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ISO 3834-6

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Quality requirements for fusion welding of metallic materials —

Part 6: Guidelines on implementing the ISO 3834 series

Exigences de qualité en soudage par fusion des matériaux métalliques —

Partie 6: Lignes directrices pour la mise en application de la série ISO 3834

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 10, *Quality management in the field of welding*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding and allied processes*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This document cancels and replaces ISO/TR 3834-6:2007, which has been technically revised.

The main changes are as follows:

— document changed from a Technical Report to an International Standard;

— references to IIW and IAB removed;

— Clause 11 updated to address visual testing of welds;

— text aligned with ISO 14731.

A list of all parts in the ISO 3834 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html. Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

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Introduction

Welding is a special process in that it is not always possible to verify the final result by testing. The quality of the weld is manufactured into the product, not inspected. This means that welding normally requires continuous control or that specific procedures be followed, or both. The ISO 3834 series deals with quality requirements in welding and has been prepared in order to identify those controls and procedures.

The ISO 3834 series is not a quality system standard intended to take the place of ISO 9001, but a useful, additional tool for use when ISO 9001 is applied by manufacturers, in which case the meeting of its requirements needs to be recorded in certificates or documentation. However, the ISO 3834 series can be used independently of ISO 9001.

The ISO 3834 series is intended for the fusion welding of metallic materials, and its application is independent of the products manufactured. However, its principles and many of its detailed requirements are also relevant for other welding and welding-related processes.

One of the aims of the ISO 3834 series is to specify requirements in the field of welding so that contracting parties or regulators do not have to do this themselves. A reference to a particular part of the ISO 3834 series should be sufficient to demonstrate the capabilities of the manufacturer to control welding activities for the type of work being done. This concept also applies to committees responsible for drafting product standards.

The ISO 3834 series does not in itself require external assessment or certification. However, assessments by customers and certification by independent bodies are growing trends in commercial relations and the series can serve as a basis for these purposes, as well as for the demonstration of performance by those manufacturers implementing it.

Other International Standards covering resistance welding and thermal spraying include the ISO 14554 series and ISO 14922, respectively.

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Quality requirements for fusion welding of metallic materials —

Part 6: Guidelines on implementing the ISO 3834 series

1 Scope

This document gives guidelines for the implementation of requirements given in the other parts of the ISO 3834 series. It is intended to help users select the appropriate part of the ISO 3834 series. It is expected that users will already be familiar with the ISO 3834 series as a whole.

This document does not provide additional requirements to those in ISO 3834-1 to ISO 3834-5.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

NDT	non-destructive testing
PWHT	post-weld heat treatment
pWPS	preliminary welding procedure specification
WI	work instruction
WPQR	welding procedure qualification record
WPS	welding procedure specification

5 Using the ISO 3834 series

5.1 General

ISO 3834-1 provides criteria for the selection and use of the ISO 3834 series. The following subclauses identify different ways that the manufacturer can select or be required to adopt a part of ISO 3834.

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5.2 Product standards

Where product standards require control of fusion welding, the ISO 3834 series should be used to organize those welding activities.

5.3 Purchasers and users

Purchasers and users of welded products can specify in contract documents that manufacturers demonstrate their competence by conformity with a part of ISO 3834.

5.4 Quality management systems in accordance with ISO 9001

Since ISO 9001 does not include specific requirements for welding activities, ISO 3834-2, ISO 3834-3 and ISO 3834-4 can be used.

5.5 Quality management systems other than ISO 9001

For welding activities in quality management systems other than ISO 9001 that do not include specific requirements for welding activities, ISO 3834-2, ISO 3834-3 and ISO 3834-4 can be used.

5.6 Manufacturers

Whenever manufacturers wish to give evidence of their competence in fusion welding activities, the appropriate part of ISO 3834 can be used.

6 Incorporating the ISO 3834 series in product standards

An important group of users of the ISO 3834 series is committees that draft product standards at international, regional or national level. ISO 3834-2, ISO 3834-3 and ISO 3834-4 provide a range of quality requirements for welding. Committees drafting product standards are encouraged to select a part, or parts, of ISO 3834 that provide the appropriate quality requirements for the products to be manufactured. This should take into account the selection criteria given in ISO 3834-1. Each part of ISO 3834 is designed to provide a complete set of quality requirements. Additional requirements should not need to be specified unless compelling reasons exist. In case of doubt, or where additional requirements are being considered, consultation with ISO/TC 44/SC 10 is recommended.

Where welding is involved in the manufacture of a product, the standards committee may specify the documents to be applied or else take them from the ISO documents specified in ISO 3834-5. The committee should also select the appropriate quality requirement standard or standards to be applied. Where a series of levels exist in the ISO documents in ISO 3834-5, for example for welding procedure qualification, it is satisfactory for the standardization committee to select only those that are acceptable. The development of tables linking parts of ISO 3834 (with or without other quality-related standards, such as ISO 9001) to requirements other than those given in ISO 3834 is strongly discouraged.

