

INTERNATIONAL STANDARD

ISO
3834-2

First edition
1994-12-15

Quality requirements for welding — Fusion welding of metallic materials —

Part 2:

Comprehensive quality requirements

*Exigences de qualité en soudage — Soudage par fusion des matériaux
métalliques —*

Partie 2: Exigences de qualité complète



Reference number
ISO 3834-2:1994(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 3834-2 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 10, *Unification of requirements in the field of metal welding*.

This part of ISO 3834 cancels and replaces International Standards ISO 3834:1978 as well as ISO 6213:1989 which have been technically revised so as to gather all quality requirements for welding in one standard and to be in alignment with the principles for quality systems given in the ISO 9000 series.

ISO 3834, which is equivalent to EN 729, consists of the following parts, under the general title *Quality requirements for welding — Fusion welding of metallic materials*:

- Part 1: *Guidelines for selection and use*
- Part 2: *Comprehensive quality requirements*
- Part 3: *Standards quality requirements*
- Part 4: *Elementary quality requirements*

Annex A of this part of ISO 3834 is for information only.

© ISO 1994

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Quality requirements for welding — Fusion welding of metallic materials —

Part 2: Comprehensive quality requirements

1 Scope

This part of ISO 3834 has been prepared such that

- it is independent of the type of welded construction to be manufactured;
- it defines quality requirements for welding both in workshops and on site;
- it provides guidance for describing a manufacturer's capability to produce welded constructions to meet specified requirements;
- it may also be used as a basis for assessing the manufacturer with respect to his welding capability.

This part of ISO 3834 is appropriate when demonstration of a manufacturer's capability to produce welding constructions and to fulfill specified quality requirements, are specified in one or more of the following:

- a contract between involved parties;
- an application standard;
- a regulatory requirement.

The requirements contained within this part of ISO 3834 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 welding in the following cases:

Case 1

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

Case 2

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

Case 3

To provide specific requirements for fusion welding as guidance to a manufacturer developing a quality system.

Case 4

To provide specific requirements for references in application standards which uses fusion welding as part of its requirements or in a contract between relevant parties. It may however be more appropriate for ISO 3834-3 or ISO 3834-4 to be used in such cases.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 3834. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 3834 are encouraged to investigate the possibility of applying the most recent editions of the

standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3834-1:1994, *Quality requirements for welding — Fusion welding of metallic materials — Part 1: Guidelines for selection and use.*

ISO 9606-1:1994, *Approval testing of welders — Fusion welding — Part 1: Steels.*

ISO 9606-2:1994, *Approval testing of welders — Fusion welding — Part 2: Aluminium and aluminium alloys.*

ISO 9712:1992, *Non-destructive testing — Qualification and certification of personnel.*

ISO 9956-1:1995¹⁾, *Specification and approval of welding procedures for metallic materials — Part 1: General rules for fusion welding.*

ISO 9956-2:1995¹⁾, *Specification and approval of welding procedures for metallic materials — Part 2: Welding procedure specification for arc welding.*

ISO 9956-3:1995¹⁾, *Specification and approval of welding procedures for metallic materials — Part 3: Welding procedure tests for the arc welding of steels.*

ISO 9956-4:1995¹⁾, *Specification and approval of welding procedures for metallic materials — Part 4: Welding procedure tests for the arc welding of aluminium and its alloys.*

ISO 13916:—¹⁾, *Welding — Measurement of preheating temperature, interpass temperature and preheat maintenance temperature during welding.*

3 Definitions

For the purposes of this part of ISO 3834, the definitions given in ISO 3834-1 apply.

4 Contract and design review

4.1 General

The manufacturer shall review the contractual requirements and the design data provided by the purchaser or in-house data for construction designed by the manufacturer. This is to ensure that all information

necessary to carry out the fabrication operations is available prior to the commencement of the work. The manufacturer shall affirm his capability to meet all welding contract requirements and ensure adequate planning of all quality related activities.

