



BSI Standards Publication

# **Railway applications — Welding of railway vehicles and components**

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Part 6: Maintenance welding requirements

## National foreword

This British Standard is the UK implementation of EN 15085-6:2022.

The UK participation in its preparation was entrusted to Technical Committee RAE/3/-/11, Railway Applications - Structural requirements and Welding.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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© The British Standards Institution 2022  
Published by BSI Standards Limited 2022

ISBN 978 0 539 12492 7

ICS 25.160.10; 45.060.01

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2022.

**Amendments/corrigenda issued since publication**

Date

Text affected

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 15085-6**

October 2022

ICS 25.160.10; 45.060.01

English Version

**Railway applications - Welding of railway vehicles and components - Part 6: Maintenance welding requirements**

Applications ferroviaires - Soudage des véhicules ferroviaires et des pièces - Partie 6 : Exigences de soudage en maintenance

Bahnanwendungen - Schweißen von Schienenfahrzeugen und -fahrzeugteilen - Teil 6: Anforderungen für die schweißtechnische Instandsetzung

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## European foreword

This document (EN 15085-6:2022) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2023, and conflicting national standards shall be withdrawn at the latest by April 2023.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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 Standardization Request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s).

For relationship with EU Directive(s) / Regulation(s), see informative Annex ZA, which is an integral part of this document.

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## **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 is the basic technical welding standards with respect to the special requirements for the construction of railway vehicles.

This series of standards applies to welding of metallic materials in the manufacture and maintenance of railway vehicles and their parts.

It describes the control for the welding process for railway vehicles and their components for new manufacture and maintenance.

With respect to the railway environment, this series of standards defines the quality requirements for the welding manufacturer to undertake new building and repair work.

Components, parts and subassemblies are assigned a classification level, based on their safety relevance. According to these levels, qualifications for welding personnel of the manufacturer are specified.

This series provides an essential link between the weld performance class defined during design, the quality of the weld, and the demonstration of the required quality by inspection.

This series of standards does not deal with product qualification.

**NOTE** This series standard can also be used by internal and external parties, including certification bodies, to assess the organization's ability to meet customer, regulatory and the organization's own requirements.



## 1 Scope

This document defines the quality requirements as well as the design and production requirements for welding to be followed by manufacturers during maintenance or maintenance activities on railway vehicles and components.

## 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 13306:2017, *Maintenance — Maintenance terminology*

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

EN 15085-2:2020, *Railway applications — Welding of railway vehicles and components — Part 2: Requirements for welding manufacturer*

EN 15085-3: -<sup>2</sup>, *Railway applications — Welding of railway vehicles and components — Part 3: Design requirements*

EN 15085-4: -<sup>3</sup>, *Railway applications — Welding of railway vehicles and components — Part 4: Production requirements*

EN 15085-5: -<sup>4</sup>, *Railway applications — Welding of railway vehicles and components — Part 5: Inspection, testing and documentation*

EN 17018:2019, *Railway applications — Rolling stock maintenance — Terms and definitions*

EN ISO 3834-1:2021, *Quality requirements for fusion welding of metallic materials — Part 1: Criteria for the selection of the appropriate level of quality requirements (ISO 3834-1:2021)*

EN ISO 3834-2:2021, *Quality requirements for fusion welding of metallic materials — Part 2: Comprehensive quality requirements (ISO 3834-2:2021)*

EN ISO 3834-3:2021, *Quality requirements for fusion welding of metallic materials — Part 3: Standard quality requirements (ISO 3834-3:2021)*

EN ISO 3834-4:2021, *Quality requirements for fusion welding of metallic materials — Part 4: Elementary quality requirements (ISO 3834-4:2021)*

EN ISO 3834-5:2021, *Quality requirements for fusion welding of metallic materials — Part 5: Documents with which it is necessary to conform to claim conformity to the quality requirements of ISO 3834-2, ISO 3834-3 or ISO 3834-4 (ISO 3834-5:2021)*

EN ISO 15613:2004, *Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test (ISO 15613:2004)*

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<sup>1</sup> Under preparation. Stage at time of publication: prEN 15085-1:2021.