7 Using other documents with the ISO 3834 series

Full conformity with ISO 3834-2, ISO 3834-3 and ISO 3834-4 can be achieved either by adopting the ISO documents in accordance with ISO 3834-5 or applying other standards that provide equivalent technical conditions.

Standards that do not provide equivalent conditions may be adopted if they are referenced in product standards that are used by the manufacturer.

Product standards that have been used satisfactorily in service may be considered by a manufacturer as being recognized for application with the ISO 3834 series. Where a manufacturer bases its demonstration of conformity to a part of ISO 3834 on product standards, it is the responsibility of the manufacturer to apply the corresponding standards – whether separately specified or incorporated in the product standard – in their totality. It is the responsibility of the manufacturer to demonstrate technically equivalent conditions

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when standards other than the ISO documents in accordance with ISO 3834-5 are applied. Certificates issued following assessment by independent certification bodies or claims of conformity by a manufacturer with any part of ISO 3834 should clearly identify the documents used by the manufacturer and provide or reference evidence of technical equivalence as applicable.

8 Documentation and quality systems

8.1 Documentation

In any control system there is a need for documentation, a term which embraces a range of different types of documents, such as procedures, records, instructions and certificates (see Table 1).

ISO 3834-2, ISO 3834-3 and ISO 3834-4 require certain documents to be produced. Annex A gives examples of the types of documents which may be used by manufacturers.

Table 1 — Examples of different types of welding-related documents

Type of document	Description[a]	Examples of welding coordinator
Procedure	Description of welding-related activity	Description of the role (tasks, responsibilities and authority) of welding coordinator Description of the handling of welding consumables and parent metals Description of how welding procedure tests are carried out Description of how welder's qualification is carried out
Record	Report of welding-related activity	Record from a procedure test (WPQR) Record from a welder qualification test Welding record
Instruction	Description of welding-related operation	Welding procedure specification (WPS) Work instructions
Certificate	Verification of welding-related operation	Welder's qualification test certificate Material test report

[a] Not to be confused with a definition of the terms.

8.2 Quality management system

The ISO 3834 series does not specifically require a quality management system. However, ISO 3834-1 identifies those elements that could be considered as complementing the ISO 3834 series if a quality management system were to be adopted. Of these, one of the most important is document control, and manufacturers are expected to implement a document control procedure ensuring that:

a) documents are kept up to date;

b) those in receipt of documents are identified;

c) the latest issues of the documents are available at locations where they are used;

d) obsolete documents are withdrawn;

e) records are archived to avoid deterioration and to enable retrieval;

f) records are not destroyed without authorization.

Some records generated as part of this system can require updating at periodic intervals. These include calibration or validation records and welder qualification records.

Manufacturers who operate a quality management system conforming to ISO 9001 are expected to have a documented system in place covering those elements identified in ISO 3834-1.

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The effectiveness of the welding control system will depend to a large extent on the management input and their role in monitoring performance and implementing action when weaknesses are detected. Applying management review and internal audit ensures senior management involvement in the welding control system and enables the monitoring of performance and introduction of measures to overcome identified deficiencies. Figure 1 provides a summary of critical measures in the welding control system to assist management review of the performance of the welding control system.

9 Selecting the level of quality requirements

The ISO 3834 series incorporates three levels of quality requirements that may be included in product standards, regulations and contracts or selected by a manufacturer. The level selected will depend on the nature of the product being manufactured, the conditions under which it is to be used and the range of products manufactured. In ISO 3834-1, it is stated that the standard can be applied in a variety of industrial situations. The following criteria are identified as being those applying in the selection of the most suitable level:

a) the extent and significance of safety-critical products;

b) the complexity of manufacture;

c) the range of products manufactured;

d) the range of different materials used;

e) the extent to which metallurgical problems can occur;

f) the extent to which fabrication imperfections (e.g. misalignment, distortion, weld imperfections) affect product performance.

Product standards that require conformity with a part of ISO 3834 emphasize two critical areas in the choice of the level of quality requirements: the safety-critical nature of the products and the significance of dynamic loading in the product service environment.

In general, the standard level of quality requirements should be suitable for a broad range of products having a normal safety-critical component and that could experience dynamic loading. Such products are manufactured from conventional materials where the weldability is known and the precautions to be taken to ensure mechanical performance and defect-avoidance are well documented. Products having a very limited safety component and that are subjected to only moderate static loads with minor dynamic components would normally only require the elementary level of quality requirements.

