

Guideline of the European Committee for Welding of Railway Vehicles - ECWRV (2017-11-28) - PART 2 Technical Interpretation of EN 15085

Contents

1	Introduction	2
2	Interpretation of EN 15085-1.....	2
3	Interpretation of EN 15085-2.....	2
3.1	Quality requirements for the welding manufacturer.....	2
3.2	Staff requirements	2
3.3	Technical requirements	7
3.4	Welding coordination organization	7
3.5	Welding procedure specification	7
3.6	Assignment of the requirements to certification level	7
3.7	Certification procedure	7
3.8	Validity	8
3.9	<i>Classification</i> of the certificates	9
3.10	<i>Performance</i> of yearly surveillance	9
3.11	<i>Range</i> of the certificate	10
3.12	<i>Change</i> of the MCB.....	11
4	Interpretation of EN 15085-3.....	11
4.1	General.....	11
4.2	<i>Weld</i> performance classes	11
4.3	<i>Weld</i> inspection classes	12
4.4	<i>Choice</i> of parent metals and welding consumables	13
4.5	<i>Welding</i> in cold formed areas.....	14
4.6	<i>Joint</i> preparation.....	15
5	Interpretation of EN 15085-4.....	15
5.1	Welding procedure specification	15
5.2	Supplementary regulations.....	15
5.3	Production weld tests	18
5.3.1	General.....	18
5.4	Conformity of parent metals	19
5.5	Special requirements for maintenance welding of railway vehicles.....	19
5.6	General rules for maintenance welding	19
6	Interpretation of EN 15085-5.....	20
6.1	Inspection and testing before, during and after welding	20
6.2	Self-inspection by the welder or welding operator.....	20
6.3	Non-conformance and corrective actions	20
6.3.1	General.....	20
6.4	Sub-contractors	20
6.5	Declaration of conformity.....	21
6.6	Traceability	21

1 Introduction

Part 2 of this guideline provides a technical interpretation of the EN 15085 series of standards. It is comprised of a series of remarks and additional information which aid the comprehension and correct implementation of the standards.

The explanations that are given in this guideline have been taken into consideration by manufacturing certification bodies (MCBs) that are members of the European Committee for Welding of Railway Vehicles (ECWRV) during past audits. Future ECWRV guideline working groups may adapt this guideline accordingly.

2 Interpretation of EN 15085-1

EN 15085-1 does not include technical information, therefore no interpretation is given in this guideline.

3 Interpretation of EN 15085-2

3.1 Quality requirements for the welding manufacturer

The management of the welding activities, as defined in EN ISO 3834 Parts 2 to 4, depending of the certification level, shall be described by documents e.g. written procedures, records, work instructions.

Manufacturer certification to EN ISO 3834 is only necessary if required by contract. In the case of certification level CL4 for CL1 assemblies and components, the relevant requirements of EN ISO 3834 Part 2 shall be fulfilled.

The manufacturer must manage the calibration and/or verification of welding equipment, devices, gauges, jigs and fixtures which have an impact on the quality of the product according to the existing applicable standards.

Calibration, validation and verification have to be done according EN ISO 17662.

Review of documents and records should be organized / supervised by the welding coordinator periodically e.g Welding Procedure Specifications (WPSs), visual inspection (VT) records.

3.2 Staff requirements

Welders and welding operators

Concerning CL3: If there is no qualified welding coordinator (at least EWS / IWS), the qualifications shall be carried out by an external examining body.

The minimum number of qualified welders or welding operators should be two for each process, material group, joint type and dimension.

Depending on the type of work, the workload and the shifts, the number of qualified welders or welding operators needs to be increased.

For joints which are not covered by standard test pieces, production weld tests according to EN 15085-4 shall be done to demonstrate the skill of the welder.

Weld positions which are not in use frequently but are covered by the welder qualification may be re-qualified with production weld tests.

If the evaluation of welder and welding operator qualification test pieces, production weld tests and other test pieces are done by the welding coordinators of the manufacturer, the following items have to be taken in consideration.

When the welding coordinator is witnessing the qualification of welders, he/she is working as an inspector. In order to carry out this type of inspection, generally the examining body (or inspector) requires a specific accreditation (e.g. EN ISO/IEC 17020, EN ISO/IEC 17024). For this reason several points must be verified by the MCB, in relation to this accreditation standards, during the EN 15085 audit.

The welding coordinator who will be responsible for issuing the welder and welding operator qualification approvals needs to demonstrate to the MCB that a complete test according to EN 287-6, EN ISO 9606 relevant parts, EN ISO 14732 or other relevant standards is done correctly, including the test piece evaluation and all related documentation.

The welding coordinators who are responsible for welder and welding operator qualification must be named in the EN 15085-2 certificate.

1) The manufacturer must demonstrate that the welding coordinator is independent from production during the witness of test piece qualification and examination. (e.g. using a function data sheet). In case of a CL1-company which tests and qualifies his own welders, operators and processes in an own testing lab and / or welding training center the independency of this units and its personnel has to be clearly described and must be independent from the production process.

The responsible welding coordinator has to be independent. All conflicts of interest must be managed.

