SLOVENSKI STANDARD
SIST CR ISO 17663:2001

01-december-2001

Varjenje - Smernice za kakovostne zahteve za toplotno obdelavo v povezavi z varjenjem in sorodnimi postopki (ISO/TR 17663:2001)

Welding - Guidelines for quality requirements for heat treatment in connection with welding and allied processed (ISO/TR 17663:2001)

Schweißen - Richtlinien für Qualitätsanforderungen zur Wärmebehandlung beim Schweißen und bei verwandten Prozessen (ISO/TR 17663:2001)

Soudage - Lignes directrices concernant les exigences de qualité relatives au traitement thermique en soudage et techniques connexes (ISO/TR 17663:2001)

Ta slovenski standard je istoveten z: **CR ISO 17663:2001**

ICS:

25.160.10 Varilni postopki in varjenje Welding processes

SIST CR ISO 17663:2001 **en**

CEN REPORT

RAPPORT CEN

CEN BERICHT

CR ISO 17663

March 2001

ICS

English version

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This CEN Report was approved by CEN on 30 June 1999. It has been drawn up by the Technical Committee CEN/TC 121.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. CR ISO 17663:2001 E

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Foreword

This Technical Report has been prepared by the Technical Committee CEN/TC 121 "Welding", of which the Secretariat is held by DS, in collaboration with the Technical Committee ISO/TC 44 "Welding and allied processes".

The Technical Committee decided to publish this Technical Report.

1 Scope

This Technical Report proposes quality requirements for heat treatment in air or controlled atmospheres carried out in workshops and on site in connection with welding and forming. It applies mainly to ferritic steels, but may be used for other materials, as appropriate.

The purpose of this report is to form as a guidance for manufacturers which perform heat treatment or produce heat treated products or components. This report may also be used as a basis for assessing the manufacturer in respect to its heat treatment capability.

The requirements contained within this report may be adopted in full or may be selectively deleted by the manufacturer if not applicable to the construction concerned. They provide a flexible framework for the control of heat treatment in the following cases:

– Case 1

To provide specific requirements for heat treatment in contracts which require the manufacturer to have a quality system in accordance with EN ISO 9001 or EN ISO 9002.

– Case 2

To provide specific requirements for heat treatment in contracts which require the manufacturer to have a quality system other than EN ISO 9001 or EN ISO 9002.

– Case 3

To provide specific requirements for heat treatment as guidance to a manufacturer developing a quality system.

– Case 4

To provide specific requirements for post weld heat treatment when required by EN 729-2 or EN 729-3.

– Case 5

To provide specific requirements for references in application standards which uses heat treatment as part of its requirements or agreed in a contract between relevant parties.

2 Normative references

This Technical Report incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this Technical Report only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 729-2
Quality requirements for welding - Fusion welding of metallic materials - Part 2: Comprehensive quality requirements

EN 729-3
Quality requirements for welding - Fusion welding of metallic materials - Part 3: Standard quality requirements

EN 10052
Vocabulary of heat treatment terms for ferrous products

EN ISO 13916
Welding - Guidance of the measurement of preheating temperature, interpass temperature and preheat maintenance temperature (ISO 13916:1996)

3 Terms and definitions

For the purposes of this Technical Report, the terms and definitions in accordance with EN 10052 and EN ISO 13916 apply.

In addition the following terms and definitions apply.

3.1
manufacturer
firm which performs heat treatment or produces heat treated products or components.

3.2
post weld heat treatment
heat treatment carried out after welding in order to decrease residual welding stress and/or change the micro structure.

3.3
post forming heat treatment
heat treatment carried out after forming in order to regain the original properties of the material or reduce stresses caused by the forming.

3.4
loading temperature
temperature of the furnace at the stage when the product or component is put into the furnace.

3.5
holding temperature
temperature range in which the product or component is kept in order to achive specified properties. The holding temperature depends on the type of heat treatment and material. Normally it is expressed as a temperature range.

3.6
holding time
time the product or component is kept in the holding temperature. The holding time starts when the temperature in all measuring points has reached minimum value of the range of the holding temperature and stops when one of the measuring points falls below that temperature.

The holding time depends on the type of heat treatment, material and material thickness.

3.7
unloading temperature
temperature of the product or component when it is taken out e.g. of a furnace or when any other heat treatment is finished.

4 Contract review

4.1 General

The manufacturer should review the contractual requirements and the design data. This is to ensure that all information necessary to carry out the heat treatment operations is available prior to the commencement of the work.

The manufacturer should affirm his capability to meet all heat treatment contract requirements and ensure adequate planning of all quality related activities. Contract review is carried out by the manufacturer to verify that the contract requirements are within his capability to perform, that sufficient resources are available to achieve delivery schedules and that documentation is clear and unambiguous. The manufacturer should ensure any variations between the contract and previous tender documentation are identified.

4.2 Contract review

The following items are typically considered at or before the time of the contract review. It should be ensured that all necessary information has been supplied by the purchaser.

a) the application standard to be used and appropriate drawings;

b) location and accessibility of the product or component to be heat treated;

c) type of marking of the product or component to be heat treated;

d) heat treatment specifications (appropriate heat treatment values) and inspection procedures for heat treatment;

e) the connection between heat treatment specifications and welding and/ or forming procedure specifications;

f) methods of heat treatment, e.g. which products or components are to be treated in a furnace and which products or components are subjected to local heat treatment;

g) competence of personnel;

h) suitability of equipment;

i) heat treatment documentation;

j) control and inspection arrangements;

k) quality requirements for the sub-contractor;

l) handling of non-conformances of heat treatment;

m) means of temperature measurement and recording;

n) quality requirements and testing of heat treatment, if any;

o) heat treatment in the time table for the progress of work;

p) availability of sufficient energy;

q) other special agreements, e.g. supporting of the product or component.