Where there are significant safety factors with high static and dynamic loadings and the materials are designed for high-performance applications, the comprehensive level of quality requirements is appropriate. However, there can be situations where, because of the innovative nature of the design or the use of novel production processes, the comprehensive level of quality requirements is selected in place of the standard level.

It is not possible in this document to allocate specific parts of ISO 3834 to particular types of product. This is because there can be different levels of complexity in the design, materials and fabrication processes in any product group. Selection of these levels is the responsibility of product standards committees or of those purchasing or manufacturing particular constructions or groups of constructions.

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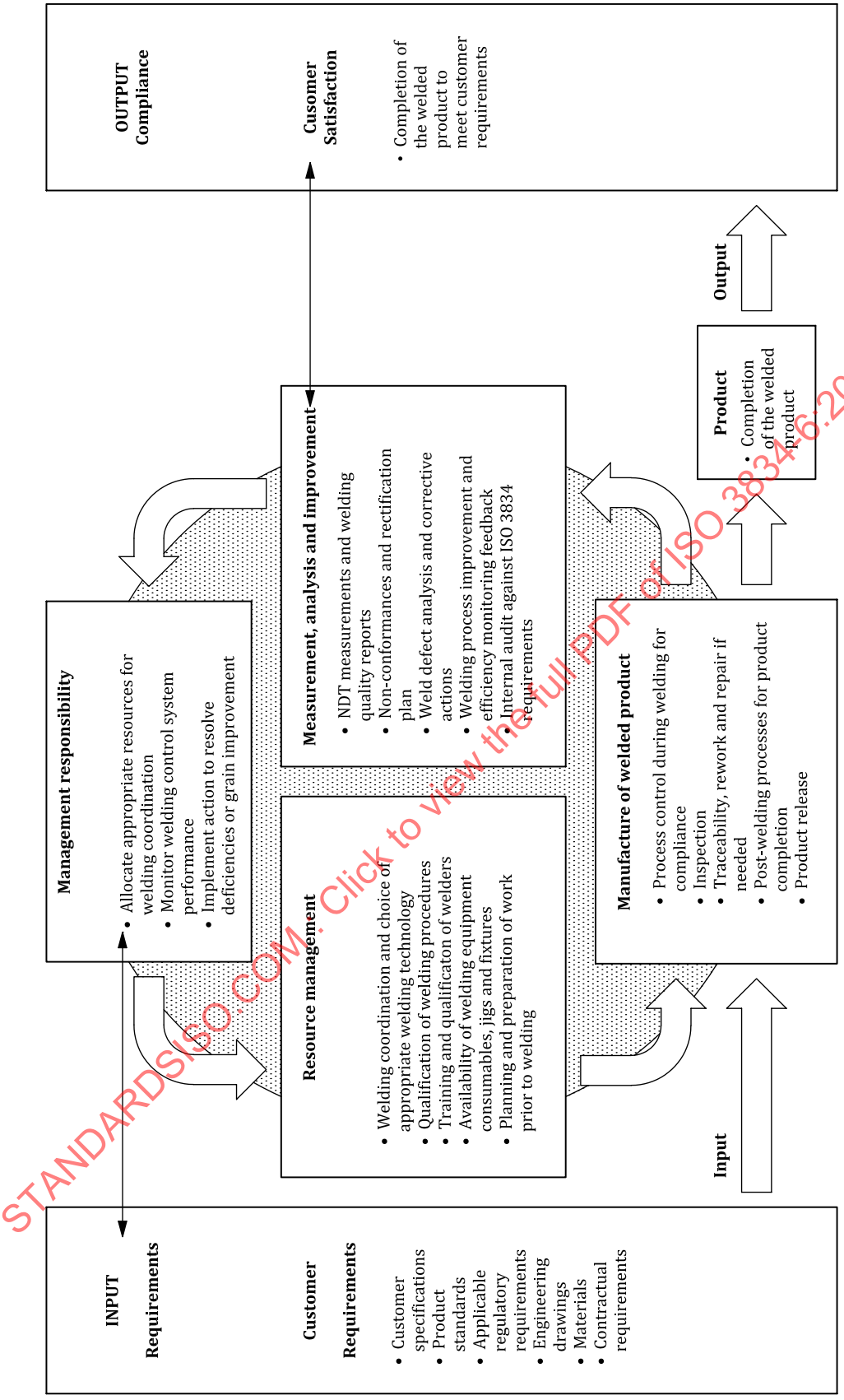

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Figure 1 — Summary of welding system control measures

The sequence of activities involved in the selection of the welding quality requirements is summarized in the flow chart shown in Figure 2.

