

# EWF Manufacturer Certification System for the Management of Quality, Environment and Health and Safety in Welding Fabrication



Supplement for the Implementation of EN ISO 3834  
Oriented to Welded Products



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## **EFW MCS**

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#### **Supplement for the implementation of EN ISO 3834 oriented to welded products**

## FOREWORD

“Special processes” in manufacture are those processes for which the quality requirements of the product cannot be verified by final inspection and which require special competence before and during operation, if compliance with such quality requirements is to be assured. Moreover the environmental impacts and the health and safety risks related to special processes can play a considerable role in the whole fabrication process of a product. Welding is an example of such a processes.

With reference to the quality requirements of welded products EN ISO 3834 “Quality Requirements for Welding” has been developed; on the other hand no European or International standards dealing with environment and safety of personnel specifically related to welding are currently available.

Based the above, the European Federation for Welding, Joining and Cutting (EWF), by virtue of its unique international expertise, has developed a high integrity and specialised certification system to assure companies’ compliance with EN ISO 3834 and with the EWF requirements for the Environmental and Health and Safety Management. This system is refereed to as the EWF Manufacturer Certification System (EWF MCS).

Therefore the Manufacturer has the opportunity to implement the EWF EN ISO 3834 Scheme and, at his choice, the EWF Environment Management Scheme and/or the EWF Health and Safety Management Scheme. The effort which a Manufacturer is required to make in adopting the three schemes together is undoubtedly reduced, because the structures of the three schemes are harmonized so that many of the management procedures can be considered valid for all. Moreover, the involvement of the external organisations (e.g. subcontractors, customers, authorities, etc.) can be dealt with in a better way.

In the field of quality management in fabrication, the European trend is clearly moving toward a product/process approach. The European Directives and their supporting European harmonised standards (requiring the fulfilment of specific technical requirements, typical of any merchandise sector) are examples of that. In order to help companies in the fulfilment of such requirements, consistently to the product manufactured, EWF have produced specific supplementary guides for the processes/products considered (e.g. railway components, pressure vessels and construction products), taking into consideration the applicable standards and best practice manufacturing procedures, already shared by the main European manufacturers and customers.

Great care has been taken to detail the interpretation of the standard in terms of third party assessment, to specify and register properly trained scheme assessors, and to devise an operational structure so that certification of companies will be consistent wherever the scheme(s) rules are applied.

The system is based on the set of the following four documents:

- EWF 636-07 “EWF Manufacturer Certification System for the Management of Quality, Environment and Health and Safety in Welding Fabrication - Management Schemes Interpretation and Implementation”

- EWF 637-07 “EFW Manufacturer Certification System for the Management of Quality, Environment and Health and Safety in Welding Fabrication - Supplement for the implementation of ISO 3834 oriented to welded products”
- EWF 638-07 “EFW Manufacturer Certification System for the Management of Quality, Environment and Health and Safety in Welding Fabrication - Rules for ANBCC Operating the EWF Manufacturer Certification System.
- EWF 639-07 “EFW Manufacturer Certification System for the Management of Quality, Environment and Health and Safety in Welding Fabrication - ANBCC Assessment of Manufacturers of Welded Products Operating the EWF Manufacturer Certification System

EFW appoints one organisation in each country to act for EFW, and these organisations are assessed and monitored against Rules provided by EFW. These organisations are known as the EFW Authorised National Bodies for Company Certification (ANBCCs), and are responsible for ensuring that the standards of assessment and certification are maintained.

In this, the objective is that EFW certified companies will have demonstrated that they have achieved an identified, minimum level of capability over a specified scope of activity, irrespective of the country in which they had been qualified.

The certification is given to a company after a preliminary phase in which the manufacture has to give information about its activities by filling in an information sheet and after a subsequent positive result of an assessment visit conducted by the ANBCC's Assessors and Technical Experts. Manufacturers can prepare the visit by use of the assessment questionnaire they receive in the preliminary phase.

All the documents of the EFW Manufacturer Certification System have been produced to integrate European Cooperation for Accreditation guideline EA 6/02; the activities carried out by EFW and ANBCCs in respect of manufacturer certification to EN ISO 3834 are therefore fully compliant with this guideline.

The primary intention of MCS certification is to ensure that manufacturers are competent and exercise adequate control of the special process of welding so that customers and others can have confidence that the welded products they produce will comply with the regulatory and/or contractual requirements as relates to quality and Environment Health and safety.