5 Sub-contracting

Any sub-contractor should work under the order and responsibility of the contractor and should fully comply with the relevant requirements of this report. The contractor should ensure that the sub-contractor can comply with the quality requirements of the contract.

Information to be provided by the contractor to the sub-contractor should include all relevant data from the contract review (see 4.2).

The contractor who orders heat treatment should supply all relevant specifications and requirements concerning these work to the sub-contractor. The sub-contractor should provide records and documentation of his work as may be specified by the contractor.

6 Personnel

The manufacturer should appoint a sufficient number of competent personnel for the planning, performing and supervising of the heat treatment work according to specified requirements.

The competence of personnel who will carry out heat treatment should be confirmed by the manufacturer.

7 Inspection and testing

7.1 General

The manufacturer should have at his disposal a sufficient number of competent personnel for planning and performing, inspection, testing and assessing of the heat treatment activities according to specified requirements.

7.2 Non-destructive testing

The final non-destructive testing should be carried out at the stage of heat treatment if specified in the application standard or otherwise after the final heat treatment.

7.3 Destructive testing

Destructive testing may be carried out if:

a) the application standard or contract requires;

b) for the product or component the heat treatment is extremely demanding.

The destructive testing can be carried out on separate test pieces if they are of the same material as the product and the work activities should be the same as was done during production.

8 Equipment for heat treatment

8.1 Equipment and measurement

Following equipment should be available when necessary:

a) furnace and/or heating equipment;

b) programmer for the heating process;

c) equipment for measuring and recording of temperature;

d) cooling equipment;

e) lifting and transport devices;

f) personnel protective equipment and other safety equipment;

8.2 Description of facilities

The manufacturer and/or sub-contractor should maintain a list of essential equipment, used for heat treatment. This list should identify items of major equipment, essential for an evaluation of workshop capacity and capability. This includes for example:

a) maximum load and dimensions of the furnace and temperature-range (°C);

b) heat treatment equipment and their capacity;

c) programmers and their capacity;

d) equipment for temperature measurement and their capacity, e.g. type of measurement, capacity and recording devices;

e) type of thermo-couple to be used and type of attaching;

f) quench tanks;

g) other equipment needed for heat treatment and its inspection.

8.3 Suitability of equipment

Equipment should be adequate for the application concerned.

8.4 Checking of heat treatment equipment

8.4.1 General

The uniformity of the furnace temperature should be checked by regularely performed measurements of uniform temperature. All devices used for adjustment and recording the temperature should be suitably checked at specified intervals by calibrated measuring instruments.

8.4.2 Measurement of uniform furnace temperature

The measurement is performed in an empty furnace with calibrated thermo couples. The temperature should be measured by a calibrated recording device. The thermo couples should be located in such a way that for different types of furnaces the possible biggest difference of temperatures can be measured, e.g. at a distance of 300 mm from the loading area. The number of measurement should be at least four, two at the top of the furnace and two at the bottom. They should be located in the opposite corners.

The measurement should be carried out at a minimum of two temperature ranges; one equal to the maximum working temperature of the furnace and another about half of that temperature.

The temperature should be increased up to the measurement temperature and kept there for 15 minutes where after the results of the measurements should be recorded.

The differences between the temperature at the different measuring points should not deviate more than ±20 °C.

The measurement of the uniformity of temperature should be performed at an interval of 36 months or when a major repair or rebuild of the furnace is carried out.

As an alternative the measurement could also be carried out during loaded conditions with a typical load. The measuring points should be the same as stated above.

A test report of the measurement results should be prepared. The report should be kept on file in connection with quality documents.

8.4.3 Calibration of adjustment and recording devices

The devices used for adjustment and recording of the temperature should be calibrated at specified intervals as follows:

a) temperature regulator at least 12 months[1]);

b) recording device at least 6 months;

c) thermo couples at least 12 months (at least 4 months for temperature above 800 °C).

For stationary furnaces the intervals may be extended to twice the time.

Calibration reports should be prepared and they should be kept on file in connection with quality documents. They should be available whenever necessary.

A file should be kept on calibrated equipment including the validity.

8.5 New equipment

After installation of new or refurbished equipment appropriate tests of the equipment should be performed. The tests should verify the correct function of the equipment. Records should be maintained of such tests.

8.6 Maintenance

The manufacturer should have documented programs for the maintenance of equipment. The plan should ensure maintenance checks of those items in the equipment which controls variables listed in the relevant heat treatment specifications. The maintenance plan should also include inspections on safety matters.

9 Heat treatment activities

9.1 General

The heat treatment should, whenever possible, be carried out in furnaces.

9.2 Heat treatment parameters

The manufacturer of the product or component is responsible for determining the heat treatment parameters. The parameters are related to the type and thickness of material.

Depending on the type of heat treatment the following parameters should be specified, as appropriate:

a) loading temperature;

b) heating rate;

c) holding temperature;

d) holding time;

e) cooling rate;

f) unloading temperature.

9.3 Heat treatment specification

The manufacturer should prepare heat treatment specifications, which in case of welds, are recommended to be included in the welding procedure specification. The specification will specify that work can be carried out correctly.

The heat treatment specification should include following information, as appropriate:

a) type of heat treatment, e.g. preheating, stress relieving, normalization;

b) method of heat treatment, e.g. furnace, local heat treatment;

c) location and number of measuring points;

d) need for shielding gas;

e) heat treatment parameters;

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[1]) In case of local heat treatment the interval should be as specified by the equipment manufacturer