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ISO 3834-1 states that a manufacturer conforming to a particular level of quality requirements also conforms with lower-quality levels. Thus, a manufacturer demonstrating conformity with ISO 3834-2 also conforms with ISO 3834-3 and ISO 3834-4. This could be relevant for a manufacturer producing a range of products, some of which can require comprehensive quality requirements, while others require only standard or elementary quality requirements. Consequently, a manufacturer can apply comprehensive quality requirements to those products where that comprehensive level is applicable, while applying the requirements of the standard or elementary parts to products where these are more appropriate.

10 Implementation in fabrication

10.1 General guidelines for implementation

10.1.1 Basic principles

The ISO 3834 series specifies requirements for a number of different categories of activity, notably those relating to:

a) the manufacturer's procedures for the overall control of welding as a special process;

b) technical instructions for production (e.g. WPSs for ISO 3834-2 and ISO 3834-3);

c) demonstration of personnel competence, capability and suitability (e.g. welder's qualifications).

Each category is considered more fully in the following subclauses. Further comments relate to the manufacturer's organization, the implementation in an ISO 9001 environment and, finally, individual elements of the control.

10.1.2 Implementation

Many manufacturers apply requirements relating to procedures and instructions for production as well as the documentation of competence, capability and suitability of personnel. For such manufacturers, the ISO 3834 series should not incur major change or cost. However, some manufacturers can require more significant action, for one or more of the following reasons:

a) Where the implementation of a part of ISO 3834 coincides with a transition to new national or internationally recognized product standards, such transitions can require new measures that have not been previously applied, such as qualification of welders and welding procedures and the training or employment of welding coordination personnel, to ensure a knowledge base for the types of product manufactured.

b) Customers can require that manufacturers which have previously operated using different practices conform with a part of ISO 3834.

c) National or regional regulations could require that manufacturers conform with a part of ISO 3834 in specific industrial sectors in order for their products to be granted approval for use in that country or region. Such demands can involve significant changes to previously applied practices.

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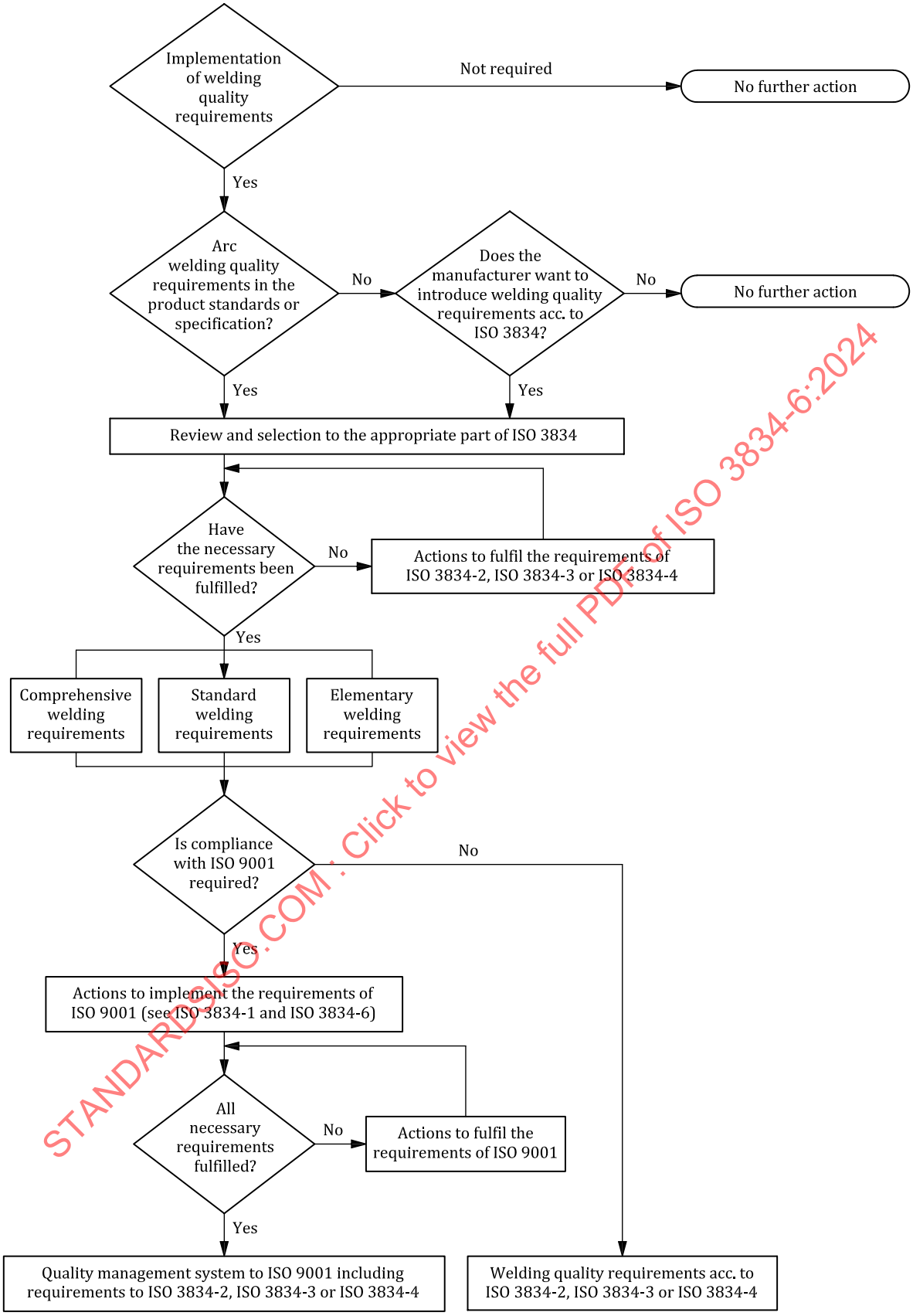