In order to give evidence of such specific technical capabilities of Manufacturers, the EFW Certificate indicates the scope of certification achieved together with the issue and expiry date of the Certificate itself. The Company's data, is supplemented with a Schedule, where technical information (reference standards, materials, welding processes, supplementary requirements, deviations, etc.) on the fabrication process adopted and the welded products manufactured is detailed together with the name of the responsible welding co-ordinator.

The Certificate has a validity period of five years, subject to satisfactory surveillance, from the date of issue. Such surveillance may be accomplished on a yearly basis through visits by the ANBCC's auditors and technical experts or through a questionnaire covering all items of the scheme, sent to and duly filled in by the Manufacturer. Monitoring only through a questionnaire is allowed provided the following conditions are satisfied, at least:

- the welding coordinators are qualified according to the EWF/IIW guidelines for welding coordination personnel (I/EWE, I/EWT, I/EWS and I/EWP) consistently with the products (applies only to ISO 3834-2 and ISO 3834-3);
- the Manufacturer, since the last surveillance visit, has maintained strict compliance with all items reported in the Schedule and demonstrated, with objective evidence (e.g. through the absence of major non-conformities during previous audits), the correct implementation of the EWF MCS.

Advantages for the Manufacturers in getting a certification against the EWF MCS, can be summarised as follows:

- welded products are differently treated according to the specific needs of their welding fabrication process;
- manufacturers are guided to satisfy harmonised European Directives' requirements through implementation of the Scheme;
- the specific areas of competence (for Personnel and Companies) are explicitly encompassed and registered in the Schedule;
- manufacturers can get visibility through the Register ([www.efw.be](http://www.efw.be)) of Certified Companies.

This Document describes the EWF Guidelines for a Manufacturer of welded products willing to implement a fabrication process management system which takes care of the quality of the welded product, the environmental impacts in the working and surrounding areas and the health and safety of the personnel involved.

It must be borne in mind that, although it has many advantages, certification is voluntary and does not, in itself, meet the statutory requirements in terms of compliance with a European Directive. Such compliance can only be confirmed through a Notified Body.

Furthermore many countries have statutory requirements for the control of occupational Health and Safety. Certification under the scheme described in Part 3 of this document may not necessarily guarantee compliance with those requirements.

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## **Part 1: Product Supplements concerning the fabrication of steel and aluminium structures**

### **1. Introduction and use**

In the framework of the EWF EN ISO 3834 Certification Scheme, the present Supplement concerns the fabrication of steel and aluminium structures for the construction of buildings and any other kind of civil engineering works. It has been produced as the expression of best practice manufacturing procedures, already shared by the main European manufacturers and customers.

Although this Supplement refers to steel and aluminium structures in general, the supplementary requirements reported are particularly focused on the European fabrication system, that is the Construction Product Directive – CPD – 89/106/CEE and one of its relevant supporting product standard (prEN 1090: Execution of steel and aluminium structures).

This Supplement may be used both in the fabrication process management (the fulfilment of the supplementary requirements helps the Manufacturer to cope with the relevant CPD regulatory requirements) and in the assessment of manufacturers, in the specific field of application.

An advantageous aspect with the Construction Product Directive (89/106/EEC- CPD) is related to the conformity assessment procedure being required (procedure 2+ for the product “Structural Metallic Construction Members”). Such a procedure requires the certification, by a Notified Body, of the Manufacturer’s factory production control through an assessment focused on the specific fabrication process adopted. Such an assessment, for all welding and allied technologies, can conveniently be achieved by making reference to the EWF EN ISO 3834 Certification Scheme.

Within the Supplement, the proposed supplementary requirements allow Manufacturers to keep most of their own technical practices while achieving a commonly recognised quality level for their products.

In order to properly define the supplementary requirements, four “execution classes” are considered for manufacturers, based mainly on the safety relevance of the structural components; the higher the safety relevance, the more comprehensive the requirements (see prEN 1090 part 1 and 2 for detail).

According to the execution class, the following parts of EN ISO 3834 apply:

- EXC1: Part 4 "Elementary quality requirements";
- EXC2: Part 3 "Standard quality requirements";
- EXC3 and EXC4: Part 2 "Comprehensive quality requirements".

For an easier comprehension of the document in the following paragraphs only reference to EN ISO 3834-2 is proposed; in any case the supplementary requirements can be considered also for part 3 and part 4 as applicable.

## **2. Supplementary requirements**

The requirements of this Supplement are to be considered as an integration to those already contained in EN ISO 3834 and in the relevant EWF MCS interpretative document (i.e. EWF 636).

### *2.1 Welding personnel (Ref. EN ISO 3834-2 clause 7.)*

#### *2.1.1 Welders and welding operators (Ref. EN ISO 3834-2 clause 7.2)*

Welders and welding operators shall be properly qualified: this shall apply to shop and site welders and shall include operators welding temporary attachments and tack welds.

For welding hollow section lattice structures, welders shall also be qualified by a single-side welding test carried out on a branch connection (see prEN 1090-2 clause 7.4.2)

#### *2.1.2 Welding Co-ordination (Ref. EN ISO 3834-2 clause 7.3)*

Co-ordination personnel shall have a technical knowledge according to EN ISO 14731 with a level of knowledge (Comprehensive, Standard or Basic) dependent on the execution class and the steel grade involved in the fabrication process.

Reference shall be made to prEN 1090-2 clause 7.4.3 for steel structures and to prEN 1090-3 clause 7.4.4 for aluminium structure.

### *2.2 Qualification of the Welding Procedures Specification (Ref. EN ISO 3834-2 clause 10.3)*

#### *2.2.1 Steel structure*

The welding procedures specification shall be qualified according to the relevant standard as specified in prEN 1090-2 clause 7.4.1.

If a welding procedure specification has been qualified by means of a welded test piece (e.g. according to EN ISO 15614-1) additional requirements apply as specified in prEN 1090-2 clause 7.4.1.2.

Any welding procedure specification qualification has a limited validity in terms of time: what referred to in prEN 1090-2 clause 7.4.1.4 applies.

#### *2.2.2 Aluminium structure*

The welding procedures specification shall be qualified according to the relevant standard as specified in prEN 1090-3 clause 7.4.1.

If a welding procedure specification has been qualified by means of a welded test piece (e.g. according to EN ISO 15614-2) additional requirements apply as specified in prEN 1090-3 clause 7.4.1.

Any welding procedure specification qualification has got a limited validity in terms of time: what referred to in prEN 1090-2 clause 7.4.2 applies.

### 2.3 *Welding consumables (Ref. EN ISO 3834-2 clause 11)*

The welding consumables, to be mentioned in the welding procedure specification, are chosen by the manufacturer in order to satisfy all design, fabrication and service conditions; in particular the weld metal fitness must be evaluated in combination with the parent metal, with reference to possible fracture mechanics, fatigue and corrosion phenomena that can arise during the whole expected service period of the steel structure.

Welded joints operating in atmospheric corrosion conditions, should be produced with filler metals having a chemical analysis similar to that relevant to the base materials (normally containing some atmospheric corrosion resistant elements, such as Cr, Ni, etc), a part from those build up with only one pass.

The delivery conditions should be in conformity to EN 13479 – 1.

The conditioning, preservation and handling of the welding consumables must be regulated through a written procedure, prepared by the manufacturer, in accordance with the welding consumable producer, and quoted in the welding procedure.

The manufacturer must verify that the welding consumables are in conformity with the applicable requirements and must request from the producer the appropriate documentation demonstrating such a conformity.

The Manufacturer shall insert into the technical file the identifying documents of the welding consumables, used for the fabrication of each steel structure.

### 2.4 *Post weld heat treatment (Ref. EN ISO 3834-2 clause 13)*

Even if welded steel structures do not normally undergo any post weld heat treatment, at times specific parts can need to be heat treated, during or after completion, due to their structural complexity or particular service conditions.

When required the Post Weld Heat Treatment (PWHT) shall be performed in accordance with a written procedure describing and defining the parameters considered as critical for the process itself. When applicable, in addition to the type of heat treatment (furnace or localised), heating speed, maintenance temperature and time, cooling speed (with the relevant variability range) and also the following conditions shall be properly defined:

- heating methods (gas, resistance, induction, etc.);
- type and location of thermocouples on the piece;
- fixing methods of thermocouples on the piece;
- position of thermocouples in the furnace;
- highest allowed temperature difference, among thermocouples, during heating, maintenance and cooling;
- technical personnel qualification.

The written procedure shall indicate also the precautions to be adopted when the heat treatment deals with:

- specific conditions as for: complexity of the structure, restraint, rigidity, overall dimensions, overlapping with previously treated areas, etc.
- very long heat treatment times (tens of hours);
- repetition of the heat treatment.