<sup>2</sup> Under preparation. Stage at time of publication: FprEN 15085-3:2022.

<sup>3</sup> Under preparation. Stage at time of publication: prEN 15085-4:2020.

<sup>4</sup> Under preparation. Stage at time of publication: prEN 15085-5:2020.

EN ISO 15614-1:2017, <sup>5</sup> *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2017, Corrected version 2017-10-01)*

EN ISO 15614-2:2005, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 2: Arc welding of aluminium and its alloys (ISO 15614-2:2005)*

EN ISO 15614-3:2008, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 3: Fusion welding of non-alloyed and low-alloyed cast irons (ISO 15614-3:2008)*

EN ISO 15614-4:2005, <sup>6</sup> *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 4: Finishing welding of aluminium castings (ISO 15614-4:2005)*

EN ISO 15614-7:2019, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 7: Overlay welding (ISO 15614-7:2016)*

EN ISO 15614-11:2002, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 11: Electron and laser beam welding (ISO 15614-11:2002)*

EN ISO 15614-12:2014, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 12: Spot, seam and projection welding (ISO 15614-12:2014)*

EN ISO 15614-13:2012, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 13: Upset (resistance butt) and flash welding (ISO 15614-13:2012)*

CEN ISO/TR 15608:2017, *Welding — Guidelines for a metallic materials grouping system*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 15085-1:-<sup>1</sup>, EN 17018:2019 and in EN 13306:2017 as well as the following 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/>

#### 3.1

##### **repair**

physical action taken to restore the required function of an entity treated either in position or removed

#### 3.2

##### **maintenance plan**

railway vehicle or component based structured document containing a set of planned maintenance activities and their maintenance interval limits based upon information in the maintenance manual

[SOURCE: EN 17018:2019, 3.1.4]

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<sup>5</sup> Document impacted by A1:2019.

<sup>6</sup> Document impacted by AC:2007.

### 3.3

#### **vehicle file**

collection of documents containing evidence to prove that the maintenance has been performed in accordance with the maintenance plan information on the vehicle configuration and other vehicle specific information

[SOURCE: EN 17018:2019, 3.1.10]

## **4 Quality requirements for welding during maintenance**

### **4.1 General**

For maintenance welding of railway vehicles and their components, EN 15085-4:-<sup>3</sup> shall be applied.

For maintenance welding all necessary information about the vehicle such as documentation of vehicle manufacturer (drawings, operation manuals, manufacturer requirements) as well as special guidelines and working instructions should be available.

If damage occurs repeatedly on similar components or if a maintenance welding activity introduces a change with respect to the original drawing, all involved parties shall be informed.

### **4.2 Welding coordination**

In addition to the experience requirements mandated by the classification level defined in EN 15085-2:2020, given the specific nature of maintenance welding, the responsible welding coordinator shall have experience in maintenance. This experience shall be proven by documentary evidence.

### **4.3 Conditions for welding**

#### **4.3.1 General**

All welding should be carried out within a suitable workshop. However, welding may be carried out outside a workshop providing the conditions given in 4.3.2 and 4.3.3 are satisfied.

#### **4.3.2 Welding outside a workshop**

Welding outside a welding workshop shall only be carried out if the following conditions are fulfilled:

- Welding shall be performed in accordance with EN 15085 (all parts).
- The environmental conditions (e.g. wind, rain, relative humidity, temperature, accessibility etc.) shall be taken into account to ensure the quality of the welding operation.
- The supporting documentation shall include any special conditions that shall be met in order to return the vehicle back to service.

#### **4.3.3 Welding to enable running for transfer purposes**

If welding is required only to ensure safe movement of a railway vehicle to the nearest appropriate workshop, it shall not be considered as a maintenance activity as defined in the scope of this standard.

A description of the welding activities undertaken, including the location of any additional welds, shall be documented to support any special conditions that shall be met in order to move the vehicle.

