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Railway applications - Welding of railway vehicles and components - Part 4: Production requirements

Bahnanwendungen - Schweißen von Schienenfahrzeugen und -fahrzeugteilen - Teil 4: Fertigungsanforderungen

Applications ferroviaires - Soudage des véhicules et des composants ferroviaires - Partie 4: Exigences de production

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Railway applications - Welding of railway vehicles and components - Part 4: Production requirements

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 256.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (prEN 15085-4:2020) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 15085-4:2007.

This series of European Standards EN 15085 “Railway applications – Welding of railway vehicles and components” consists of the following parts:

— Part 1: General;

— Part 2: Requirements for welding manufacturers;

— Part 3: Design requirements;

— Part 4: Production requirements;

— Part 5: Inspection, testing and documentation;

— Part 6: Maintenance welding requirements.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, B, C or D, which is an integral part of this document.

Introduction

Welding is a special process in the manufacture of railway vehicles and their parts. The required provisions for this process are laid down in the standards series EN ISO 3834. The basis of these provisions are the basic technical welding standards in respect of the special requirements for the construction of railway vehicles.

This document is aimed at defining the terms of enforcement applicable to European Standards, it should not be construed as a substitute to these standards.

This document can also be used by internal and external parties to assess the organization's ability to meet customer, regulatory, and the organization's own requirements.

1 Scope

This document describes the production requirements (i.e. preparation and execution) of the welding work.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1011 (all parts), *Welding — Recommendations for welding of metallic material*

EN 287-6, *Qualification test of welders - Fusion welding - Part 6: Cast irons*

EN 10204, *Metallic products - Types of inspection documents*

EN 13479, *Welding consumables - General product standard for filler metals and fluxes for fusion welding of metallic materials*

EN 14532-1, *Welding consumables - Test methods and quality requirements - Part 1: Primary methods and conformity assessment of consumables for steel, nickel and nickel alloys*

EN 14532-2, *Welding consumables - Test methods and quality requirements - Part 2: Supplementary methods and conformity assessment of consumables for steel, nickel and nickel alloys*

EN 15085-1, *Railway applications — Welding of railway vehicles and components — Part 1: General*

EN 15085-3:2007, *Railway applications — Welding of railway vehicles and components — Part 3: Design requirements*

EN 15085-5, *Railway applications - Welding of railway vehicles and components - Part 5: Inspection, testing and documentation*

EN ISO 544, *Welding consumables - Technical delivery conditions for filler materials and fluxes - Type of product, dimensions, tolerances and markings (ISO 544:2017)*

EN ISO 4063:2010, *Welding and allied processes — Nomenclature of processes and reference numbers*

EN ISO 9606 (all parts), *Qualification test of welders — Fusion welding*

EN ISO 14555, *Welding - Arc stud welding of metallic materials (ISO 14555)*

EN ISO 14732, *Welding personnel - Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials (ISO 14732)*

EN ISO 15609 (all parts), *Specification and qualification of welding procedures for metallic materials — Welding procedure specification*

EN ISO 15613, *Specification and qualification of welding procedures for metallic materials - Qualification based on pre-production welding test (ISO 15613)*

EN ISO 15614-(all parts),[1] *Specification and qualification of welding procedures for metallic materials — Welding procedure test*

EN ISO 15620, *Welding - Friction welding of metallic materials (ISO 15620)*

EN ISO 17652-1, *Welding - Test for shop primers in relation to welding and allied processes - Part 1: General requirements (ISO 17652-1)*

EN ISO 17652-2, *Welding - Test for shop primers in relation to welding and allied processes - Part 2: Welding properties of shop primers (ISO 17652-2)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 15085-1 apply.

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

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

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

4 Preparation before welding

4.1 Welding planning documents

4.1.1 General

Welding planning documents shall be prepared by the manufacturer with the assistance of the responsible welding coordinator. Type, scope and time of the submission and inspection should be defined in the technical specification.

Welding planning documents may include working plans, welding sequence plans, test planning documents, and welding procedure specifications.

Design documents of welded components shall be checked by the responsible welding coordinator or one of his deputies about their suitability. If necessary – the design documents can be adapted for the manufacturing under the supervision of the responsible welding coordinator, e.g. by changing chamfer angle of the weld preparation to achieve the required weld quality.

The following changes shall not be done without a permission of the design office:

— weld type;

— weld performance class;

— weld inspection class;

— base material;

— properties of the weld metal;

— reduction of weld throat thickness;

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[1] For railway applications, only EN ISO 15614-1, EN ISO 15614-2, EN ISO 15614-3, EN ISO 15614-4, EN ISO 15614-7, EN ISO 15614-11, EN ISO 15614-12, and EN ISO 15614-13 are relevant.

— location of the weld;

— addition of welded joints;

— elimination of welded joints.

After a successful check and possible adaptation, the design documents can be included in the welding planning documents. The weld preparation should be finally defined during design review and this definition shall be documented.

4.1.2 Working plans

For the production of railway vehicles, it is necessary to have working plans for the following sub-assemblies:

— bogie (sub-assemblies, assembly);

— underframe (with sub-assemblies);

— car body components (side wall, end wall, roof);

— car body assembly;

— 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).