The equipment used for the heat treatment shall be suitable to the purpose and shall permit the temperature control with adequate accuracy and uniformity.

The Post Weld Heat Treatment shall be recorded by the Manufacture.

## 2.5 *Inspection and testing (Ref. EN ISO 3834-2 clause 14)*

### 2.5.1 Preheating

When tack welds are to be performed, due to the very localized thermal intervention, the preheating temperature to apply should be that foreseen for the relevant joint increased by 25°C.

### 2.5.2 Welding inside hole and slot

Due to the delicacy of this type of welding, given the objective execution difficulty, a documented procedure should be produced where weld shape and dimension, welding process and relevant techniques, foreseen NDT are defined.

## 2.6 *Material identification and traceability (Ref. EN ISO 3834-2 clause 17)*

When required, the steel structure Manufacturer shall have and maintain an Identification and Traceability System for materials subject to heavy static or dynamic loads and those welded thereto. This includes the use of welding consumables.

All materials and those welded thereto, together with their relevant certification, shall be checked upon receipt, to verify, at least:

- b) all markings required to be imposed, by the relevant material specification, and the traceability between the actual markings and those recorded on the material certification.
- c) all properties required to be reported, by the relevant material specification, and the correspondence of the reported results to the related requirements.

Material traceability to the original identification markings should follow one or more of the following paths:

- a) accurate transfer of the original identification markings to a location where the markings will be visible on the completed equipment;
- b) identification by a coded marking traceable to the original required marking;
- c) recording the identification markings using material lists or as built sketches which assure identification of each piece of material during fabrication and subsequent identification in the completed equipment;
- d) recording of the batch numbers of welding consumables.

Materials which cannot be stamped or which will not be visible after the equipment is completed or for small multiple parts, the Manufacturer may operate a documented system which ensures material traceability for all materials in the completed equipment.

## **Part 2: Product Supplements concerning the fabrication of pressure equipment**

### **1. Introduction and use**

In the framework of the EWF EN ISO 3834 Certification Scheme, the present Supplement concerns the fabrication of pressure equipment. It has been produced as the expression of best practice in manufacturing procedures, already shared by the main European Manufacturers and Customers.

Although this Supplement refers to pressure equipment in general, the supplementary requirements reported are particularly focused on the European fabrication system, that is the Pressure Equipment Directive – PED - 97/23/EC and its relevant supporting product standards that is:

- EN 13445: Unfired Pressure Vessels;
- EN 13480: Metallic Industrial Piping;
- EN 12952: Water-Tube Boilers and Auxiliary Installations;
- EN 12953: Shell Boilers.

This Supplement may be used both in the fabrication process management (the fulfilment of the supplementary requirements helps the Manufacturer to cope with the relevant PED regulatory requirements) and in the assessment of Manufacturers, in the specific field of application.

An advantageous aspect with the Pressure Equipment Directive (97/23/EC – PED) is that concerning the conformity assessment procedures (modules in PED) which refer to the fabrication process management.

In such a context, to guarantee the pressure equipment conformity to the PED requirements, the Manufacturer shall apply a fabrication management system focused on:

- the production quality (modules D and D1);
- the product quality (modules E and E1);
- the full manufacturing quality (modules H and H1).

The Manufacturer must produce all technical information relevant to the pressure equipment under construction and all documentation relevant to the specific quality management system; that is, when applicable according to the reference module, an adequate description of:

- the specific fabrication process with all relevant operational procedures and the envisaged sequence (before, during and after the product completion);
- the documentation relevant to quality (such as: approvals for materials, operational procedures and personnel, calibration and/or validation reports, inspection reports, etc.);
- the foreseen actions to control the management system efficiency.

With these modules, the assessment by a Notified Body, can conveniently be achieved, for all welding and allied technologies, making reference to the EWF EN ISO 3834 Certification

Within the Supplement, the proposed supplementary requirements allow Manufacturers to keep most of their own technical practices while achieving a commonly recognised quality level for their products.

A great importance has been recognized to personnel competence, intended as a combination of knowledge and experience, being convinced that no management system can be successful in manufacturing without an appropriate specific technical competence. According to that, the Welding Coordinator has become the real “key” element around whom all the welding production process works.

For an easier comprehension of the document in the following paragraphs only reference to EN ISO 3834-2 is proposed; in any case the supplementary requirements can be considered also for part 3 and part 4 as applicable.

