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Aerospace series – Metallic materials – Heat treatment facilities – General requirements

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EUROPEAN STANDARD

EN 4268

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2012

ICS 25.200; 49.025.05; 49.025.15

English Version

Aerospace series - Metallic materials - Heat treatment facilities - General requirements

Série aérospatiale - Matériaux métalliques - Installations de
traitement thermique - Exigences générales

Luft- und Raumfahrt - Metallische Werkstoffe -
Wärmebehandlungsanlagen - Allgemeine Anforderungen

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Foreword

This document (EN 4268:2012) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.

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SS-EN 4268:2012 (E)

1 Scope

This European Standard covers the general requirements for heat treatment facilities processing semi-finished products and parts in metallic aerospace materials.

It defines the terms used herein and describes the test procedures and requirements for mandatory tests of heat treatment facilities. It also serves as an aid in the surveillance and approval of heat treatment facilities.

This standard applies to all types of heat treatment facilities, including those using direct or indirect heat transfer and liquid or gaseous heating media, with or without circulation, and to vacuum furnaces.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60584-2, *Thermocouples — Part 2: Tolerances* ¹⁾

3 General

The heat treatment of metallic materials produces specific material properties only if performed within relatively narrow temperature ranges, the respective tolerances of which are specified in the applicable standards. A heat treatment facility can therefore be used for a heat-treating operation only provided its temperature variations over space and time remain within the specified temperature tolerance.

Proper temperature distribution in the heat treatment facility depends on e.g. the type of furnace or bath, the heating medium, the control instruments with their feedback and run-up circuitry, and the rigging and positioning of control sensors.

A suitable recording instrument is needed to properly monitor and document the heat treatment.

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1 temperature uniformity
measure of the temperature variation at various points in the effective working volume after thermal equilibrium has been reached

4.2 effective working volume
for the purposes of the present standard, the effective working volume is the working zone of the heat treatment facility in which temperatures run within the specified maximum temperature variation and which is available for the intended heat treatment

1) Published by International Commission Electrotechnique Internationale <http://www.iec.ch/> (CENELEC EN 60584-2).

4.3

maximum temperature variation

maximum temperature variation indicates how much the temperatures at different points in the effective working volume are allowed to vary from the working temperature after thermal equilibrium has been reached

4.4

category classification

depending on their technical characteristics, heat treatment furnaces or baths are classified into 4 categories A, B, C, D of different maximum temperature variation (see Table 1)

4.5

thermal equilibrium

thermal equilibrium is reached when following the temperature rise phase no validly recorded temperature varies by more than 20 % of the maximum allowable temperature variation in the effective working volume for the duration of one closed-loop oscillation

4.6

temperature setting

feature permitting analog or digital reproducible selection of the facility temperature set-point

4.7

correction factor

this is the correction applied to the set-point to achieve the specified working temperature

4.8

working temperature

temperature to which the heat treatment facility is brought for a certain heat treatment

4.9

working temperature range

range extending from the lowest to the highest working temperature at which the heat treatment facility is to be operated

Note 1 to entry: A code number identifies the maximum allowable working temperature.

4.10

test temperature

agreed temperature at which the reference measurement is to be made or the temperature uniformity to be demonstrated

4.11

temperature sensors

temperature-sensing elements for the various measuring, control and recording functions

4.12

recording sensor

temperature-sensing element of a chain of validly indicating and recording instruments

4.13

approval

for the purposes of the present standard, approval is the formal release of a facility for production heat treatment

Note 1 to entry: It is granted if compliance with the requirements of the present standard has been demonstrated by acceptance testing.

5 Heat treatment facility requirements

5.1 General

Heat treatment facilities shall be capable of satisfying the requirements of the heat treatment process to be applied.

Heat treatment facilities as defined in Clause 1 shall be approved prior to their release for production heat treatment and shall be subjected to periodic in-service checks. Approval and periodic checks shall be performed by the responsible company quality assurance, facilities support and calibration activities.

Approval and periodic checks shall be in conformance with the requirements of Clause 6.

In the case of safety tests, the competent specialist department shall be consulted. The test results shall be reported by the competent specialist department and filed with the heat treatment facility records.

5.2 Category classification

A heat treatment facility may fall within several categories if designed to operate in different working temperature ranges.

Table 1 — Maximum permissible temperature variation of effective working volume

Code number	Working temperature range °C	Maximum permissible temperature variation °C			
		Category			
		A	B	C	D
03	$\theta \leq 300$	$\pm 7,5$	± 5	± 3	—
07	$300 < \theta \leq 700$	± 10	$\pm 7,5$	± 5	—
10	$700 < \theta \leq 1\ 000$	± 15	± 10	$\pm 7,5$	± 5
13	$1\ 000 < \theta \leq 1\ 300$	± 20	± 15	± 10	± 5

Where a working temperature range of a facility is less than the maximum value given in Table 1, the corresponding code number shall be indicated in the designation as outlined in 5.6.

5.3 Heating media

Heating media shall be selected so as to avoid changes in the material surfaces during the heat treatment operation affecting the operational properties of the parts, unless such changes are allowed or specified in the material standards or design documents. Heating media, especially salts used in heat treatment baths, are liable to change with consumption or due to external influences.

5.4 Quenching equipment and quenchants

The quenching equipment shall be located close enough to the heat treatment facility to permit quenching in accordance with the relevant specifications.

For quenchants, use is made of water, oil, industrial gases, emulsions, air, etc., to achieve the cooling profile needed to develop the required material properties.

5.5 Temperature sensors

5.5.1 General

The temperature sensors for control and recording functions shall operate independently of each other.

The recording sensors shall be located in the effective working volume of the heat treatment facility or shall be positioned at locations representative of the effective working volume.

5.5.2 Temperature sensor accuracy (M)

The accuracy of temperature sensors shall be within the limit deviations as specified in IEC 584-2. The tolerance includes the compensating leads.

The thermocouple tolerance classes are shown in Table 2 versus the various facility categories.

Table 2 — Applicable tolerance classes of temperature sensor (M) in accordance with IEC 60584-2

Code number	Working temperature range °C	Category			
		A	B	C	D
03	$\theta \leq 300$	M = Class 2	M = Class 1	M = Class 1	M = Class 1
07	$300 < \theta \leq 700$				
10	$700 < \theta \leq 1\ 000$				
13	$1\ 000 < \theta \leq 1\ 300$				

5.5.3 Number and distribution of recording sensors

The number of temperature sensors to be used in the effective working volume generally depends on the design and construction of the particular heat treatment facility involved.

The number and distribution of the temperature sensors shall be selected so as to suit the particular facility such that the temperature reading represents an authoritative value for the respective zone monitored (total effective working volume or portion thereof).

The number of recording sensors given in Table 3 is indicated for reference only.