2) The manufacturer must issue a written procedure that describes the welder and welding operator qualification process. This procedure shall include:

- Required documents (e.g. WPS, evaluation sheet, qualification record)
- Identification and storage of test pieces
- Traceability of test piece execution data (e.g. welder identification, start and stop locations).
- Performance of visual examination, DT and NDT
- Determination of the range of validity of the qualification
- Qualification record numbering

3) The manufacturer must issue a standard form for the welder qualification record.

4) The release of the test pieces will be made after a surveillance visit of the MCB.

The MCB should make a remark on the back page of the certificate:

„Capable to perform organisation, evaluation and approval of qualification tests of welders and operators belonging to the company and in connection with the scope of this certificate is (are) the following welding coordinator(s):

Name and qualification

5) Special arrangements in case of use of EN ISO 9606-1:

Different from EN 287-1 welders approvals for steel according EN ISO 9606-1 ask for

- Description of the transfer mode for welding processes where different transfer modes are possible (131, 135, 138) see EN ISO 9606-1, section 5.2 and ISO 4063, section 2.2.2

combined with table 1. In this case it is recommended to show by WPS, that minimum one layer has been welded in short arc (e.g. FW in PF, BW without backing, BW for thin plates).

- Filler materials used for the testing of welders must show qualification for the base material, see EN 15085 part 4, section 5.3.2, conformity of welding consumables.

- FW`s require a testpiece always, the combined testpiece for FW/BW, EN ISO 9606-1, annex C is not recommended!

In case, the prolongation will be done according EN ISO 9606-1, section 9.c) a special agreement with the customer is necessary.

Welding coordination

The welding manufacturer must demonstrate its compliance with the requirements of section 5.1.2 and Annex C of EN 15085-2. EN 15085-2 contains minimum requirements regarding the availability of welding coordinators. The required number of welding coordinators depends on the size of the welding manufacturer as well as the extent of welding production and the number of subcontractors.

The tasks and areas of competence of the welding coordinators must comply with the requirements of EN 15085-2, Annex B. They must be specified in writing for each welding coordinator and must be verified by the MCB as part of the audit for the certification. The independence of the welding coordinators from production must be clearly shown in an organization chart.

The MCB must verify that the welding coordinators are integrated in the organization of the welding manufacturer in a way that allows them to carry out their tasks in their areas of competence according to EN ISO 14731 without any restrictions. For this purpose, they must have the required authority to instruct and make decisions. If the areas of competence are separated (e.g. for production, subcontracting and design), this must be indicated in the certificate.

The welding manufacturer must provide evidence of the professional experience and training of its welding coordinators.

Welding coordinators without a qualification according to the relevant IIW/EFW guidelines (IWE/EWE, IWT/EWT, IWS/EWS) must demonstrate the necessary technical knowledge of welding during an extended interview as part of the certification audit.

If a welding coordinator does not have a IIW/EFW qualification, a EN 15085-2 certificate can be issued if the following conditions are met:

- this person has passed the extended interview, by means of written questionnaire or oral assessment and practical tests (e.g. evaluation of test pieces).
- the extended interview shall be appropriate to the application of the company.
- all other requirements of the standard are fulfilled.
- the tasks and responsibilities do not change over time and have to be checked during the surveillance audits.
- the frequency of surveillance audits can be adapted to complexity of welding activities and fabrication.
- the certificate is restricted to the audited product.
- the recognition of the level A, B, C welding coordinator is limited to the company.

The content and intensity of the extended interview depends on the different levels A, B and C. The MCB is responsible for this, taking into account the specific personal situation of the candidate.

For the extended Interviews complementary rules apply:

1. For level A and B according to EN 15085-2:

- a) For level A qualification as technologist or graduate as engineer is mandatory
- b) The extended interview has to be executed by an examination board of the manufacturer certification body; the board has to consist of two technical members of the manufacturer certification body

2. For level C according to EN 15085-2:

The extended interview can be executed by the auditor during the audit.

Level A, B or C without IIW/EFW training cannot be accepted as subcontracted (external) welding coordinators.

In addition, the welding manufacturer must provide evidence of the professional experience of the welding coordinators.

Section 5.1.2 of EN 15085-2 specifies who may deputise without restriction for the responsible welding coordinator.

Generally the welding coordinator assessment is carried out by the MCB as follows:

- review of technical diploma
- review of participation in professional training in welding processes, metallurgy, control methods, etc.
- review of his/her resume that shows the number of years of experience in railway welding
- review of the number of years of experience in the manufacturer organisation
- position of the coordinator in the manufacturer organisation chart
- review of personal datasheet showing his/her responsibilities and the link to the quality manager
- comparison of the personal datasheet with the requirements of EN ISO 14731
- review of documentation implemented by the welding coordinator (e.g. WPQR, WPS)
- verification of the efficiency of the welding coordinator supervision (records, remarks, corrective actions).

The auditor may perform a technical assessment of the welding coordinator based on questions concerning the implementation of materials and processes in the workshop. Questions shall be limited to materials and processes used in the workshop and covered by the range of certification requested by the manufacturer.

The assessment shall be documented.