Contract review is carried out by the manufacturer to verify that the contract is 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 and the purchaser notified of any programme, cost or engineering changes that may result.

The items in 4.2 are typically considered at or before the time of the contract review. The items in 4.3 usually form part of the design review and should be taken into account during the contract review if the design is not carried out by the fabricator. It shall be ensured that all relevant information has been supplied by the purchaser.

When a contract does not exist, e.g. items made for stock, the manufacturer is required to take into consideration the requirements of 4.2 whilst carrying out his design review (4.3).

4.2 Application — Contract review

Contractual requirements to be considered should include:

- a) the application standard to be used, together with any supplementary requirements;
- b) the specification of welding procedures, non-destructive testing procedures and heat treatment procedures;
- c) the approach to be used for welding procedure approval;
- d) the approval of personnel;
- e) post-weld heat treatment;
- f) inspection and testing;
- g) selection, identification and/or traceability, e.g. for materials, welders and welds (see clause 16);
- h) quality control arrangements, including any involvement of an independent inspection body;

1) To be published.

- i) other welding requirements, e.g. batch testing of consumables, ferrite content of weld metal, ageing, hydrogen content;
- j) environmental conditions relevant to welding on site, e.g. very low temperature ambient conditions or any necessity to provide protection against adverse weather conditions;
- k) subcontracting;
- l) handling of nonconformances.

4.3 Application — Design review

Design requirements to be considered should include:

- a) location, accessibility and sequence of all welds;
- b) surface finish and the weld profile;
- c) parent metal(s) specification and welded joint properties;
- d) permanent backing;
- e) welds which are to be made in the workshop, or elsewhere;
- f) dimensions and details of joint preparation and completed joint;
- g) use of special methods, e.g. to achieve full penetration without backing when welded from one side only;
- h) quality and acceptance requirements for welds;
- i) other special requirements, e.g. acceptability of peening, heat treatment.

5 Subcontracting

When a manufacturer intends to use subcontracted services (e.g. welding, inspection, non-destructive testing, heat treatment), all relevant specifications and requirements shall be supplied by the manufacturer to the subcontractor. The subcontractor shall provide such records and documentation of his work as may be specified by the manufacturer.

Any subcontractor shall work under the order and responsibility of the manufacturer and fully comply with the relevant requirements of this part of ISO 3834.

The manufacturer shall ensure that the subcontractor can comply with the quality requirements of the contract.

The information to be provided by the manufacturer to the sub-contractor shall include all relevant data from the contract review (see 4.2) and the design review (see 4.3). Additional requirements may need to be specified if the design of a structure is to be sub-contracted.

6 Welding personnel

6.1 General

The manufacturer shall have at his disposal sufficient and competent personnel for the planning, performance and supervision of the welding production according to specified requirements.

6.2 Welders

All welders and welding operators shall be approved by an appropriate test according to the relevant part of ISO 9606.

All records of approval shall be maintained up to date.

6.3 Welding coordination personnel

The manufacturer shall have at his disposal appropriate welding coordination personnel, e.g. according to EN 719, such that the welding personnel can be supplied with the necessary welding procedure specification or work instructions and that the work can be properly performed and controlled. Such persons having responsibility for quality activities shall have sufficient authority to enable any necessary action to be taken. The duties, interrelationships and limits of responsibility of such persons should be clearly defined.

7 Inspection, testing and examination personnel

7.1 General

The manufacturer shall have at his disposal sufficient and competent personnel for planning and performance, supervision and inspection, testing and examination of the welding production according to specified requirements.

7.2 Non-destructive-testing personnel

The non-destructive-testing personnel shall be approved in accordance with ISO 9712.

8 Equipment

8.1 Production and testing facilities

The following equipment shall be available when necessary:

- welding power sources and other machines;
- equipment for joint preparation and cutting, including thermal cutting;
- equipment for preheating and post-weld heat treatment including temperature indicator;
- jigs and fixtures;
- cranes and handling equipment used for welding production;
- personnel protective equipment and other safety equipment, directly associated with welding;
- ovens, quivers etc. used for treatment of welding consumables;
- cleaning facilities;
- destructive and non-destructive-testing facilities.

