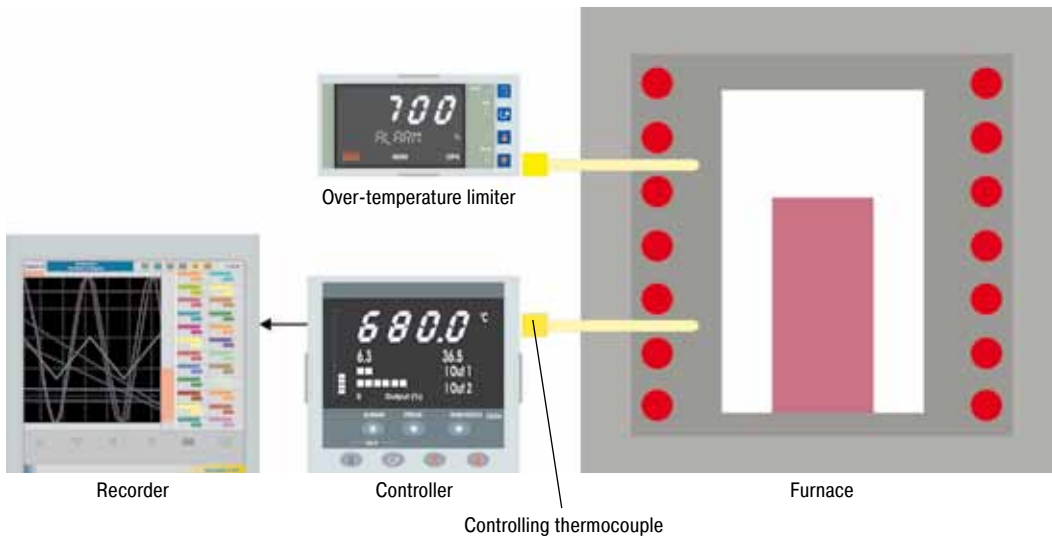
The TUS standard requires that the temperature uniformity of the furnace be tested with a TUS measurement at regular intervals. This measurement must be performed by an independent measurement system and not by the instrumentation used for process control. The testing intervals are filed in the NCC in days. The system reminds in time that a test must be performed.

This test can be performed either using an independent temperature recorder (see page 64) with the customer's calibrated testing thermocouples or using the Nabertherm TUS module that is connected to the Nabertherm Control Center as a separate module.

The TUS module has its own PLC which converts the measurement results of the testing thermocouples. The evaluation, including an easy-to-navigate and simply log function, is then performed via the furnace's Nabertherm Control Center.



TUS module with ports for 16 thermocouples and PROFIBUS connection to the Nabertherm Control Center



Example of a design containing Type D Eurotherm instrumentation

**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 64).



N 12012/26 HAS1 according to AMS 2750 D