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Figure 2 — Welding quality requirements — Flow diagram

Where such actions become necessary, it should be noted that the ISO 3834 series reflects good practice in the manufacture of products where welding is an important production process. Conformity with a

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part of ISO 3834 confers confidence for the manufacturer, and the customer alike, that the product will be manufactured properly. The product should not suffer premature failure during service life as a result of manufacturing deficiencies, provided a suitable programme of inspection and maintenance is undertaken.

10.1.3 Control of welding

Because welding is a special process and the consequences of poor welding can be severe, it is necessary to exercise controls to ensure that the welding is performed correctly and that required inspections are carried out thoroughly on the products manufactured. These controls and their subjects include:

a) verification of welding procedures;

b) verification of the capabilities of welding personnel;

c) availability, suitability and maintenance of equipment;

d) identification of product requirements;

e) the manner in which subcontracting is carried out;

f) the level of production planning;

g) storage and handling of parent metals and welding consumables;

h) operation and performance of inspection;

i) identification and traceability of product and work in progress;

j) correction of product non-conformity;

k) the extent and storage of quality records.

Such controls should specify:

— what it is that is to be controlled;

— how it is controlled (if necessary, by reference to one or more procedures or standards);

— who has been allocated tasks and responsibilities for the control system, and;

— how individual aspects of the control system are to be reported and documented.

10.1.4 Production procedures

10.1.4.1 Technical documentation

The ISO 3834 series specifies a number of technical instructions, procedures, specifications and records in order to ensure the effectiveness of the welding control system. Those production activities that require such technical documentation are specified in ISO 3834-1. Where a particular activity is not within the range of production activities, for example PWHT, it is not necessary for the manufacturer to address these in the control system.

Examples of documentation that manufacturers have found useful for their control systems are given in Annex A.

10.1.4.2 Welding procedure qualification

ISO 15607 and ISO 15609 give information on specification and qualification of welding procedures and the following five general methods:

a) tested welding consumables (ISO 15610);

b) previous welding experience (ISO 15611);

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c) standard welding procedure (ISO 15612);

d) pre-production welding test (ISO 15613);

e) welding procedure test (ISO 15614).

If the product standard does not specify which method (ISO 15610 to ISO 15614) is to be used, this should be agreed on between the contracting parties.

When a welding test is carried out (welding procedure or pre-production welding tests), the results obtained are recorded in a WPQR. The recommended steps are summarized in Table 2.

Table 2 — Recommended steps for welding procedure qualification

Task	ISO 3834-2	ISO 3834-3	ISO 3834-4
Preliminary planning of qualification	pWPS	pWPS	Work instruction
Qualification	WPQR[c]	WPQR[c]	No documentation required[a,c]
Specification of welding procedure	WPS	WPS	Work instruction[a]
Work instruction	WPS or dedicated WI (optional)	WPS or dedicated WI (optional)	Verbal communication or WI
Documentation of process	Production report (optional, usually not required)	Not relevant[b]	Not relevant

[a] The WPSs applied in an ISO 3834-4 context are well established and are considered as "known to be satisfactory". The WPS can usually be reduced to a specification of welding process, parent metals and welding consumables. Furthermore, the supplier of the welding consumables could have indicated wide ranges for the essential welding parameters which then have to be adhered to.

[b] Records of actual welding data during fabrication might not be useful unless the instruments for measurement are calibrated or verified.

[c] The WPQR should be signed by the examiner or examining body. In accordance with ISO 15607, the pWPS, WPS and WI are prepared and signed by the welding coordinator (or welding supervisor if ISO 3834-4 applies) on behalf of the manufacturer.

10.1.4.3 Other processes

The principles for qualification of other production processes can be similar to those of welding procedure qualification. The same general methods for welding procedure qualification (see 10.1.4.2) may also be applied for other production documentation used in connection with welding fabrication.