Subcontracted welding coordinator

Welding coordinators who are not employed directly (on site) by the respective welding manufacturer are "subcontracted welding coordinators" (referred to below as "external welding coordinators") – please refer to section 5.1.3 "Subcontracted welding coordinator" of EN 15085-2. This also applies to part-time staff who work less than 50 % of the collectively agreed working hours.

Level A, B, C without IIW / EFW training are not accepted, see above.

According to EN 15085-2, the welding coordinator may be subcontracted in special cases. If there is an internal level A the external welding coordinator can also be a deputy with equal rights.

For subcontracted welding coordinators, the following must be observed:

- The working hours of external welding coordinators must be contractually agreed so that they can perform their tasks as defined in Annex B of EN 15085-2. The working hours must be evidenced in a work log.

In addition, the following applies:

- ✓ For start of new build production, the external welding coordinator should be present during at least 50 % of the welding production within the scope of the relevant standard EN 15085. These hours must be evidenced in a work log.
- ✓ For repair/finishing welding, the required presence depends on the extent of the welding production within the scope of the relevant standard. These hours must be evidenced in a work log.
- MCB auditors may generally not act as external welding coordinators.

If a welding coordinator is assigned for tasks at different sites or different companies, each manufacturer has to check whether the tasks can be carried out in the sense of this standard.

Complexity of the tasks, reaction time, distances from site to site, and required working hours on each site must be considered.

Conflicts of interest, e.g. the external welding coordinator is a customer's employee, should be avoided.

The number of welders, complexity of production and tasks and responsibilities of the welding coordinator as well as other relevant influences shall be taken into account!

Deviations in special cases, e.g. holding groups, central offices, shall be discussed with the MCB.

A welding coordinator should not be assigned for more than 2 sites.

Exceptions can be:

- Single purpose production (i.e. automated welding of one product)
- Maintenance with only a few welding tasks per year.
- Design or Purchase, where most tasks can be performed from another site

A deputy shall be assigned at each site (in case the external WS is not the deputy !).

All welding tasks of external and internal welding coordinators have to be described in the matrix according EN ISO 14731 and have to be in line with annex B of EN 15085-2.

Inspection personnel

According to section 5.1.4 of EN 15085-2, the welding manufacturer must have visual inspection personnel. PT, MT, RT and/or UT can be sub-contracted.

The existence of certified inspection personnel according to EN ISO 9712 must be demonstrated if inspections such as PT, MT, RT and/or UT according to EN 15085-3 are required.

PT, MT, RT and UT shall be performed according to written procedures.

VT shall be performed according to an instruction validated by the welding coordinator or by personnel certified to level 2 per EN ISO 9712, according to EN ISO 17637 and EN15085-5 Table 1.

The supervision of NDT is required to be made by the welding coordinator or level 2 according EN ISO 9712.

3.3 Technical requirements

The production workplaces, including workplaces for assembly, must be sufficient in size and nature to allow correct and reproducible weld execution and related work. The requirements of section 5.2 of EN 15085-2 must be met.

If a manufacturer uses different types of materials (i.e. carbon steel, stainless steel, aluminium) in the same workshop, the following should be checked:

- The storage areas for materials should be organized in such a way that metal to metal contact between different material types is avoided.
- Grinding and cutting operations that produce dust or particles shall be avoided near or in the storage area
- Bending tools and fixtures should be cleaned (usually the manufacturer of the machine, e.g. Hamada, offers cleaning products).
- The tools and fixtures for these machines should, in general, be insensitive to ferritic contamination
- Cleaning using compressed air systems (dust scattering) should be avoided
- If different materials are used simultaneously in close proximity (e.g. in contiguous workshops), a physical separation of 2 m, minimum, above the working height is necessary
- If different materials are used simultaneously in the same area, a distance of 5 m, minimum, must be maintained between them
- Grinding or sharpening (e.g. TIG electrodes for welding) shall not be carried out in the welding area or where base materials can be contaminated
- Each type of material shall have dedicated small tools (brushes, flex discs...)
- The workbench shall be protected to prevent contact between incompatible materials
- The workshops shall be equipped with air extractors

A cleaning procedure must be available!

3.4 Welding coordination organization

No comment

3.5 Welding procedure specification

No comment

3.6 Assignment of the requirements to certification level

No comment

3.7 Certification procedure

Certificate

Small welding manufacturer:

The assessment of small welding manufacturers shall not be different from the others, but the time required for the assessment shall be adapted by the audit team depending on the following:

- Number of welders / welders certificates / WPQR`s
- Workshop size
- Number of welding machines
- Product complexity

In case the welding manufacturer is small according to EN 15085-2, Annex C, Footnote c, the certificate shall indicate: "Small welding manufacturer with a single welding shop".

Manufacturer with design:

For a welding manufacturer requesting CL1 CL2 or CL3 certification, the certificate must indicate if the range of certification includes design or not.

If design is not included in the range of certification, the certificate shall indicate: "without design of welded parts".

If design is included, no special remark is necessary.

For CL4 certification, the certificate shall indicate only design.

Manufacturer with purchasing:

The assessment shall include:

- The organisation of the purchaser
- The skill of the welding coordinator
- The purchasing documents (procedures, order, list of subs, audits performed, FAI)
- The verification of the documentation
- The organisation of sub-contracting audits

Note: Purchasing is part of the assessment of the manufacturer (see EN ISO 3834-1). In case of CL4, the certificate shall indicate the limitation to purchasing. In case purchasing is not done for CL1, CL2, CL3, indicate in the certificate: "without purchase of welded parts".

3.8 Validity

As stipulated in section 7 of EN 15085-2, the manufacturer certification body (MCB) verifies the compliance with the requirements of EN 15085-1 to -5 in the field of application for which the certificate was granted during the period of the certificate's validity. The verification applies to current production (components, subassemblies) and the quality records for on-going and completed projects as well as to knowledge about new standards and regulations.

The verification is based on the following principles:

- compliance with EN 15085-1 to -5; and
- annual verification on site by the manufacturer certification body.

The annual verification will be carried out even if no components or subassemblies according to EN 15085-1 to -5 are available in the workshop at the time of the audit. This means that the welding manufacturer must demonstrate that it continues to satisfy the personnel and operational requirements of the standard for as long as its certificate is listed in the Online register. This ensures that upcoming (and possibly unforeseen) work according to EN 15085 can be carried out without delay. If certification is granted with conditions, the verification interval may be shortened, depending on the extent of production.

During the annual on-site verification, the results of internal audits by responsible welding coordinators may be considered (e.g. in case of separate welding shops).

3.9 Classification of the certificates

The certificates are classified based on the certification levels (CL) defined in EN 15085-2.

According to EN 15085-2, section 4, these certification levels depend on the weld performance class (CP) of the welded joints and the safety relevance of the components and subassemblies. The certification levels should be specified in the relevant drawing (see EN 15085-3). In the absence of such specification, the certification level according to EN 15085-2 must be determined prior to submitting the application. For this purpose, the national safety authority and the customer should be consulted as necessary.

The certification levels that are included in the level for which the certificate was issued are listed in Table 1, below:

Table 1. Included certification levels

Table 2: Included certification levels				
Certified certification level	Included certification level			
	CL 1	CL 2	CL 3	CL 4
CL 1	X	✓	✓	✓ ¹⁾
CL 2		X	✓	✓ ²⁾
CL 3			X	
CL 4				X ³⁾
X	Certified certification level.			
✓	Included certification level.			
¹⁾	A CL 1 certificate also permits design or purchase & resale or purchase & assembly for all certification levels if taken into consideration during the audit.			
²⁾	A CL 2 certificates also permits design or purchase & resale or purchase & assembly for the certification levels CL 2 and CL 3 if taken into consideration during the audit.			
³⁾	A CL 4 certificate permits design or purchase & resale or purchase & assembly for the certification level specified in the field of application of the certificate.			
⁴⁾				
Note: If CL 4 for design or purchase is not included, this must be indicated in the certificate.				

3.10 Performance of yearly surveillance

The purpose of the yearly surveillance is the assessment of the quality system for welding. Surveillance is carried out yearly, but in certain cases surveillance shall be made after a shorter interval of time. These cases are:

A modification of the responsible welding coordinator without the appropriate documental evidence (thereby causing a lack of confidence on behalf of the MCB)

OR

a large modification of the scope of certification (process, material, thickness)

OR

an increase in joint performance level or test level.

After 3 years, a full reassessment shall be done. The MCB audit team in charge of the full reassessment should be different from the audit team in charge of the previous full assessment (i.e. one new auditor, as a minimum).

3.11 Range of the certificate

In principle the Online Register entries are based on the manufacturer's Welding Procedure Qualification Records (WPQRs), mainly according to EN ISO 15614 or EN ISO 15613. Please refer to EN 15085-4, section 4.1.4.

The WPQR identification numbers shall be specified in the audit report or in the certificate. Production weld tests can also be taken into account if the requirements of EN ISO 15613 have been fulfilled, as a minimum, regarding the range of testing. In these cases, a WPQR must be issued.

Welder and welding operator qualification approvals must be available for the range of approval specified in the certificate, e.g. processes and material groups. It is not necessary to cover the complete range of all of the WPQRs.

The responsible welding coordinator is responsible for ensuring that the ranges of the WPQRs and the welder and welding operator qualifications cover the range of production. The welding coordinator(s) in charge of this can perform these qualifications by their own. Otherwise this approvals have to be done by a accredited 3rd party!

Details have to be shown in the audit report.

Process:

The standard used to qualify the WPQR should be indicated in the audit report, e.g. EN ISO 15614 or EN ISO 15613. It does not need to be indicated in the certificate.

It makes sense to indicate the degree of mechanization. The degree of mechanization can be inserted in the Online Register, however, it does not appear automatically in the certificate at the present time. It can be included in the certificate under «comments». If no information is given, by default the degree of mechanization is understood to be **manual** for welding processes 111, 141, 311 and **partly mechanized** for welding processes 131, 135, 136, 138. If otherwise, «robot» or «fully mechanized» should be indicated in the certificate.

Remarks can be made to indicate if the process specified applies to BW or FW joints. If no remark is included, it is understood that the range is the same for both joint types.

Materials:

The entry is based on the material group mentioned in the WPQR. In principle, the qualification of the groups is according to EN ISO 15614. Customers can define other inclusions in a material group

Subgroups must be specified for groups 1 to 6, e.g. 3.1. Groups 7 and 8 cover one another, as long as the filler material is from group 8.

Dimensions:

The range of tmin, tmax and Dmin, Dmax is defined in EN ISO 15614 -1 and -2.

The thickness of the weld and the number of layers (sl, ml) is not mentioned but traceable via the WPQR identification number.

Thicknesses below 3 mm are indicated with a comma and one decimal place. They can be rounded up to 0,5 or a whole number, e.g., 1,4 mm to 1,5 mm, 1,9 mm to 2,0 mm. Thicknesses above 3 mm are rounded to a whole number, e.g. 5,4 mm to 5 mm, 5,8 mm to 6 mm.

3.12 Change of the MCB

Each manufacturer can hold one entry in the Online Register with a certificate in the same scope, e.g. maintenance. If the manufacturer would like to change its MCB, the following must be taken into account:

- The new MCB must get the last report of the old MCB from the manufacturer.
- The new MCB gives an information to the old MCB that the certification process is closed and the new certificate is issued. The old MCB deletes their certificate in the Online Register.

4 Interpretation of EN 15085-3

4.1 General

Assessment of design

The assessment includes:

- Verification of procedures applicable for calculation and design
- Verification of the design review parameters
- Verification of the implementation of EN 15085-3 in the design (in particular the performance of the joint in relation to the stress level and the possibility to perform the visual examination during the life of the part)
- Verification of the skill of the persons in charge to design (diploma, experience)
- Verification of the design verification method before manufacturing begins (method of design validation)
- Verification of the tools (software) used for the design; for commercial tools, verification of software updates (licenses and subscription); for in-house tools, verification of the validation
- Verification of design updates (transmission of new drawings and documents and the withdrawal of obsolete drawings and documents)
- Verification of the documentation (e.g. standards, technical requirements) at the disposal of the designer and the document management system (e.g. document updates)
- Verification that internal audits of design have been done and managed appropriately (no large findings have been discovered; small findings have been treated according to a reasonable schedule)
- Verification of the specifications and/or procedures provided to subcontractors
- Verification of subcontractor management, in particular, subcontractor assessment
- Verification of one or several files.

4.2 Weld performance classes

“Without the possibility for a volumetric test” means that RT and/or UT make no sense for fillet welds and other welds without full penetration like Y, HY etc.

“Joints with weld performance class CP A, CP B and CP C1, which can be inspected during production but cannot be inspected and repaired in maintenance, shall be allocated to the next higher inspection class according to Table 3 or the stress level shall be reduced.”

Exception: CP A

See EN 15085-5, table 1

The performance of the joint is given by 4 parameters

- The safety coefficient (determined by the failure risk analysis)
- The stress level
- The possibility of inspection during its life cycle
- The type of weld (full or partial penetration)

4.3 Weld inspection classes

Considering the material characteristics (e.g. materials that tend to crack), a different class may be assigned, e.g. for steels of group 11 according to CEN ISO/TR 15608: CP C2 - CT 2 (100 % VT + 10 % surface test).

Safety Category									
Criteria									
	High			Medium			Low		
	Stress Category			Stress Category			Stress Category		
	High	Medium	Low	High	Medium	Low	High	Medium	Low
Weld Performance Class	CP A	CP B	CP C1	CP B	CP C2	CP C3	CP C2	CP C3	CP D
Full penetration weld	Mandatory	Mandatory	Not Mandatory	Not Mandatory	Not Mandatory	Not Mandatory	Not Mandatory	Not Mandatory	Not Mandatory
Full access for inspection in production and maintenance	Mandatory	Yes, if not CP A requested	Yes, if not CP B requested	Yes, if not CP A requested	Not Mandatory	Not Mandatory	Not Mandatory	Not Mandatory	Not Mandatory
Volumetric test	Mandatory	Mandatory	Yes, if not 100% surface testing	Yes, if not 100% surface testing	Not Mandatory	Not Mandatory	Not Mandatory	Not Mandatory	Not Mandatory
information on drawing			"Surface test necessary"	"Increase of surface test is required"					
Return Weld	Mandatory	Mandatory	Mandatory	Mandatory	Mandatory	Not Mandatory	Mandatory	Not Mandatory	Not Mandatory
Run on/off plates	Mandatory	Mandatory	Not Mandatory	Mandatory	Not Mandatory	Not Mandatory	Not Mandatory	Not Mandatory	Not Mandatory

4.4 Choice of parent metals and welding consumables

Choice of parent metals

Parent metal:

If there is any deviation in the material specified, the manufacturer must fill out a non-conformance report.

To demonstrate weldability, a WPQR according to EN ISO 15614 is necessary. See EN 15085-4, section 4.1.4.

A WPQR does not eliminate the necessity to determine fatigue strength values.

Values for fatigue strength are also given in DVS 1608 for aluminium and DVS 1612 for steel.

When choosing a parent metal, design engineering must take several considerations into account:

- Tensile strength
- Elastic limit
- Corrosion and wear properties
- Toughness (impact strength)
- Fatigue strength (if subjected to dynamic loads)
- Heat treatment and surface treatment possibilities
- Formability

If the manufacturer wishes to use an alternative material, it must prove that the alternative material fully complies with the specifications of the original material (including the raw material processing methods, manufacturing tolerances and tests methods). Classification according to ISO/TR 15608 is required.

The raw material certificate, according to EN 10204 Type 3.1, shall confirm that the specified properties are met. This certificate shall be issued in a language understandable by the manufacturer's incoming inspection personnel. The certificate shall be issued by the raw material producer and approved by an authorized person from their quality department.

Additional tests done by accredited laboratories independent of the raw material producer are allowed.

The manufacturer shall verify the applicability of existing WPS, WPQR and welder and welding operator qualifications.

Complete records shall be presented to design engineering, in order to release the non-conforming material into production.

Choice of welding consumables

If a consumable is used that is not covered by a European designation, new qualifications dedicated specifically to that consumable are required.

Note: EN ISO 15614-1 limits some qualifications to the commercial designation. See 8.4.4 and 8.4.5 of EN ISO 15614-1.

4.5 Welding in cold formed areas

The table is valid for angles of 90° and greater. Angles below 90° should be tested. The table refers to static load.

Note: Compare with Eurocode 3 Design of steel structures EN 1993-1-8 table 4.2!

4.6 Joint preparation

Weld form, weld thickness and weld length (see Annex B) shall be indicated on the drawing. Deviations of joints shown in table B.1 are allowed, as long as there is no influence on mechanical properties (heat input!) and a production weld test shows the possibility of execution.

Table B.1 of EN15085-3 is informative. That means design engineering can propose alternative weld seams in addition to those described in this table.

A weld seam that complies with table B.1 must have a symbol that complies with table B.1 as well. In addition, the use of “z” instead of “a” has to be clearly indicated in the drawing. A corresponding table can be issued if necessary.

5 Interpretation of EN 15085-4

5.1 Welding procedure specification

According to EN 15085-2, welding procedure specifications (WPS) in line with EN ISO 15607 (EN ISO 15609, EN ISO 14555, EN ISO 15620) are required for welds with weld performance classes CP A to CP C3. Evidence of the qualification must be provided as described in section 4.1.4 of EN 15085-4. Existing approved welding procedure specifications remain valid, see the introductions of EN ISO 15614-1 and EN ISO 15614-2. In case of new qualifications according to EN ISO 15614-1 level 2 must be used.

5.2 Supplementary regulations

Finishing

Requirements shall be defined for:

- TIG remelting (procedure)
- Grinding (procedure)
- Pickling, passivation, etching and other chemical treatments (procedure)
- Spatters (quantity, dimensions...): Not allowed on CL 1 parts with painted surface.

Tack-welding

A general procedure for tacking is necessary. Welders have to be qualified.

Post-weld heat treatment

The PWHT shall be performed according to a written procedure which defines the essential parameters. EN ISO 17663 “quality requirements for heat treatment in connection with welding and allied processes” shall be respected.

Heat straightening

Requirements (raw material, max. temperature, duration, testing, jigs, blowtorch ...) need to be defined. A written procedure shall describe the execution and control of the straightening process.

Subcontracting activities in connection with welding

The manufacturer is responsible for its subcontractors and EN15085-5 section 8 shall be respected. The subcontractor shall respect the same specifications and requirements as the manufacturer.

This remark is applicable for subcontracting of:

- Cutting, bending...
- Heat treatment/PWHT: Respect EN ISO 17663.
- Painting and varnishing
- Straightening
- Welding activities: Welding workshops need to fulfill the requirements of EN 15085-2, Annex C

The manufacturer must audit all the subcontractors of primary parts (CL1). Subcontractors for these activities should comply with EN ISO 9001.

- NDT: External personnel needs to be certified, see EN 15085-5, Table 1
- DT: Accredited lab

Manufacturer's qualification for longitudinally welded pipes as semi-finished products

To produce longitudinal welded pipes, there are 3 possibilities:

- Use of standards for pressure equipment complying with directive 2014/68/EU or
- Implementation of EN 15085 series of standards
- Certificate according EN ISO 3834-2 and qualification of the process according EN ISO 15614)

The use of European standards of welded pipes intended to be used for pressure equipment per directive 2014/68/EU is acceptable, because the requirements are equivalent to those specified in EN 15085. The material certificate, according to EN 10204 Type 3.1, must show full compliance with the EN for pipes according to directive 2014/68/EU.

Otherwise, the pipe manufacturer must show evidence of the compliance with EN 15085.

The requirements of EN 15085 are applicable, in particular

- Welder and welding operator qualifications
- Welding procedure qualification according to EN ISO 15614
- Material certificates (raw material and filler material) per EN 10204 Typ 3.1
- Level of control

Single-purpose production

Single-purpose production in the certification level CL 1 is the fully mechanized welding production of identical subassemblies in a series (e.g. cardan shafts).

The field and range of application of the certificate according to EN 15085-2 must be limited to the subassembly and the welding procedure specification.

Notwithstanding the requirements of EN 15085-2, a responsible welding coordinator of the qualification level B may be approved for this purpose.

Details on the inspection and verification measures must be agreed upon with the MCB; a shorter verification interval (e.g. every six months) may be necessary.

Finishing welding

This chapter concerns castings.

Finishing welding of aluminium castings after heat treatment is forbidden.

A WPQR shall be performed in order to prove that the nominal mechanical properties (such as elastic limit, tensile strength, elongation, toughness KCV, hardness) and, if required, the chemical composition of the repaired areas are maintained after welding. Preheating and heat treatment are essential variables of the WPQR.

WPQR can follow EN ISO 15613 with tests according to EN ISO 15614-1 or EN ISO 11970.

A mock-up specimen shall be created in order to validate the joint preparation (grinding, arc gouging, groove, depth), the welding process (accessibility, shrinkage, hammering, welding position), the heat treatment after welding (with oven or annealing by welding) and the quality of the welded areas according to the relevant standards

For finishing welding on subassemblies of the certification level CL 1, the foundry must provide proof of the required properties and casting quality by tests and inspections. The evaluation criteria (such as weld performance class) and the inspection procedures (such as weld inspection class) must be determined by the responsible welding coordinator and – if contractually agreed – be approved by the customer.

The responsible welding coordinator may also be a foundry engineer if he/she has demonstrated "comprehensive technical knowledge" pursuant to EN ISO 14731 for this field of application in the interview - Level A, see 8.2.5.

The manual skill of the welder may be demonstrated by an appropriately documented production weld test. See EN 15085-4.

EN 1011-8 has to be taken into consideration.

Friction stir welding – application of the welding process

Friction stir welding – application of the welding process (6)

For the application of friction stir welding, the following provisions apply:

- The EN ISO 25239 shall apply.
- Process number: 43 according to EN ISO 4063
- Materials: Aluminium and Aluminium alloys
- Dimensions: All dimensions covered by the manufacturer's welding procedure specifications according to EN ISO 25239-4.
- Quality requirements: There is only one acceptance level for imperfections, which is defined in table A.1 of Annex A in EN ISO 25239-5.
- Operational prerequisites:
 - In terms of CL1-certification: Welding coordinator: Level A (see 8.2.5) according to EN 15085-2; for manufacturers only certified for friction stir welding, a responsible welding coordinator of the qualification level B (see 8.4.4) may be approved.
 - Welding operator qualification test: according to EN ISO 25239-3
 - Welding procedure specification: according to EN ISO 25239-4
 - Production weld tests: according to EN ISO 25239-5 (e.g. see chapters 4.4.2, 4.4.3, 4.12.4)
 - Quality and inspection: according to EN ISO 25239-5

Welding of damper rings in wheelsets

Some railway vehicle wheels have grooves with Y-welded rings that are used to dampen noise.

Because of the safety relevance of the wheel sets, manufacturers that weld damper rings of this type need to be certified to CL 1. The EN 15085-2 certificate should include specifically “welding on damper rings“ in the field of application.

Brazing

For brazing on railway vehicles a certificate according to EN 15085-2 is not necessary.

5.3 Production weld tests

5.3.1 General

Realization and amount of testing of production weld tests

Production weld tests in general include VT (100 %), PT/MT (100 %), macro section(s), and hardness. Hardness testing is not necessary for ferritic steels with $R_e < 275 \text{ N/mm}^2$ or groups 8, 21 or 22. See EN ISO 15613.

Other tests according to ISO 15614 must be coordinated with the customer.

The resulting documentation shall include a WPS, a WPQR and the corresponding test reports.

The evaluation of the weld test piece shall be based on EN ISO 15614 or EN 287-6/EN ISO 9606; production safety must be demonstrated!

The welders and operators should be trained by the welding coordinator. The training has to be documented (attendance list, subject of training, validation of knowledge).

Additional training has to be organized by the welding coordinator for new welders, for new production and in case of defects caused by welders or welding operators.

Production weld tests to check and ensure the design

Production weld tests to ensure the design are done in the design phase.

The welding coordinator and designer cooperate to create a design solution which is economically and technically possible and to check accessibility for NDT of welds. In general the design shall be according to EN 15085-3 and joints should comply with Table B.1.

If not, production weld tests are necessary.

The production weld test results can be applied to different projects as long as the conditions are the same. The validity is unlimited in this case.

Production weld tests to prove the welding conditions

Production weld tests to prove the welding conditions are also done to avoid irregularities in production that may be caused by the use of new equipment, fixtures, and/or filler materials.

The validity is unlimited if there are no essential changes.

Production weld tests to demonstrate the skill of the welder

Production weld tests to demonstrate the skill of welders are necessary when joints are not in accordance with EN 287-6/EN ISO 9606. See EN 15085 part 4, section 4.2.4.

If the result of this type of production weld test is acceptable (that means, evaluation criteria, length and size of the weld and tests according to EN 287-6/EN ISO 9606), the validity is according to the welders qualification test certificate as long as the welder welds that type of

joint at least every 6 months. This type of production weld test may also be used to qualify positions not used often in production.

The resulting documentation can include a WPS, test reports, and a welder qualification record that includes the remark "production weld test", e.g. as additional information.

Production weld tests to demonstrate the quality of the weld

Production weld tests to demonstrate the quality of the weld are done according to EN 15085-5, Table 1, footnote b. The validity depends on the specific part, joint and project. The welding coordinator defines the number and kinds of tests. The resulting documentation is similar to that generated by production weld tests to demonstrate the skill of the welder.

General requirements

5.4 Conformity of parent metals

The standard requires Type 3.1 certificates according to EN 10204 in case of CL 1 and CL 2 welds. In this case the legal situation can require a full traceability, different from EN ISO 3834.

5.5 Special requirements for maintenance welding of railway vehicles

Performing of maintenance welding for Germany can require evidence of compliance with DIN 27201-6, State of railway vehicles –Basic principles and production technology – Part 6: Welding

Special requirements can also be necessary, if the old design does not show any weld details, calculation and/or level of control.

Additional note: The problem of maintenance is now managed by a new European standard to be issued shortly (WG 48). This standard is linked to the new European regulation 445/2011 concerning the maintenance of Freight wagons. The new standard (package) would replace DIN 27201 (package).

5.6 General rules for maintenance welding

The assessment of maintenance welding has to include additional points:

A specific procedure must be issued for the management of maintenance. The offer and contract review must include the verification of special requests (supplementary requirements) from the operator and/or the national safety authorities (e.g. DIN 27201 part 6).

All necessary documentation concerning manufacturing shall be provided to the company in charge of maintenance. The documents will include "as built" drawings, WPSs and WPQRs. In the case of a specific process, a manufacturer information/validation procedure must be planned (i.e. communication procedure to be implemented among operator/authorities/manufacturer/repair shop). The detection of defects and indications (before repairs) will be made by methods proposed to operators and safety authorities, and accepted by operators and safety authorities. If weld repairs are performed that include preheating and/or PWHT, the effect of such treatment must be verified (e.g. possibility to

perform several treatments and/or modification of stress distribution after several treatments).

EN 15085 requires that specific welding reports, written by the coordinator, are issued. In addition the technical assessor must verify tools, facilities and devices for welding on site and in large repair shops.

6 Interpretation of EN 15085-5

6.1 Inspection and testing before, during and after welding

Checks by the welder or welding operator

Regarding the sections inspection and testing before, during and after welding, the welding coordinators must perform welder training (in connection with EN 15085-4, sections 5.2.1, 5.2.2, 5.2.3). This is independent from the self-inspection which is described in 4.4.2 of the standard!

6.2 Self-inspection by the welder or welding operator

In case of self-inspection, welder training needs to be increased in order to correctly detect imperfections according to EN ISO 5817 and EN ISO 10042, specifically, regarding the proper use of gauges and how to perform measurements.

Self-inspection is only valid for CT 4 (CP C 3, CP D). The level of documentation must be specified by the customer (if a welding coordinator is not available).

Note: A special situation occurs when the welder is the welding coordinator as well (what can happen in small companies). In this case the inspection of the welds must be done by another person (not the welder), depending on the CT level.

The qualification of the welder for visual inspection of welds in accordance with EN ISO 17637 in case of CL 3 must be done externally (because no welding coordinator is available in the manufacturer!).

6.3 Non-conformance and corrective actions

6.3.1 General

Procedures must be available which describe who is responsible for managing weld defects:

- Repair decision is made by the welder: defect type for simple repair is fixed, size of defect is limited, welding according to original WPS
- Repair decision is made by the welding coordinator or weld inspectors: larger defects, new approved WPS may be necessary
- Repair decision made by the customer: repair may have influence during use, e.g. change in mechanical properties, changes in joint design, e.g. DV-joint instead of V-joint), several repairs in the same place

6.4 Sub-contractors

See also subcontracting activities in connection with welding!

6.5 Declaration of conformity

See EN ISO/IEC 17050-1

Annex A (informative)

Supplier's declaration of conformity

A.1 Guidance to complete the form of declaration of conformity and

A.2 Example of form of declaration of conformity

6.6 Traceability

Identification means assigning an individual number (numbering). In the case of issued documents, numbering should include the date of issue and revision.

Traceability is **important** for the management of documents and records in any quality system. Traceability concerns:

- Drawings
- Procedures
- Welding procedures
- Welder and welding operator qualifications
- Welding processes
- Material certificates (raw materials and consumables)
- Repair locations
- Location of temporary attachments
- Reports (manufacturing data sheets, visual, NDT, non-conformance, calibration, heat treatment)
- Declaration of conformity

The traceability is the link between two actions.

The traceability mainly refers to 3 items:

- Link between the material certificate and the plate or sheet metal (up until the cutting operation)
- Link between the material certificate and the filler material
- Link between the visual examination and the welder

Other identification and traceability requirements should be defined by the contract.

The extent of traceability depends on the following circumstances:

- Are there any legal requirements regarding the part or component in case of failure?
- EN 15085-4 requires an EN 10204 Type 3.1 certificate for CL 1 and CL 2 welded fabrication. In general these certification levels correspond to welds with safety categories high and medium. That implies the necessity of traceability in all stages of manufacturing. For important parts and components, full traceability is useful!

Annex A (normative), Inspection and testing of welded joints

No comment