## **2. Supplementary requirements**

The requirements of this Supplement are to be considered as an integration to those already contained in EN ISO 3834 and in the relevant EWF MCS interpretative document (i.e. EWF 636). Only those product standard which requires supplementary conditions for the specific items of EN ISO 3834, are reported in the following.

### *2.1 Welding personnel (Ref. EN ISO 3834-2 clause 7)*

#### *2.1.1 Welders and welding operators (Ref. EN ISO 3834-2 clause 7.2)*

In case of unfired pressure vessel (ref. EN 13445-4)

Any welders not in the employ of the manufacturer may be used provided they are under the full technical control of the manufacturer and work to the manufacturer's requirements

In case of water-Tube Boilers and Auxiliary Installations (ref. EN 12952-5 clause 8.3.2 and EN 12952-6 clause 7 and annex A)

Welders and welding operators approval shall be carried out in accordance with EN 287-1, 4.2.1 and 4.2.2 of EN 1418 respectively (see clause 7 of EN 12952-6).

Welders involved in the butt welding of tube lined with a dissimilar metal shall be approved in accordance with the requirements of EN 287-1, 4.2.1 and 4.2.2 of EN 1418 respectively. In addition, any special requirements recommended by the tube manufacturer shall be taken into consideration. The approval shall have been carried out using lined tubing complying with the same specification as the tubing to be used on the boiler.

When a welder or and welding operator is approved according to EN 287-1 or EN 1418:1997, 4.2.1 and 4.2.2, as appropriate, for the welding of butt welds, no additional approval shall be required for the welding of branches, nozzles or attachments, provided that the welding operations are carried out in the range of approval of the welder or and welding operator approval given in EN 287-1 or EN 1418:1997, 4.2.1 and 4.2.2 as appropriate..

In case of Shell Boilers (ref. EN 12953-4)

For category II, III and IV boilers, all welders or welding operators shall be approved. For category I boilers, approval shall not be mandatory.

## 2.2 Welding and related activities (Ref. EN ISO 3834-2 clause 10)

### 2.2.1 Qualification of welding procedure specifications (WPQR)

In case of unfired pressure vessel (ref. EN 13445-4 clause 7.3)

For the pressure retaining welds of a pressure equipment this shall be achieved by performing welding procedure approval tests in accordance with EN ISO 15614 or by pre-production tests in accordance with EN ISO 15613

In addition to the requirements of EN ISO 15614 the following tests shall apply.

- a) For test plates on butt joints equal to and over 20 mm thickness a longitudinal weld tensile test having a minimum diameter equal to and over 6 mm shall be performed in accordance with EN 876:1995 and  $R_{eT}$ ,  $R_m$  and  $A_5$  shall satisfy specified requirements of the base material or other relevant values specifically taken into account in the design (e.g. austenitic filler metal in 9 % Nickel steel).

Where the design temperature is higher than 300 °C then the test shall be done at the design temperature.

Special consideration should be given where the mechanical properties of the weld are below the base materials by design, e.g. 9 % Ni steels welded with austenitic filler metal.

- b) a micro examination shall be performed for material groups 8.2 and 10 in accordance with EN 13445, Table A.1.1-1:
- requirements on welds, material group 8.2: the micro examination shall show adequate microstructure.  
Occasional isolated micro fissures with a length of 1.5 mm may be acceptable, but should be reported.
  - requirements on welds, material group 10: the micro examination shall show adequate microstructure
  - the ferrite content in the heat affected zone (HAZ) shall be between min. 30 % and max. 70 %. In the high temperature HAZ, a distance of about two times the grain size from the fusion line, the ferrite content shall be equal to or less than 85 %. Where the welding consumable used are of an austenitic-ferritic matching type the ferrite content in the weld metal shall also be between 30 % and 70 %. The ferrite content shall be measured by metallographic methods. If the welding consumables are of non-matching type (i.e. austenitic) the requirement for ferrite content in the weld metal does not apply<sup>1</sup>.
- c) Impact test: the testing and the acceptance criteria shall conform to EN ISO 15614; in addition, the impact test requirements in accordance with EN 13445-2, Annex B shall apply.

For welds other than pressure retaining welds directly attached to the pressure vessels e.g. tray rings, support feet, etc. welding procedure specifications may be acceptable by holding welding procedure approval records carried out in accordance with EN ISO 15611 and EN ISO 15612.

In case of piping system (ref. EN 13480-4 clause 9.3)

The suitability of the intended welding processes shall be verified on the basis of a welding procedure approval in accordance with the following.

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<sup>1</sup> The limit deviation on metallographic measurements frequently are of the order of  $\pm 5\%$ .

Piping class II, III	Welding procedures shall be approved in accordance with EN ISO 15614 and EN ISO 15613 by a third party
Piping class I	Welding procedures for the pressure envelope shall be approved in accordance with EN ISO 15614 and EN ISO 15613 as relevant unless the design specification specify that EN ISO 15612 and EN ISO 15611 is acceptable.
Piping class 0	Welding procedures in the pressure envelope shall be approved in accordance with EN ISO 15614, EN ISO 15613, EN ISO 15612 and EN ISO 15611. Welding procedures in non-pressure retaining parts shall be approved in accordance with EN ISO 15610.

In case of Water-Tube Boilers and Auxiliary Installations (ref. EN 12952-5)

Approval of fusion welding procedure specifications shall be carried out in accordance with N ISO 15614 and EN ISO 15613.

The welding procedures for the butt welding of tube lined with a dissimilar metal shall be in accordance with the requirements of EN ISO 15613. In addition, any special requirements recommended by the tube manufacturer shall be taken into consideration. The procedures shall be qualified using lined tubing complying with the same specification as the tubing to be used on the boiler.

Additional requirements referred to in clause 6 of EN 12952-6 apply.

In case of shell Boilers (ref. EN 12953-4)

For category II, III and IV boilers, all welding procedures shall be approved according to EN ISO 15614. For category I boilers, approval shall not be mandatory.

*2.3 Welding consumables (Ref. EN ISO 3834-2 clause 11)*

The welding consumables, to be mentioned in the welding procedure specification, are chosen by the Manufacturer in order to satisfy all design, fabrication and service conditions; in particular the weld metal fitness must be evaluated in combination with the parent metal, with reference to possible fracture mechanics, creep, fatigue and corrosion phenomena that can arise during the whole expected service period of the pressure component.

Specifically the welded joints operating in creep regime are zones of discontinuity from metallurgical, tensional and geometric point of views. As a consequence the creep resistance of welded joints is normally reduced with regard to that relevant to the parent metal. Such a reduction increases with the difference between the filler and parent metal creep characteristics (mismatching) and with the metallographic modifications in the heat affected zone, due to the heat input of the adopted welding procedure. Creep resistance reduction parameters for welded joints (normally in the range 0,5-1) have generally a trend more than a design significance and other considerations, based on bibliographic and/or experimental data, should validate the choice to be adopted.

The conditioning, preservation and handling of the welding consumables must be regulated through a written procedure, prepared by the Manufacturer, in accordance with the welding consumable producer, and quoted in the welding procedure.

The Manufacturer must verify that the welding consumables are in conformity with the applicable requirements and must request from the producer the appropriate documentation demonstrating such a conformity.

The Manufacturer shall insert into the technical file the identifying documents of the welding consumables, used for the fabrication of each pressure component.

#### 2.4 *Post weld heat treatment (Ref. EN ISO 3834-2 clause 13)*

Post Weld Heat Treatment (PWHT) shall be performed in accordance with a written procedure describing and defining the parameters considered as critical for the process itself.

When applicable, in addition to the type of heat treatment (furnace, localised, by hot air, etc.), heating speed, maintenance temperature and time, cooling speed (with the relevant variability range) and also the following conditions shall be properly defined:

- heating methods (gas, resistance, induction, etc.);
- type and location of thermocouples on the piece;
- fixing methods of thermocouples on the piece;
- position of thermocouples in the furnace;
- highest allowed temperature difference, among thermocouples, during heating, maintenance and cooling;
- technical personnel qualification.

The written procedure shall indicate also the precautions to be adopted when the heat treatment deals with:

- clad materials;
- materials with different high temperature characteristics;
- specific conditions as for: restraint, rigidity, overall dimensions, overlapping with previously treated areas, etc.
- very long heat treatment times (tens of hours);
- repetition of the heat treatment.

The Post Weld Heat Treatment could have to be carried out even if the welded thicknesses are lower than those indicated the as a minimum in the reference product Standards, and this when, during the service, specific phenomena supported by significant level of stresses (e.g. stress corrosion cracking, hydrogen attack, etc) can occur.

The equipment used for the heat treatment shall be suitable to the purpose and shall permit the temperature control of the pressure retaining parts with adequate accuracy and uniformity, especially with materials having a small permissible temperature range.

The Post Weld Heat Treatment of pressure equipment shall be recorded by the Manufacturer. The CEN Report (CR) ISO 17663 gives useful information concerning quality control of the post weld heat treatment.

#### 2.5 *Material identification and traceability (Ref. EN ISO 3834-2 clause 17)*

When required, the pressure equipment Manufacturer shall have and maintain an Identification and Traceability System for materials subject to stress due to pressure and those welded thereto. This includes the use of welding consumables.

All pressure retaining materials and those welded thereto, together with their relevant certification, shall be checked upon receipt, to verify, at least:

- a) all markings required to be imposed, by the relevant material specification, and the traceability between the actual markings and those recorded on the material certification.
- b) all properties required to be reported, by the relevant material specification, and the correspondence of the reported results to the related requirements.

Material traceability to the original identification markings should follow one or more of the following paths:

- a) accurate transfer of the original identification markings to a location where the markings will be visible on the completed equipment;
- b) identification by a coded marking traceable to the original required marking;
- c) recording the identification markings using material lists or as built sketches which assure identification of each piece of material during fabrication and subsequent identification in the completed equipment;
- d) recording of the batch numbers of welding consumables.

Materials which cannot be stamped or which will not be visible after the equipment is completed or for small multiple parts, the Manufacturer may operate a documented system which ensures material traceability for all materials in the completed equipment.

## **Part 3: Supplement concerning the fabrication of railway vehicles and components**

### **1. Introduction and use**

In the framework of the EWF EN ISO 3834 Certification Scheme, the present Supplement is concerned with the fabrication of railway vehicles and components. It has been produced as the expression of the best practice manufacturing procedures, already shared by the main European manufacturers and customers and it is based on prEN 15085 “Railway applications – Welding of railway vehicles and components”.

Within this Supplement, the proposed supplementary requirements allow manufacturers to keep most of their own technical habits while achieving a commonly recognised quality level for their products.

This Supplement may be used as a reference document both for the product manufacturing process and the manufacturers’ assessment, in the specific field of application.

In order to properly provide the supplementary requirements to comply with, four levels are considered for manufacturers of railway vehicles and components, based mainly, but not only, on the safety relevance of the products; the higher the safety relevance, the more comprehensive the requirements.

Table 1 provides references to identify the levels and gives a cross reference to the required part of EN ISO 3834 to comply with (see prEN15085-2 clause 4 and appendix A for detail).

<b>LEVEL 1</b>	<b>LEVEL 2</b>	<b>LEVEL 3</b>	<b>LEVEL 4</b>
New build, conversion and repair of rail vehicles and relevant components with high safety relevance	New production of parts of railway vehicles with medium safety relevance	New production of parts of railway vehicles with low safety relevance	Design and/or assembly of railway vehicles and relevant components with high, medium or low safety relevance, when welding activities are sub-contracted.
EN ISO 3834 – 2	EN ISO 3834 – 3	EN ISO 3834 – 4	According to the safety relevance of the product (see Levels 1, 2, 3)

Table 1 – Manufacturer Level

For an easier comprehension of the document in the following paragraphs only reference to EN ISO 3834-2 is proposed; in any case any supplementary requirements can be considered also for part 3 and part 4 if applicable.

## **2. Supplementary requirements**

The requirements of this Supplement are to be considered as an integration to those already contained in EN ISO 3834 and in the relevant EWF MCS interpretative document (i.e. EWF 636).

### *2.1 Subcontracting (Ref. EN ISO 3834-2 clause 6)*

Subcontractors shall be in compliance with the requirements of this Supplement in order to assure the required quality level for the products according to the appropriate qualification level.

The main manufacturer, responsible for the products delivered to the final customer, shall have evidence that subcontractors are able to guarantee the requested quality performances on the products and to manage the process in accordance with this document and contractual requirements.

Manufacturers shall conduct audits on subcontractors, unless they are certified according to the EWF EN 3834 Certification Scheme, integrated with the present Supplement. However if the Manufacturer is qualified at level 3, a final inspection on delivery conditions is sufficient. Assessment and/or checking activities shall be registered, if requested.

### *2.2 Welding personnel (Ref. EN ISO 3834-2 clause 7.)*

#### *2.2.1 Welders and welding operators (Ref. EN ISO 3834-2 clause 7.2)*

Welders and welding operators shall be properly qualified according to prEN 15085-2 clause 5.1.1. Moreover, for weld seams requiring special dexterity or not properly specified in EN ISO 3834-5 referenced standards, additional test specimens are necessary to qualify welders (see next clause 2.4.3).

#### *2.2.2 Welding Co-ordination (Ref. EN ISO 3834-2 clause 7.3)*

Co-ordination personnel shall have a technical knowledge according to EN ISO 14731 with a knowledge (Comprehensive, Standard or Basic) dependent on the level referred to in previous clause 1, table 1. Reference shall be made to prEN 15085-2 clause 5.1.2, 5.1.3 and 5.3 and annex C.

### *2.3 Welding activities (Ref. EN ISO 3834-2 clause 10)*

Welding planning documents shall be prepared by manufacturers with the assistance of the Authorised Welding Co-ordinator for fabrication, converting and maintenance of railway vehicles and components.

#### *2.3.1 Production planning (Ref. EN ISO 3834-2 clause 10.1)*

For the fabrication of railway vehicles and components it is necessary to have operation lay-out sheets at least for the following sub-assemblies:

- bogie (sub-assemblies, assembly);
- under-frame (with sub-assemblies);
- body (side wall, end wall, roof);

- further sub-assemblies with high safety and functional requirements (e.g. cardan shafts, brake cross members, motor housing, hollow shaft drive, drawbar coupling, bogie pivot pin, cross bearer).

For more complicated assemblies, welding sequence plans can be necessary, e.g. for the following:

- bogies (bogie polster, bogie centre plate including bogie pivot pin member, solebar, headstock, bogie pivot pin cross member, traction bar coupling, assembly of solebar and cross member);
- under-frame (including cross member, solebar, headstock, bogie pivot pin cross member, traction bar coupling).

However, standardised welding sequence plans (that apply for different types of vehicles) are also allowed.

Other welding planning documents may be necessary (e.g. tacking sequence plans, repairing plans, test plans, documents for jigs and tools, inspection documents for non-destructive tests, remarks for protection of workers and health, plans for guaranteeing of damaged parts, special instructions for electronic parts).

The recommendations of EN 1011 shall be observed during the welding activities.

#### 2.3.2 Qualification of the Welding Procedures (Ref. EN ISO 3834-2 clause 10.3)

WPSs shall be qualified according to the appropriate standard. Reference to prEN 15085-2 clause 5.4 and annex C shall be made.

#### 2.4 Inspection and testing (Ref. EN ISO 3834-2 clause 14)

Pre- or in-production tests may be necessary:

- to check and ensure the feasibility of the design;
- to verify the quality requirements of the welds;
- to demonstrate the qualification of the welders.

Reference to prEN 15085-4 clause 4.1 and 4.2 shall be made.

##### 2.4.1 Test specimens to check the design feasibility.

Test specimens shall be welded as sub-assembly samples. They are necessary to demonstrate:

- practicability (design which is convenient for welding);
- feasibility of testing;
- quality requirements.

##### 2.4.2 Test specimens to verify the quality requirements of the welds.

In the case of joints which are not included in the relevant standard for WPS qualification, test specimens are recommended, for example, in case of:

- partial penetration butt and T joints (to demonstrate that the required penetration has been achieved);
- HV seams on T joints with single side accessibility;
- to verify the quality requirements of the weld, if X-ray or ultrasonic inspection are requested but not feasible (e.g. for bad accessibility or joint configuration).

#### 2.4.3 Test specimens to demonstrate the qualification of the welders.

Work specimens for the qualification of welders (depending on their specific tasks) are necessary for:

- fillet welds;
- HV and HY seams on T butt joints;
- welds with several degrees of difficulty (e.g. three plate butt welds, hole welds, cross weld, complicated extrusion profiles);
- welds under complicated conditions e.g. repairing;
- bad accessibility;
- materials with a poor base metal weldability;
- pipe branches and pipe collars;
- overlap seams and corner seams in thin sheets ( $t \leq 3$  mm);
- especially high quality requirements, e.g. parts with high safety relevance (see Appendix A)
- when taking on new welders or welding operators (e.g. staff on loan).
- non-conformities classified as “important” if having an impact on normal operation;
- non-conformities classified as “secondary” if not included in the two above cases.