#### 4.4 Restrictions or prohibitions of welding

With the exclusion of original existing welds, welding is generally not allowed on the following components. If derogations from the prohibitions listed below are required, these shall be validated and documented during the design review and the responsibilities of the relevant personnel defined.

Where welding is permitted by a derogation, the details of the welding repair shall be documented and recorded in detail in the vehicle file.

- a) Monobloc wheels, wheels with separate tyres and spoked wheels;
- b) Rims, flanges;
- c) Axle bodies;
- d) Suspension arms, axle boxes, and parts of guiding of wheelset axles;
- e) Crank pins (in relation with connecting rod);
- f) Springs of all kind, suspension ring;
- g) Oscillation damper;
- h) Quenched components;
- i) Screw couplings;
- j) Welding of riveted assemblies;

The welding of bolt heads and nuts is not permitted without evidence of their weldability.

### 5 Design requirements for components manufactured prior to the implementation of EN 15085-3:-<sup>2</sup> or where no manufacturing drawings exist

#### 5.1 Determination of the applicable weld performance classes

The applicable weld performance class shall be defined, validated and documented during the design review. One of the following methods should be used:

- a) Based on the safety category of the weld

If the stress level of the weld is unknown, the highest possible weld performance class related to the safety category of the weld is used, see EN 15085-3:-<sup>2</sup>.

- b) By calculation

The weld performance class should be determined by calculation to determine the stress category and application of the safety category according to EN 15085-3:-<sup>2</sup>.

- c) Based on the classification level of the component

If the stress level and the safety category of the weld are unknown, the weld performance class is defined in accordance with Table 1.

**Table 1 — Weld performance class (CP), inspections class (CT) and supplementary testing requirements**

Classification level of the component (see EN 15085-2:2020)	Applicable weld performance class and inspection class
CL 1	If high safety category is suspected, CP B1 with CT 1 (If a volumetric test is not possible, a supplementary production weld test according to EN 15085-4:- <sup>3</sup> is necessary.)
	For medium and low safety categories, CP C2 with 100 % VT and 100 % MT or PT
CL 2	CP C2 with 100 % VT with test documentation
CL 3	CP C3 with CT 4

- d) By experimental stress measurements in service (i.e. application of strain gauges)

Experimental stress measurements are used to define the stress category and applied to the safety category to determine the weld performance class (see EN 15085-3:-<sup>2</sup>).

- e) By fatigue tests

Fatigue tests are performed using a simulated repair (mock-up) to determine its service behaviour and validate a previously defined weld performance class. The simulated repair should be representative of welding in production (i.e. the same welding conditions and quality level).

- f) Based on previous experience

For components welded according to national standards prior to the implementation of EN 15085, historical data may be used to validate their performance in service. In this situation, application of the historical data should be maintained. The inspection / testing applied under the current maintenance plan is used to define the inspection class according to EN 15085-5:-<sup>4</sup>.

## 5.2 Applicable testing requirements

Welded assemblies shall have the weld performance class (CP) determined according to the requirements of EN 15085-3:-<sup>2</sup>.

As a minimum for CL1 components, welding repairs on cracks and butt welded patch plates shall be subject to 100 % surface testing (MT or PT).

Maintenance welding shall be carried out according to the requirements of EN 15085-4:-<sup>3</sup>.

The level of inspection shall satisfy the requirements of EN 15085-5:-<sup>4</sup>.

## 6 Preparation before maintenance welding

### 6.1 Welding plans

Prior to the commencement of welding, documented weld plans shall be prepared and reviewed according to EN 15085-4:-<sup>3</sup>. These should include, but not be limited to the following:

- a) requirement / technical review according to the relevant part of EN ISO 3834;
- b) information relevant to welding from the vehicle file;
- c) information relevant to welding from the maintenance plan (e.g. frequency, type of repair, nature of the work and applicable weld performance class) or damage assessment report;

NOTE The requirements for maintenance plans are defined in EN 17023.