4.1.3 Other welding planning documents

For more complicated assemblies welding sequence plans may be necessary to reduce residual stresses or deformation and shrinkage or to avoid missing welds e.g. for:

— bogie frames and their components, and

— underframes and their components.

Standardized welding sequence plans (that applies for different types of components) are also allowed.

Furthermore, other welding planning documents may be necessary (e.g. tacking sequence plans, repairing plans, documents for jigs and tools, plans for separating of damaged parts, special instructions for electronic parts). These details shall be determined by the responsible welding coordinator and/or the customer.

The test plan shall be done in accordance with EN 15085-5:2007, Clause 6.

4.1.4 Welding procedure specification

For weld performance classes CP B1, CP B2, CP C1, CP C2 or CP C3 each weld shall be covered by WPS according to the relevant part of EN ISO 15609, EN ISO 14555 or EN ISO 15620.

For weld performance class CP D a welding instruction shall exist.

For weld performance classes CP B1, CP B2, CP C1 or CP C2 an evidence by WPQR according to EN ISO 15613, to EN ISO 15614 series, for EN ISO 15614-1 only level 2 is applicable, to EN ISO 14555 or to EN ISO 15620 shall be given. When tests as described in the mentioned standards do not provide information on the mechanical properties of the joint, and these properties are relevant to the application, an additional qualification shall be carried out on a butt weld.

If changes in EN ISO 15614 series appear regarding range of validity and testing, the requirements of the level should apply, which is comparable the requirements of the latest version of EN ISO 15614 in use in 2018.

For weld performance class CP C3 all standards for the qualification of welding procedure according to EN ISO 15607 and EN ISO 14555 are permitted.

For fillet welds a separate fillet weld qualification is necessary.

The manufacturer shall have a written procedure detailing how to manage the welding procedure qualification process.

All WPS shall be verified and authorized for use by the responsible welding coordinator or by the welding coordinator in charge.

4.1.5 Training and qualification of welders and operators

The manufacturer shall have welders and welding operators with qualification in accordance with series of standard EN ISO 9606, with EN 287-6, with EN ISO 14555 or with EN ISO 14732. Additionally they should be trained for tasks, which they do in the workshop.

The manufacturer shall have a list of the valid qualification of its welders and welding operators.

The welders and operators shall follow the instructions of the welding coordinators of the manufacturer.

The manufacturer shall have an adequate number of qualified welders and operators. At least two welders or operators, who are employees of the manufacturer, for each welding process and welded material type are recommended.

For the application of EN ISO 9606 (series) in the production of railway vehicles the following rules shall be considered:

— For fillet welds a separate fillet weld qualification is necessary.

— The FW/BW – test sample according to EN ISO 9606-1:2017, Annex C isn't accepted.

In addition, welders and operators should be trained about the following issues:

— correct state of the welding equipment;

— availability and compliance of the welding planning documents with the welded component;

— conformity of joint preparations;

— conformity of welding consumables;

— if necessary: cleaning, preheating temperature, inter-pass temperatures, and post weld heat treatment;

— conformity of the weld relating to the drawing;

— ability to check the weld quality, which is required in accordance with the weld performance class;

— correct tack welding;

— content of 5.2 (see also applicable parts of EN 1011);

— working safety.

For welding of steel the validity of the qualification of welders shall be in accordance with EN ISO 9606-1:2017, 9.3 option a or b.

The manufacturer shall have a written procedure detailing how to manage the welder and operator qualification process.

All welders and operators shall be authorized to weld by a welding coordinator.

4.2 Production weld tests

4.2.1 General

4.2.1.1 Aims and objectives of production weld tests

Due to the complexity of many welded joints in railway vehicles, the responsible welding coordinator may decide carry out production weld tests to demonstrate that the required quality level can be, or has been, achieved.

The aims and objectives of (pre-) production weld tests are:

— to check and ensure that the design is suitable as specified in EN 15085-3 (see 4.2.2);

— to prove the welding procedure (see 4.2.3) for welded joints, which are not covered by the usual welding standards for the welding procedures qualification;

— to demonstrate the skill of the welders (see 4.2.4) for welded joints, which are not covered by the usual welding standards for the welder qualification;

— to ensure the integrity of the welded joint (see 4.2.5 to 4.2.10).

One production weld test can be used for several tasks indicated above.

4.2.1.2 Realization and amount of testing of production weld test

The production weld tests and the amount of testing shall be specified by the welding coordinator e.g. during design review or during manufacturing phase.

The production weld test shall be carried out under the same manufacturing conditions as the real product. They shall be carried out under the supervision of the responsible welding coordinator and they shall be documented.

The production weld tests may be welded separately as test plates, as sample sub-assemblies (mock-ups) or together with sub-assembly, for example, as an extension of the weld.

The production weld tests and the amount of testing should be listed in the test plan or specified by the welding coordinator.

The manufacturer shall have a written procedure detailing how to manage the execution of production weld tests.

All production weld test results shall be accepted by a welding coordinator.

The results of every production weld test shall be documented.

4.2.2 Production weld tests to check and ensure the design

Test specimens to demonstrate the weldability of the design should be welded as a sample sub-assembly during the design phase. They are necessary to demonstrate:

— practicability (design which is convenient for welding);

— selection of the material;