8.2 Description of facilities

The manufacturer shall maintain a list of essential equipment, used for welding production. This list shall identify items of major equipment essential for an evaluation of workshop capacity and capability. This includes, for example:

- capacity of largest cranes;
- size of components the workshop is able to handle;
- capability of mechanized or automatic welding equipment;
- dimensions and maximum temperature of furnaces for post-weld heat treatment;
- capacities of rolling, bending and cutting equipment.

Other equipment only needs to be specified by approximate total numbers which cover each general type (e.g. total number of power sources for the different welding processes).

8.3 Suitability of equipment

The equipment shall be adequate for the application concerned. Approval of welding and heating equipment is not normally required unless specified in the contract.

8.4 New equipment

After installation of new (or refurbished) equipment appropriate tests of the equipment shall be performed. The tests shall verify the correct function of the equipment. The tests shall be carried out in accordance with appropriate standards, whenever relevant. Records shall be maintained of such tests.

8.5 Maintenance

The manufacturer shall have documented plans for the maintenance of equipment. The plan shall ensure maintenance checks of those items in the equipment which controls variables listed in the relevant welding procedure specifications. The plans may be limited to those items which are essential for assuring the quality of the welded construction.

Examples of those items are:

- condition of guides in equipment for thermal cutting, mechanized welding fixtures etc.;
- condition of ammeters and voltmeters, flowmeters etc. used for the operation of the welding machines;
- condition of cables, hoses, connectors, etc.;
- condition of control system in mechanized and/or automatic welding equipment;
- condition of thermocouples and other temperature measurement instruments;
- condition of wire feeders and conduits.

Defective equipment shall not be used.

9 Welding activities

9.1 Production plan

The manufacturer shall carry out adequate production planning, compatible with facilities as in 8.1. This shall include at least:

- specification of the sequence by which the construction shall be manufactured, e.g. as single

parts or subassemblies, and the order of subsequent final assembly;

- identification of the individual processes required to manufacture the construction;
- reference to the appropriate procedure specifications for welding and allied processes;
- sequence in which the welds are to be made, if applicable;
- order and timing in which the individual processes are to be performed;
- specification for inspection and testing, including the involvement of any independent inspection body;
- environment conditions, e.g. protection from wind and rain;
- item identification by batches, components or parts as appropriate.

9.2 Welding procedure specification (WPS)

The manufacturer shall prepare welding procedure specification in accordance with the appropriate part of ISO 9956 and shall ensure that these are used correctly in production.

9.3 Welding procedure approval

Welding procedures shall be approved prior to production in accordance with the appropriate part of ISO 9956. The method of approval shall be in accordance with the relevant application standards or as stated in the contract.

Other procedures, e.g. procedure for heat treatment, should only be approved if stated in the relevant application standards and/or in the contract.

9.4 Work instructions

The manufacturer may use the welding procedure specification directly in the workshop for instruction purposes to the welder. Alternatively, he may use dedicated work instructions. Such dedicated work instructions shall be prepared from an approved welding procedure specification and do not require separate approval (see ISO 9956-1).

9.5 Documentation

The manufacturer shall establish and maintain procedures for the control of relevant quality documents, e.g. welding procedure specification, welding procedure approval record, welder approval certificate.

10 Welding consumables

10.1 General

Responsibilities and procedures involved in the control of welding consumables shall be specified by the manufacturer.

10.2 Batch testing

Batch testing of consumables shall be required only if stated in the contract.

10.3 Storage and handling

The manufacturer shall produce and implement procedures for storage, handling and use of consumables which avoid moisture pickup, oxidation, damage, etc. The procedures shall be in accordance with the supplier's recommendations.

11 Storage of parent materials

Storage shall be such that the material will not be adversely affected. Identification shall be maintained during storage.

12 Post-weld heat treatment

The manufacturer shall be fully responsible for the specification and the performance of any post-weld heat treatment. The procedure shall be compatible with the parent metal, welded joint, construction etc. and in accordance with the application standard and/or specified requirements. A record of the heat treatment shall be made during the process. The record shall demonstrate that the specification has been followed and shall be traceable to the particular heat treatment operation.

13 Welding-related inspection and testing

13.1 General

Inspection and testing shall be implemented at appropriate points in the manufacturing process to assure conformity with contract requirements. Location and frequency of such inspection and/or testing will depend on the contract and/or application standard, the welding process and the type of construction (see 4.2 and 4.3).

The manufacturer may carry out additional tests without restriction. Reporting of such tests is not required.

13.2 Inspection and testing before welding

Before the start of welding, the following shall be checked, when necessary:

- suitability and validity of welders' approval certificates (see ISO 9606);
- suitability of welding procedure specification (see the appropriate part of ISO 9956);
- identity of parent material;
- identity of welding consumables;
- joint preparation (e.g. shape and dimensions in accordance with ISO 9692);
- fit-up, jiggling and tacking;
- any special requirements in welding procedure specification, e.g. prevention of distortion;
- arrangement for any production test;
- suitability of working conditions for welding, including environment.

13.3 Inspection and testing during welding

During welding, the following shall be checked at suitable intervals or by continuous parameter, when necessary:

- essential welding parameters (e.g. welding current, arc voltage and travel speed);
- preheating/interpass temperature (see ISO 13916);

- cleaning and shape of runs and layers of weld metal;
- back gouging;
- welding sequence;
- correct use and handling of consumables;
- control of distortion;
- any intermediate examination, e.g. checking dimensions.

13.4 Inspection and testing after welding

After welding, the compliance with relevant acceptance criteria shall be checked, when necessary:

- by visual inspection;
- by non-destructive testing, e.g. according to ISO 9712;
- by destructive testing according to relevant ISO standards;
- form, shape and dimensions of the welded construction;
- results and records of post-weld operations, e.g. grinding, post-weld heat treatment, ageing.

13.5 Inspection and test status

Measures shall be taken as appropriate to indicate e.g. by marking of the item or a routing card, the status of inspection and test of the welded construction.

14 Nonconformance and corrective action

Measures shall be implemented to control items which do not conform to specified requirements in order to prevent their inadvertent use. When repair and/or rectification is undertaken by the manufacturer, appropriate procedures shall be available at all workstations where repair or rectification is performed. When repair or rectification is carried out, the items shall be re-inspected, tested and examined in accordance with the original requirements. Measures shall also be implemented to ensure that conditions adverse to quality of the welded construction are promptly identified and corrected.

15 Calibration

The manufacturer shall be responsible for the appropriate calibration of inspection, measuring and testing equipment. All equipment used to assess the quality of the welded construction shall be suitably controlled and shall be calibrated at specified intervals.

16 Identification and traceability

Identification and traceability shall be maintained throughout the manufacturing process, where appropriate.

Documented systems to ensure identification and traceability of welding operations should include, when necessary:

- production plans;
- routing cards;
- records of weld locations in construction;
- weld marking, stamping, labels etc.;
- traceability (for fully mechanized and automatic weld-equipment including welder and welding operator) to specific welds;
- welder and procedure approvals;
- non-destructive-testing procedures and personnel;
- welding consumables, e.g. type, batch or cast numbers;
- parent material, e.g. type, batch;
- location of repairs.

17 Quality records

Quality records, according to the contract requirements, should include, when necessary:

- record of contract/design review;
- materials certificates;
- consumables certificates;
- welding procedure specification;
- welding procedure approval test records;
- welder or welding operator approval certificates;
- non-destructive testing personnel certificates;
- heat treatment and procedure specification records;
- non-destructive testing and destructive testing procedures and reports;
- dimensional reports;
- records of repairs and other non-conformity reports.

Quality records shall be retained for a minimum period of 5 years in the absence of any other specified requirements.