- d) repair and test plan (including NDT specifications / procedures);
- e) weld map and weld sequence plan (if required);
- f) qualified WPS and pre-production weld tests (if required) (see EN 15085-4:-<sup>3</sup>);
- g) welding instructions;
- h) serial or item number of the component part(s).

### 6.2 Additional production tests on welded assemblies

Where additional production weld testing is required EN 15085-4:-<sup>3</sup> shall be applied .

## 7 Additional Requirements

### 7.1 General

The following additional requirements shall be applied during the maintenance welding of railway vehicles and their components.

### 7.2 Weld performance class CP A

#### 7.2.1 General

The combination of high safety category and high stress category, which leads to weld performance class CP A, is a special class. It can only apply to welds with full penetration and full accessibility for inspection and, wherever possible, should be avoided. Where this is not possible, the activities required to manage the risk shall be defined and the following subclauses fulfilled.

#### 7.2.2 Welding procedure specification

Welding procedure specifications shall be qualified in accordance with the requirements of the relevant part of EN ISO 15614 or EN ISO 15613:2004 (with evidence of all applicable mechanical properties).

The weld acceptance criteria used for the welding procedure qualification test shall satisfy the requirements of EN 15085-3:-<sup>2</sup> for weld performance class CP A.

For aluminium and its alloys, the control of heat input is required.

### 7.2.3 Additional testing

For weld performance classes CP A, a production weld test shall be carried out according to EN 15085-4:-3. The weld acceptance criteria shall satisfy the requirements of EN 15085-3:-2 for weld performance class CP A.

### 7.2.4 Inspection and testing of welded joint

In the case of a combination of high safety category and high stress category, according to EN 15085-3:-2, appropriate volumetric tests should be performed on 100 % of the welds, to maximize the probability of detection of all types of imperfections.

For CP A, the quality levels for imperfections are defined in EN 15085-3:-2.

Maintenance plans shall integrate the monitoring of CP A welds.

## 7.3 Parent metals

### 7.3.1 Weldability of parent material - determination of material type/grade

The following rules shall be applied in order to determine the type / grade of material to be welded.

Before performing any maintenance or repair welding operation, the weldability of the material shall be established, therefore it is essential to know the type and grade of the materials being welded. This information can be obtained from available drawings or parts lists. If these are not available, then chemical analysis of the material shall be performed to determine its composition.

Welded replacement material shall be from the same material group (according to CEN ISO/TR 15608:2017) as the material originally used. The mechanical properties and chemical composition should be comparable. If this is not possible, then material with better mechanical properties may be used providing weldability is maintained.

For unknown parent metals (e.g. in historical vehicles and old freight wagons without available drawings or part lists), the capability of repair may be also demonstrated according to EN ISO 15611 based on experience of the maintenance of the vehicles or components. The experience of acceptable service behaviour shall be documented to validate the previous process.

For mounting elements where the steel is not fully killed (for example steel profiles manufactured before 1960), weldability shall be demonstrated case by case.

### 7.3.2 Steel with $\text{ReH} > 690 \text{ MPa}$ , cold rolled steel and aluminium

When a weld repair is performed outside of the original weld location, the effect of welding and the possible reduction in mechanical properties shall be validated during the design review.

In addition, the recommendations given in the series of EN 1011 should be considered.

### 7.3.3 Welding in cold formed areas

Welding in cold formed areas of material from groups 1.1, 1.2 and 1.4 according to CEN ISO /TR 15608:2017 can introduce ageing cracks or fragility. A design review should evaluate the need to implement a normalization heat treatment before welding.



## Annex ZA (informative)

### Relationship between this European Standard and the Essential Requirements of EU Directive 2016/797/EU aimed to be covered

This European Standard has been prepared under a Commission's standardization request "M/483 Mandate to CEN and CENELEC for Standardisation in the field of interoperability of the rail system" to provide one voluntary means of conforming to (parts of) Essential Requirements of Directive (EU) 2016/797 of the European Parliament and of the Council of 11 May 2016 on interoperability of the rail system (recast) as specified in the relevant technical specifications for interoperability (TSI).