Examples of documentation for other fabrication processes are as follows:

a) Non-destructive testing: NDT of welds is often specified in product standards and the normal practice is to apply a standard procedure for the NDT method used, prepared on the basis of the relevant NDT standard. An NDT report should always be prepared, detailing the results of the test and sentencing the weld. This report normally includes a record of the critical NDT parameters used during the test.

b) Post-weld heat treatment: a PWHT procedure may be required, as well as a report of heat treatment data. Quality requirements for heat treatment are given in ISO 17663.

c) Thermal cutting: documented procedures are not generally required for thermal cutting because reliance is placed on the skill and competence of the operator. In some cases, however, such as when cutting sensitive materials, for which experience is limited or where there is a risk of hard zones at the cut edges that could be harmful in the final product, documented instruction can be necessary.

10.2 Organization

The term "manufacturer" is widely used as a designation for the entity that includes responsibility for welding coordination. However, control of welding is performed within an organization by a body of people

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working under the control of a single team of welding coordinators (as specified in ISO 14731). Some typical situations are outlined in Table 3, which illustrates the principles.

Table 3 — Typical organizations and tasks

Situation	Comments
Large corporation comprising a number of companies or factories, each having a team of welding coordinators responsible to each company or factory management.	The ISO 3834 series should be implemented independently for each company or factory. Each company or factory would normally consider all other companies or factories within the corporation as subcontractors.
Large corporation comprising a number of factories, controlled by a single team of welding coordinators referring to the corporate management.	Corporate implementation involving all factories is feasible. Any factories performing welding which do not conform should not be permitted to deliver any welded product to a factory having implemented a part of ISO 3834.
Manufacturer (main contractor) wishing a subcontractor to work under its ISO 3834 series control.	Feasible only if the main contractor's authorized welding coordinators have the power and the means to efficiently control the subcontractor's welding activities.

Welding procedure specifications qualified by a welding procedure test, for example in accordance with ISO 15614, by a manufacturer in one workshop may be applied in different workshops of the same manufacturer if a common control system in accordance with a part of ISO 3834, including the same welding coordination personnel, is operated by the manufacturer.

If a subcontractor does not conform with a part of ISO 3834 in their own right, the manufacturer should ensure that the subcontractor can meet the appropriate requirements of the standard for each particular contract.

11 Interpretation of particular clauses in the ISO 3834 series

11.1 Requirements review and technical review

The manufacturer has to demonstrate, for example by completion of a checklist or by written minutes, from a contract or technical review meeting, that each requirement in the appropriate part of ISO 3834 has been fully covered. The aspects given in the standard are not intended to be exhaustive; further matters relevant to a particular contract or design requirement should be considered.

The overall intent is to ensure that the manufacturer properly understands the technical requirements and that the product can be manufactured in accordance with the contract.

Welding coordination in accordance with ISO 14731 should be specified for this activity.

11.2 Subcontracting

The manufacturer should ensure that any subcontracted welding-related activities, including welding, NDT, inspection, heat treatment, maintenance of equipment and calibration, conform with the requirements of the contract specification to the satisfaction of the welding coordinator with assigned responsibilities in this area.

Subcontractors who deliver welding or ancillary services may conform with the same or a higher level of a part of ISO 3834 as the main contractor. However, a lower level can be appropriate depending on the extent of the subcontract and the services or products provided.

It may not always be possible to subcontract work to organizations that conform with any of the quality levels in the ISO 3834 series. It is the manufacturer's responsibility to ensure that welding or related activities are properly controlled in accordance with relevant part of ISO 3834. This can require auditing of a subcontractor's premises when welding is being carried out and being involved in welder and welding procedure qualifications. If the manufacturer has suitable WPSs, it can be expedient to offer these to the subcontractor and to monitor their application. Product inspections can also be undertaken in conjunction

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with the manufacturer. Subcontractors providing associated services, such as PWHT, NDT or inspection, can be audited. More extensive supervision and surveillance can become necessary if the initial audits reveal excessive non-conformances.

When a particular part of ISO 3834 is specified, for example in contracts, regulations or other documents, subcontractors should conform with that level or higher. However, if ISO 3834-2 or ISO 3834-3 are required, a subcontractor working in accordance with ISO 3834-4 can be acceptable for producing simple welded products. This could necessitate a concession from the customer or authority involved.

If no requirements to use a part of ISO 3834 are enforced, the manufacturer should, on their own initiative, ensure either that subcontractors conform with the appropriate part of ISO 3834 or that measures are taken that provide adequate controls for the work to be carried out.

11.3 Welding coordination

11.3.1 General

Welding coordination in accordance with ISO 14731 addresses the management and execution of those manufacturing and technical activities undertaken to control welding. It should be noted that welding coordination is usually performed by various categories of personnel, many of whom are not traditionally considered to be part of the welding technology team. The following points are highlighted:

a) Large organizations performing extensive and complex welding activities will usually employ a number of persons who deal exclusively with the control of welding. Those persons can have titles such as welding engineer or welding technologist and are normally recognized as full-time welding coordinators.

b) In small organizations, similar duties may be allocated to persons having other titles, such as production manager, foreperson or supervisor, and performing other tasks in addition to welding coordination (part-time welding coordinators).

c) Some welding coordination activities, typically related to the storage and handling of consumables, and maintenance and calibration of equipment, can be allocated to persons having titles which bear little connection to welding. Such people are generally qualified for only a few specialized welding coordination tasks.

d) Some manufacturers allocate the responsibility for some of the detailed planning to welders or welding operators. In such cases, the manufacturer should ensure that the welders and welding operators have the necessary knowledge and competence.

e) Control of inspection and testing activities that are also welding coordination activities is usually performed by persons bearing titles such as welding inspector, NDT engineer or quality manager. However, in smaller organizations, such activities may be allocated to other personnel.

11.3.2 Welding coordinator

ISO 3834-2 and ISO 3834-3 require the application of ISO 14731, which presents “the human aspect” of welding control and, as such, is an important standard. Within the system, each control activity, for example control of maintenance of welding equipment, is performed by one or more persons, normally employed by the manufacturer or contracted by the manufacturer. The ISO 3834 series identifies requirements for each element of welding control. In allocating these welding coordination tasks and responsibilities, the manufacturer should:

a) identify the separate control systems and prepare lists of all tasks and responsibilities and who they are allocated to;

b) check all of the listed tasks and responsibilities to ascertain that all the activities listed in ISO 14731 have been incorporated into the control system and that they have been properly allocated to a person or persons;

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c) identify the criteria for competence in terms of qualification, experience and training for each of the welding coordination positions;

d) ensure the competence of those persons nominated as welding coordinators by way of experience, training and/or qualification is adequate for their allocated tasks.

The qualification needed for each welding coordinator is a consequence of the way in which the manufacturer has allocated tasks and responsibilities in their organizational structure.

ISO 14731 uses the term "welding coordinator" to identify the person or persons having an adequate level of technical welding knowledge for the range of products manufactured. All manufacturers should appoint at least one welding coordinator. The welding coordinator nominated by the manufacturer should have the competence to make decisions and to sign documents which affect product quality. The welding coordinator has an overall responsibility for monitoring welding activities and for taking action when welding has not been correctly performed.

11.3.3 Welding inspection personnel

Welding inspection is one of the tasks of welding coordination defined in ISO 14731. It is a requirement of ISO 14731 that personnel performing inspection tasks be suitably trained and competent to perform assigned tasks. A welding inspection qualification (e.g. at the basic, standard or comprehensive level) can be required.

11.3.4 NDT personnel

Personnel performing NDT other than visual examinations are required by ISO 3834-5 to conform with ISO 9712, unless otherwise specified or agreed.

11.3.5 Correlation between ISO 14731 and ISO 3834 series quality levels

ISO 14731 specifies three competency levels for welding coordination personnel:

a) comprehensive level;

b) specific level;

c) basic level.

The ISO 3834 series presents three levels of quality requirements for welding. The three levels in accordance with the ISO 3834 series and those in accordance with ISO 14731 are correlated for some, but not all, applications.

The following four factors can affect this correlation:

— the technical complexity of the welding operations, in particular the weldability of the parent metals;

— the complexity of the equipment used for welding (equipment such as numerically controlled equipment and welding robots can require greater production control than for manual metal arc welding);

— the production volume (mass production necessitates detailed production planning and control in order to minimize fabrication costs);

— the weld quality level (greater amounts of surface and volumetric inspection and more stringent acceptance criteria require more stringent control to avoid excessive repair or rejection).

Table 4 illustrates the correlation between the ISO 3834 series and ISO 14731, where only one of these four factors is of significance. It should be noted that many manufacturers have to take more than one factor into consideration when specifying the qualification and experience required of the welding coordinator(s); nevertheless, the table illustrates the principles to be followed. It is separately recommended that welding coordinators have appropriate manufacturing experience.

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Table 4 — Correlation between the ISO 3834 series and ISO 14731

Decisive factor	Requirements for welding coordinators[a]
Technical complexity of welding operation	The levels are directly correlated: — ISO 14731, comprehensive for ISO 3834-2 — ISO 14731, specific for ISO 3834-3
Complexity of equipment used for welding	No correlation, ISO 14731 basic may be sufficient[b]
Production volume	No correlation, ISO 14731 basic may be sufficient[c]

[a] One or more welding coordinators at this level. Manufacturers employing more than one welding coordinator do not necessarily have to require all to be at the same level. The necessary level depends on the allocated tasks and responsibilities.

[b] At least one welding coordinator should, however, have sufficient specialized knowledge in, for example, programming the numerically controlled equipment, welding robots.

[c] At least one welding coordinator should, however, have sufficient specialized knowledge of planning for mass production.

Some product standards state that the level of knowledge required by the welding coordinator should be specified. In such cases, these requirements are to be met by the manufacturer. However, ISO 14731 allows welding coordination to be subcontracted, while the responsibility for maintaining conformity with ISO 14731 remains with the manufacturer.

11.4 Equipment

The ISO 3834 series requires that a list of key equipment and facilities be prepared and kept up to date. The equipment and facilities should be monitored to ensure they are adequate to manufacture the products concerned.

It is expected that the manufacturer will have implemented a system for the identification, control, maintenance and calibration (where relevant) of all production equipment, including having designated the individuals responsible for these activities and detailed the arrangement to prevent production use of defective equipment.

11.5 Welding activities

The manufacturer should be able to show by means of plans and other documentation (e.g. drawings, instructions, specifications) how the requirements for completion of production, NDT and other related activities are to be managed and achieved.

11.6 Storage of parent metal

The manufacturer should establish systems for storing parent metals, whether purchased or supplied by the customer, including components provided for incorporation into the finished product. It is expected that the methods and systems will be specified.

11.7 Calibration and validation

Calibration and validation are frequently used terms that are not always adequately explained. Their concepts in welding are covered in ISO 17662.

Calibration is the process whereby the item of equipment is tested at intervals against measurement standards whose accuracy in terms of closeness of agreement to the true measurement is known, so that the accuracy of the instrument under test for a given level of uncertainty can be determined.

Validation, in the context of measuring equipment, is the process of demonstrating that individual measurements are satisfactory. This can be done by using a calibrated instrument or measurement standard to show that an instrument under test is providing a satisfactory output based on the instrument settings or instrument gauges.

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Calibration of welding equipment is generally only required where the quality or repeatability of the weld depends upon accurate and repeatable setting of parameters such as current, voltage, speed, gas flow or pulse characteristics. However, if a power source does not have calibrated meters for current and voltage, the manufacturer should have a calibrated instrument that can be used to verify that the welding parameters (current and voltage) conform with the requirements of the WPS or instruction.

While equipment for PWHT and the control of electrode stores is included under calibration and validation, inspection and test equipment such as NDT equipment and pressure testing gauges is not. As a general rule, inspection and test measuring equipment always needs to be calibrated.

In general, calibration or validation is also required for temperature measurement, for example recorders for heat treatment, NDT equipment and pressure gauges. Some dimensional measuring equipment, such as Vernier gauges and micrometers, requires calibration if the product itself needs that level of accuracy.

The use of a tongue tester to check the welding current level in a cable, under circumstances where the current was adjusted in accordance with given settings, or set against an ampere meter on the equipment, would validate the output from the equipment as being satisfactory. In other circumstances, where the tongue tester was used as a meter to adjust the equipment to obtain the right current in accordance with a WPS, the tongue tester would provide verification that the right current level had been achieved. In this context, there would be no checking of the accuracy of the output of the equipment. Verification, in this case, is not a calibration or validation process because it only ensures that the designated current level has been achieved.

It should be noted that new welding processes and new power sources, such as pulsed arc welding, are difficult or impossible to control without accurate measurement, and suitably accurate instruments are necessary. Control of mechanized welding operations necessitating strict control of heat input also necessitates the use of accurate instruments.

The manufacturer should identify and record the equipment that is to be calibrated and maintain records of those calibrations.

11.8 Identification and traceability

The ISO 3834 series does not always require identification and traceability. Where the manufacturer has taken on, or is likely to take on, contracts where traceability is required, appropriate procedures shall be implemented.

Such procedures should not create confusion with items for contracts which do not require traceability.

When traceability of consumables is required, it is expected that the various batches used in a weld will be recorded. However, it is not necessary to record the location of various batches of approved welding consumables for multi-run joints.

12 Assessment and certification

The ISO 3834 series does not require any assessment or certification. The manufacturer may, on their own responsibility, declare conformity with a particular part of ISO 3834. As part of this declaration, the manufacturer is required to detail the documents used in the controls implemented. Where these are ISO documents listed in ISO 3834-5, a simple statement referring to ISO 3834-5 is all that is required. This could be the most common application of a part of ISO 3834. However, the ISO 3834 series can be used by a customer (second party) or certification body (third party) to assess a manufacturer.

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