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 for freight wagons and Table ZA.2 for locomotive and passenger RST confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive as specified in the technical specifications for interoperability (TSI), and associated EFTA regulations.

**Table ZA.1 — Correspondence between this European Standard, Commission Regulation (EU) N° 321/2013 concerning the Technical Specification for Interoperability (TSI) relating to the subsystem 'rolling stock – freight wagons' of the rail system in the European Union\* and Directive (EU) 2016/797**

Essential Requirements of Directive (EU) 2016/797	Clauses of the Annex to the Technical Specification for Interoperability (TSI)	Clause/ subclauses of this European Standard	Comments
Section 3 of the Annex to the TSI indicates the correspondence between the TSI clauses and the Essential Requirements of Directive (EU) 2016/797	4.5.3 Maintenance description file	6.1	6.1 includes requirements regarding documents for the preparation and execution of welding during maintenance as well as for the test of the welds. These documents are an integral part of the maintenance plan which is part of the maintenance description file.
ER 2.6.1 ER 2.6.2	Not explicitly covered by the TSI.	4.2	Sub-Clause 4.2 includes requirements regarding the special professional competencies of the responsible welding coordinator and therefore closes a gap regarding the professional competencies of staff for the process of welding during maintenance.

\* As amended by Commission Regulation (EU) No 1236/2013, Commission Regulation (EU) 2015/924, Commission Implementing Regulation (EU) 2019/776 and Commission Implementing Regulation (EU) 2020/387

NOTE The Technical Specification for Interoperability (TSI) can refer to other clauses of this standard making the application of those clauses mandatory. Possible references to such clauses are found in the Appendix D to the TSI.



**Table ZA.2 — Correspondence between this European Standard, the Commission N 1302/2014 concerning the technical specification for interoperability relating to the subsystem ‘rolling stock — locomotives and passenger rolling stock’ of the rail system within the European Union and Directive (EU) 2016/797\***

Essential Requirements of Directive (EU) 2016/797	Clauses of the Annex to the Technical Specification for Interoperability (TSI)	Clauses/ subclauses of this European Standard	Comments
Section 3 of the Annex to the TSI indicates the correspondence between the TSI clauses and the Essential Requirements of Directive (EU) 2016/797	4.2.12.3.2 Maintenance description file	6.1	
	4.5. Maintenance rules, (4)	6.1	6.1 includes requirements regarding documents for the preparation and execution of welding during maintenance as well as for the test of the welds. These documents are the basis for the activities and procedures for welding during maintenance.
ER 2.6.1 ER 2.6.2	Not explicitly covered by the TSI.	4.2	Sub-Clause 4.2 includes requirements regarding the special professional competencies of the responsible welding coordinator and therefore closes a gap regarding the professional competencies of staff for the process of welding during maintenance
<p><b>* As amended by Commission Regulation (EU) No 2016/919, Commission Regulation (EU) 2018/868, Commission Implementing Regulation (EU) 2019/776 and Commission Implementing Regulation (EU) 2020/387</b></p> <p>NOTE The Technical Specification for Interoperability (TSI) may refer to other clauses of this standard making the application of those clauses mandatory. Possible references to such clauses are found in the Appendix J to the TSI.</p>			

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**WARNING 2** — Other Union legislation may be applicable to the product(s) falling within the scope of this standard

## Bibliography

- [1] EN 17023, *Railway applications - Railway vehicle maintenance - Creation and modification of maintenance plan*
- [2] EN ISO 15611, *Specification and qualification of welding procedures for metallic materials - Qualification based on previous welding experience (ISO 15611:2003)*
- [3] DVS 1623, *Welding of rail vehicles — Notes and recommendations for the implementation of DIN EN 15085 in comparison with DIN 6700*
- [4] A35-602, *Iron and steel. Stainless steel. Comparison of french, german, american, british, japanese and swedish standardized grades*
- [5] EN 1011 (all parts), *Welding — Recommendations for welding of metallic materials*



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## BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK