Execution of Steel Structure
EN 1090

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General

In Europe, the main reference in the field of metal structures, for civil engineer works, is the European Regulation 305/2011 "Construction Product Regulation" (CPR)

General

Extract from Directive 89/106/EC

......... For the purposes of this Directive, the term “construction product" means any product manufactured in order to be permanently incorporated in construction works, including both buildings and civil engineering works.

The construction products are hereinafter referred to as "products"; construction works, including both buildings and civil engineering works are hereinafter referred to as "works".

Extract from Regulation 305/2011

"Construction works" means buildings and civil engineering works;

......... Construction Product means any product or kit which is produced and placed on the market for incorporation in a permanent manner in construction works or parts thereof and the performance of which affects the performance of the construction works in relation to the basic requirements of the works themselves;
The CPR differs from other New Approach Directives as the basic requirements set by it do not apply directly to construction products, but to the works in which these are to be incorporated permanently (although the construction product represent what it must be CE marked).

The aim is to have construction products suitable for the intended use, i.e. with characteristics that make the works in which they are incorporated, reliable and usable.
BASIC REQUIREMENTS FOR CONSTRUCTION WORKS (former Essential Requirements for CPD)

Construction works as a whole and in their separate parts must be fit for their intended use, taking into account in particular the health and safety of persons involved throughout the life cycle of the works.

1. Mechanical resistance and stability
2. Safety in case of fire
3. Hygiene, health and the environment
4. Safety and accessibility in use
5. Protection against noise
6. Energy saving and heat retention
7. Sustainable use of natural resources

Being the Construction Product what is to be assessed (CE marked), how to “link" the construction product to Basic Requirements of the work?
The link between the construction products and the Basic Requirements is given through the:

'Essential characteristics', which are the characteristics of the construction product which relate to the basic requirements of construction works.

and it is defined by the:

"Performances of a construction product" that means the performances related to the relevant essential characteristics, expressed in terms of level or class, or description.
Finally, the link between the construction products, with their essential characteristic, and the works, with their Basic Requirements, can be achieved "exclusively" through the product's conformity to an European “harmonized technical specification (generally the Harmonized Standard)”

The essential characteristics of construction products are defined and listed in the harmonized technical specifications (standards), as well as the criteria to be used for the fabrication of the products themselves and the principle for the Conformity Assessment.
The Regulation 305/2011 CPR

The Work (e.g. a bridge) CPR 305/2011

Basic Requirements
- Mechanical resistance and stability
- Safety in case of fire
- Hygiene, health and the environment
- Safety and accessibility in use
- Protection against noise
- Energy economy and heat retention
- Sustainable use of natural resources

Construction product: steel beam
EN 10025 series
Essential Characteristic and performance
- aaaaaaa
- bbbbbbb
- ccccccc
- ddddddd
- ...........
- ...........

Criteria for production
Conformity Assessment
Declaration of Performance
CE Mark
The European Regulation 305/2011

When a construction product is within the scope of a harmonized standard and it is intended to be incorporated permanently in a “work”, the manufacturer shall draw up a declaration of performance when such a product is put on the market and the CE mark shall be affixed.

The CE marking shall be affixed to construction products for which the manufacturer has drawn up a declaration of performance in accordance with the harmonized standards.
The Type of product "Structural metallic material and ancillaries" includes:

- base materials (sheets and profiles)
- filler materials welding
- structural metallic components
- Structural connectors (bolts, nuts, etc.).

The Harmonized Standard for the structural metallic components is the EN 1090-1
The EN 1090
Execution of steel structure and aluminium structure

hEN 1090-1:2009+A1
Requirements for conformity assessment of structural components (Novembre 2011)

EN 1090-2:2008+A1
Technical requirements for steel structures (Novembre 2011)

EN 1090-3:2008
Technical requirements for aluminium structures
## Manufacturer tasks and responsibilities for the Declaration of Performance and CE Marking

### Table ZA.3 — Assignment of tasks for evaluation of conformity of structural steel and aluminium components

<table>
<thead>
<tr>
<th>Tasks under the responsibility of the manufacturer</th>
<th>Content of the task</th>
<th>Evaluation of conformity Clauses to apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial type testing</td>
<td>Relevant parameters related to the performance characteristics of Table ZA.1</td>
<td>6.2</td>
</tr>
<tr>
<td>Factory Production Control (FPC)</td>
<td>Relevant parameters related to the performance characteristics of Table ZA.1</td>
<td>6.3</td>
</tr>
<tr>
<td>Sampling, testing and inspection at the factory</td>
<td>Relevant characteristics of Table ZA.1</td>
<td>Table 2</td>
</tr>
<tr>
<td>Certification of FPC by a certified body on the basis of:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial inspection of factory and of FPC</td>
<td>Relevant parameters related to the characteristics of Table ZA.1</td>
<td>6.3 and Annex B</td>
</tr>
<tr>
<td>Continuous surveillance, assessment and approval of FPC</td>
<td>Relevant parameters related to the characteristics of Table ZA.1</td>
<td>6.3 and Annex B</td>
</tr>
</tbody>
</table>
Characteristics for which it is necessary to declare the performance
EN 1090-1

4 Requirements (Called Essential Characteristic in the CPR)

4.2 Tolerances on dimensions and shape
4.3 Weldability
4.4 Fracture toughness
4.5 Structural characteristics
   - Load bearing capacity
   - Fatigue strength
   - Resistance to fire
   - Deformation at serviceability limit state
4.6 Reaction to fire
4.7 Dangerous substances
4.8 Impact resistance
4.9 Durability
6.3.6 Component specification

The manufacture of components shall be controlled using a component specification giving all the necessary information of the component in sufficient detail to enable it to be manufactured and for its conformity to be evaluated.

The execution class to be applied shall be given in the component specification, see EN 1090-2 and EN 1090-3.

The manufacturer shall implement a written inspection and test plan for checking and recording that manufactured components conform to their component specification.

The component specification shall be prepared from design information. To the extent that the manufacturer undertakes the preparation of the component specification from design information Clause 6.3.4 applies.

Annex A gives guidance on preparation of the component specification.

NOTE In many cases the responsibility for preparation of the component specification will have been shared between the manufacturer and the purchaser (or designers acting on their behalf). A manufacturer’s declaration that a component complies with its component specification does not cover those aspects of design not undertaken by the manufacturer, nor does it cover that they have been correctly incorporated into its component specification.
Table A.1 — Manufacturer’s declaration of properties of structural components in connection with CE marking, depending on method of declaration.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Method 1</th>
<th>Method 2</th>
<th>Method 3b</th>
<th>Method 3a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural design calculations for the component</td>
<td>None</td>
<td>Based on a requirement to use a product standard referring to relevant parts of Eurocodes</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>Basis of manufacture</td>
<td>MPCS</td>
<td>MPCS</td>
<td>MPCS</td>
<td>PPCS</td>
</tr>
<tr>
<td>Declaration of component properties</td>
<td>Geometrical and material information, and any other information needed, for others to perform structural evaluation and calculations</td>
<td>Delivered components to be in accordance with this European Standard referring to relevant parts of Eurocodes, with resistance(s) given as characteristic value(s) or design value(s)</td>
<td>Delivered component to be in accordance with MPCS, and traceable to purchaser’s order</td>
<td>Delivered component to be in accordance with PPCS</td>
</tr>
</tbody>
</table>

Manufacturers operating on their own component specification including or not the declaration of the structural characteristics.
## Table 1 – Sampling, evaluation and conformity criteria for initial type testing and initial type calculation

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Requirement Clause</th>
<th>Evaluation method</th>
<th>Number of samples</th>
<th>Conformity criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerances on dimensions and shape</td>
<td>4.2</td>
<td>Inspection and test in accordance with EN 1090-2 or EN 1090-3</td>
<td>1</td>
<td>5.3</td>
</tr>
<tr>
<td>Weldability</td>
<td>4.3</td>
<td>Checking of inspection documents for compliance with the specified requirements to the constituent product.</td>
<td>1</td>
<td>5.4</td>
</tr>
<tr>
<td>Fracture toughness / brittle strength (steel components only)</td>
<td>4.4</td>
<td>Checking of inspection documents for compliance with the specified requirements to the constituent product.</td>
<td>1</td>
<td>5.5</td>
</tr>
<tr>
<td>Load bearing capacity</td>
<td>4.5, 4.5.2</td>
<td>Calculation to relevant Part of EN 1993, EN 1994, EN 1999 or structural testing to relevant European Technical Specification b Manufacturing according to component specification and EN 1090-2 or EN 1090-3 c</td>
<td>1 a</td>
<td>5.6</td>
</tr>
<tr>
<td>Fatigue strength</td>
<td>4.5, 4.5.3</td>
<td>Calculation to relevant Part of EN 1993, EN 1994 or EN 1999 b Manufacturing according to component specification and EN 1090-2 or EN 1090-3 c</td>
<td>1 a</td>
<td>5.6</td>
</tr>
<tr>
<td><strong>EN 1090-1</strong></td>
<td><strong>Type Testing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Deformation at serviceability limit state</strong></td>
<td>4.5.5</td>
<td>Calculation to relevant Part of EN 1990, EN 1993, EN 1994, EN 1999 or structural testing to relevant European Technical Specification. Manufacturing according to component specification and EN 1090-2 or EN 1090-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resistance to fire</strong></td>
<td>4.5, 4.5.4</td>
<td>Calculation in accordance with EN 1993, EN 1994 or EN 1999 for performance characteristic R or test and classification in accordance with EN 13501-2 for performance characteristics, R, E, I and/or M. Manufacturing according to component specification and EN 1090-2 or EN 1090-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Reaction to fire</strong></td>
<td>4.6</td>
<td>Checking of coated components in accordance with EN 13501-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dangerous substances</strong></td>
<td>4.7</td>
<td>Checking that constituent products conform to European Standards</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Impact resistance</strong></td>
<td>4.8</td>
<td>Evaluation covered by fracture toughness</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Durability</strong></td>
<td>4.9</td>
<td>Execution of surface preparation in accordance with component specification, EN 1090-2 or EN 1090-3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.3 Factory production control
6.3.1 General
6.3.2 Personnel
6.3.3 Equipment
6.3.4 Structural design process
6.3.5 Constituent products used in manufacture
6.3.6 Component specification
6.3.7 Product evaluation
6.3.8 Non-conforming products
EN 1090-2

Foreword
1_Scope
2_Normative references
3_Terms and definitions
4_Specifications and documentation
5_Constituent products
6_Preparation and assembly
7_Welding
8_Mechanical fastening
9_Erection
10_Surface treatment
11_Geometrical tolerances
12_Inspection, testing and correction
EN 1090-2

Annex A (normative)  Additional information, list of options and requirements related to the execution classes
Annex B (informative)  Guidance for the determination of execution classes
Annex C (informative)  Check-list for the content of a quality plan
Annex D (normative)  Geometrical tolerances
Annex E (informative)  Welded joints in hollow sections
Annex F (normative)  Corrosion protection
Annex G (normative)  Test to determine slip factor
Annex H (normative)  Calibration test for preloaded bolts under site conditions"
Annex J (normative)  Use of compressible washer-type direct tension indicators
Annex K (informative)  Hexagon injection bolts
Annex L (informative)  Guide to flow diagram for development and use of a WPS
Annex M (normative)  Sequential method for fasteners inspection
### Table B.3 — Recommended matrix for determination of execution classes

<table>
<thead>
<tr>
<th>Consequence classes</th>
<th>CC1</th>
<th>CC2</th>
<th>CC3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Service categories</strong></td>
<td>SC1</td>
<td>SC1</td>
<td>SC1</td>
</tr>
<tr>
<td></td>
<td>SC2</td>
<td>SC2</td>
<td>SC2</td>
</tr>
<tr>
<td><strong>Production categories</strong></td>
<td><strong>PC1</strong></td>
<td><strong>EXC1</strong></td>
<td><strong>EXC2</strong></td>
</tr>
<tr>
<td></td>
<td><strong>EXC2</strong></td>
<td><strong>EXC2</strong></td>
<td><strong>EXC3</strong></td>
</tr>
</tbody>
</table>

^ EXC4 should be applied to special structures or structures with extreme consequences of a structural failure as required by national provisions.
B.2.1 Consequence classes

EN 1990:2002 gives in its Annex B guidelines for the choice of consequence class for the purpose of reliability differentiation. Consequence classes for structural components are divided in three levels denoted CCi (i = 1, 2 or 3).

NOTE Annex B in EN 1990:2002 is informative. Consequently the national annex to EN 1990 may give provisions for the application of this annex.

EN 1991-1-7 gives examples of categorisation of building type and occupancy according to consequence classes that assist with the implementation of Annex B of EN 1990:2002.

A structure, or a part of it, can contain components with different consequence classes.
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Execution classes

<table>
<thead>
<tr>
<th>Categories</th>
<th>Criteria</th>
</tr>
</thead>
</table>
| SC1        | Structures and components designed for quasi static actions only (Example: Buildings)  
|            | Structures and components with their connections designed for seismic actions in regions with low seismic activity and in DCL*  
|            | Structures and components designed for fatigue actions from cranes (class S₀)** |
| SC2        | Structures and components designed for fatigue actions according to EN 1993. (Examples: Road and railway bridges, cranes (class S₁ to S₉)**, structures susceptible to vibrations induced by wind, crowd or rotating machinery)  
|            | Structures and components with their connections designed for seismic actions in regions with medium or high seismic activity and in DCM* and DCH* |

* DCL, DCM, DCH: ductility classes according to EN 1998-1  
** For classification of fatigue actions from cranes, see EN 1991-3 and EN 13001-1
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Execution Classes

Table B.2 — Suggested criteria for production categories

<table>
<thead>
<tr>
<th>Categories</th>
<th>Criteria</th>
</tr>
</thead>
</table>
| **PC1**    | • Non welded components manufactured from any steel grade products  
             • Welded components manufactured from steel grade products below S355 |
| **PC2**    | • Welded components manufactured from steel grade products from S355 and above  
             • Components essential for structural integrity that are assembled by welding on construction site  
             • Components with hot forming manufacturing or receiving thermic treatment during manufacturing  
             • Components of CHS lattice girders requiring end profile cuts |
<table>
<thead>
<tr>
<th>Clauses</th>
<th>EXC1</th>
<th>EXC2</th>
<th>EXC3</th>
<th>EXC4</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 – Specifications and documentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2 Constructor’s documentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2.1 Quality documentation</td>
<td>Nr (No requirement)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>5 – Constituent products</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2 Identification, inspection documents and traceability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspection documents</td>
<td>See Table 1</td>
<td>See Table 1</td>
<td>See Table 1</td>
<td>See Table 1</td>
</tr>
<tr>
<td>Traceability</td>
<td>Nr (No requirement)</td>
<td>Yes (partial)</td>
<td>Yes (full)</td>
<td>Yes (full)</td>
</tr>
<tr>
<td>Marking</td>
<td>Nr</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>5.3 Structural steels products</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3.2 Thickness tolerances</td>
<td>Class A</td>
<td>Class A</td>
<td>Class A</td>
<td>Class B</td>
</tr>
<tr>
<td>5.3.3 Surface conditions</td>
<td>Flat - Class A2 Long – Class C1</td>
<td>Flat - Class A2 Long – Class C1</td>
<td>More stringent conditions if specified</td>
<td>More stringent conditions if specified</td>
</tr>
<tr>
<td>5.3.4 Special properties</td>
<td>Nr</td>
<td>Nr</td>
<td>Internal discontinuity quality class S1 for welded cruciform joints</td>
<td>Internal discontinuity quality class S1 for welded cruciform joints</td>
</tr>
<tr>
<td>6 – Preparation and assembly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.2 Identification</td>
<td>Nr</td>
<td>Nr</td>
<td>Finished components / Inspection certificates</td>
<td>Finished components / Inspection certificates</td>
</tr>
</tbody>
</table>

Table A.3 — Requirements to each execution class
### Table 1 — Inspection documents for metallic products

<table>
<thead>
<tr>
<th>Constituent product</th>
<th>Inspection documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural steels (Tables 2 and 3)</td>
<td>according to Table B.1 of EN 10025-1:2004 (^a)</td>
</tr>
<tr>
<td>Stainless steels (Table 4)</td>
<td>3.1</td>
</tr>
<tr>
<td>Steel castings</td>
<td>according to Table B.1 of EN 10340:2007</td>
</tr>
<tr>
<td>Welding consumables (Table 5)</td>
<td>2.2</td>
</tr>
<tr>
<td>Structural bolting assemblies</td>
<td>2.1 (^c)</td>
</tr>
<tr>
<td>Hot rivets</td>
<td>2.1 (^c)</td>
</tr>
<tr>
<td>Self-tapping and self-drilling screws and blind rivets</td>
<td>2.1</td>
</tr>
<tr>
<td>Studs for arc studs welding</td>
<td>2.1 (^c)</td>
</tr>
<tr>
<td>Expansion joints for bridges</td>
<td>3.1</td>
</tr>
<tr>
<td>High strength cables</td>
<td>3.1</td>
</tr>
<tr>
<td>Structural bearings</td>
<td>3.1</td>
</tr>
</tbody>
</table>

\(^a\) For structural steel grade S355 JR or J0 inspection document 3.1 is required for EXC2, EXC3 and EXC4.

\(^b\) EN 10025-1 requires that the elements included in the CEV formula shall be reported in the inspection document. The reporting of other added elements required by EN 10025-2 should include Al, Nb, and Ti.

\(^c\) If a 3.1 certificate is required, this may be substituted by a manufacturing lot identification mark.
6.6.3 Execution of holing

Holes for fasteners or pins may be formed by any process (drilling, punching, laser, plasma or other thermal cutting) provided that this leaves a finished hole such that:

a) cutting requirements relating to local hardness and quality of cut surface, according to 6.4 are fulfilled;

b) all matching holes for fasteners or pins register with each other so that fasteners can be inserted freely through the assembled members in a direction at right angles to the faces in contact.

Punching is permitted provided that the nominal thickness of the component is not greater than the nominal diameter of the hole, or for a non-circular hole, its minimum dimension.

For EXC1 and EXC2, holes may be formed by punching without reaming unless otherwise specified.

For EXC3 and EXC4, punching without reaming is not permitted if the plate thickness is greater than 3 mm. For plate thickness greater than 3 mm, the holes shall be punched at least 2 mm undersize in diameter. For plate or sheet thickness less than or equal to 3 mm (i.e. sheets), holes may be formed by full size punching.

The capability of holing processes shall be checked periodically as follows:

- eight samples shall be produced from procedure tests on constituent product encompassing the range of hole diameters, constituent product thickness and grades processed;

- hole sizes shall be checked at both ends of each hole using go/no go gauges. Holes shall comply with the tolerance class as specified in 6.6.2.
7 Welding

7.1 General

Welding shall be undertaken in accordance with the requirements of the relevant part of EN ISO 3834 or EN ISO 14554 as applicable.

NOTE Guidelines for implementation of EN ISO 3834 on quality requirements for fusion welding of metallic materials is given in CEN ISO/TR 3834-6. [31]

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”.
7.4.2 Welders and welding operators

Welders shall be qualified in accordance with EN 287-1 and welding operators in accordance with EN 1418.

Welders of hollow section branch connection with angles less than 60° as defined in EN 1993-1-8 shall be qualified by specific test.

Records of all welder and welding operator qualification tests shall be kept available.

7.5.7 Tack welds

For EXC2, ECX3 and EXC4, tack welds shall be made using a qualified welding procedure. The minimum length of the tack shall be the lesser of four times the thickness of the thicker part or 50 mm, unless a shorter length can be demonstrated as satisfactory by test.

All tack welds not incorporated into the final welds shall be removed. Tack welds that are to be incorporated into the final weld shall have a suitable shape and be carried out by qualified welders. Tack welds shall be free from deposition faults and shall be cleaned thoroughly before final welding. Cracked tack welds shall be removed.
### 7.4.3 Welding coordination

For EXC2, EXC3 and EXC4, welding coordination shall be maintained during the execution of welding by welding coordination personnel suitably qualified for, and experienced in the welding operations they supervise as specified in EN ISO 14731.

With respect to the welding operations being supervised, welding coordination personnel shall have a technical knowledge according to Tables 14 and 15.

<table>
<thead>
<tr>
<th>EXC</th>
<th>Steels (steel group)</th>
<th>Reference standards</th>
<th>Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>t ≤ 25&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>EXC2</td>
<td>S235 to S355 (1.1, 1.2, 1.4)</td>
<td>EN 10025-2, EN 10025-3, EN 10025-4 EN 10025-5, EN 10149-2, EN 10149-3 EN 10210-1, EN 10219-1</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>S420 to S700 (1.3, 2, 3)</td>
<td>EN 10025-3, EN 10025-4, EN 10025-6 EN 10149-2, EN 10149-3 EN 10210-1, EN 10219-1</td>
<td>S</td>
</tr>
<tr>
<td>EXC3</td>
<td>S235 to S355 (1.1, 1.2, 1.4)</td>
<td>EN 10025-2, EN 10025-3, EN 10025-4 EN 10025-5, EN 10149-2, EN 10149-3 EN 10210-1, EN 10219-1</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>S420 to S700 (1.3, 2, 3)</td>
<td>EN 10025-3, EN 10025-4, EN 10025-6 EN 10149-2, EN 10149-3 EN 10210-1, EN 10219-1</td>
<td>C</td>
</tr>
<tr>
<td>EXC4</td>
<td>All</td>
<td>All</td>
<td>C</td>
</tr>
</tbody>
</table>

<sup>a</sup> Column base plates and endplates ≤ 50 mm.

<sup>b</sup> Column base plates and endplates ≤ 75 mm.

<sup>c</sup> For steels up to and including S275, level S is sufficient.

<sup>d</sup> For steels N, NL, M and ML, level S is sufficient.
### Table 12 — Methods of qualification of welding procedures for the processes 111, 114, 12, 13 and 14

<table>
<thead>
<tr>
<th>Method of qualification</th>
<th>EN ISO 15614-1</th>
<th>EXC 2</th>
<th>EXC 3</th>
<th>EXC 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding procedure test</td>
<td>EN ISO 15614-1</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pre-production welding test</td>
<td>EN ISO 15613</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Standard welding procedure</td>
<td>EN ISO 15612</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Previous welding experience</td>
<td>EN ISO 15611</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tested welding consumables</td>
<td>EN ISO 15610</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Permitted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>Not permitted</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

- Only for materials ≤ S 355 and only for manual or partly mechanized welding.
- Only for materials ≤ S 275 and only for manual or partly mechanized welding.
7.4.1.2 Qualification of welding procedures for processes 111, 114, 12, 13 and 14

a) The qualification of the welding procedure depends on the execution class, the parent metal and the degree of mechanization in accordance with Table 12.

b) If EN ISO 15613 or EN ISO 15614-1 qualification procedures are used, the following conditions apply:

1) If impact tests are specified, they shall be carried out at the lowest temperature required for impact testing of the material qualities being joined.

2) For steels according to EN 10025-6, one specimen for micro-examination is necessary. Photographs of weld metal, fusion line zone and HAZ shall be recorded. Microcracks are not permitted.

3) If welding on shop primers, tests shall be carried out on the maximum (nominal + tolerance) accepted layer thickness.

c) If a qualification procedure is to apply to transverse stressed fillet welds on steel grades higher than S275, test shall be completed by a cruciform tensile test performed in accordance with EN ISO 9018. Only specimens with \( a \leq 0.5 \) \( t \) shall be evaluated. Three cross tensile specimen shall be tested. If the fracture happens in the parent metal, the minimum nominal tensile strength of the parent metal shall be reached. If the fracture happens in the weld metal, the fracture strength of the cross section of the actual weld shall be determined. By processes with deep penetration the actual root penetration shall be considered. The determined average fracture strength shall be \( \geq 0.8 R_m \) (with \( R_m \) = nominal tensile strength of the used parent metal).
EN 1090-2
Welding – WPS Qualification

7.4.1.4 Validity of a welding procedure qualification

The validity of a welding procedure depends on the requirements of the standard used for the qualification. If specified, welding production tests have to be carried out in accordance with the relevant standard of qualification, e.g. EN ISO 14555.

The following additional tests are required for a welding procedure qualified in accordance with EN ISO 15614-1 which is undertaken by a welding process that has not been used:

a) for a period of between one and three years, a suitable production welding test shall be carried out for steel grades higher than S355. Examination and testing shall include visual inspection, radiographic or ultrasonic inspection (not required for fillet welds), surface crack detection by magnetic particle or penetrant test, macro-examination and hardness test;

b) for a period of more than three years,

1) a macro specimen taken from a production test shall be inspected for acceptability for steel grades up to and including S355, or

2) new welding procedure tests shall be carried out for steel grades higher than S355 as relevant.

For resistance welding, the welding parameters may be determined using tests according to EN ISO 10447.
12.4.4 Production tests on welding

If specified, for EXC3 and EXC4, production tests shall be carried out as follows:

a) each welding procedure qualification used for welding steel grades higher than S460 shall be checked with a production weld. Testing includes visual examination, penetrant testing or magnetic particle inspection, ultrasonic testing or radiographic testing (for butt welds), hardness testing and macroscopic examination. The tests and results shall be in accordance with the relevant standard for welding procedure test;

b) if the deep penetration of a welding process is used for fillet welds, the penetration of the welds shall be checked. The results of the actual penetration shall be documented;

c) for bridge deck orthotropic steel plates:

1) stiffener to deckplate connections welded by fully mechanized welding process shall be checked with a production test for each 120 m length of bridge, with a minimum of one production test for a bridge, and inspected by macro-examination. Macro section tests shall be prepared at start or stop and at the middle of the weld;

2) stiffener to stiffener connections with splice plates shall be checked with a production test.
7.5.2 Storage and handling of welding consumables

The welding consumables shall be stored, handled and used in accordance with the manufacturer's recommendations.

If electrodes and fluxes need to be dried and stored, appropriate temperature levels and times shall be fulfilled in accordance with the manufacturer's recommendations or, if not available, with the requirements of Table 16.

| Table 16 — Temperature and time for drying and storage of welding consumables |
|------------------------------------------|-----------------|------------------|
| Drying \(^a\)                             | 300 °C < T ≤ 400 °C | 2 h < t ≤ 4 h    |
| Storage \(^a\)                             | ≥ 150 °C          | prior to welding |
| Storage \(^b\)                             | ≥ 100 °C          | during welding   |
| \(^a\) Fixed oven                         |                  |                  |
| \(^b\) Portable quiver                    |                  |                  |

Consumables remaining unused at the end of the welding shift shall be dried again in accordance with the above requirements. For electrodes, drying shall be carried out no more than twice. Remaining consumables shall be discarded.

Welding consumables showing signs of damage or deterioration shall be rejected.

NOTE Examples of damage or deterioration include cracked or flaked coatings on covered electrodes, rusty or dirty electrode wires and electrode wires with flaked or damaged copper coatings.
12.4.1 Inspection before and during welding

Inspection before and during welding shall be included in the inspection plan according to the requirements given in the relevant part of EN ISO 3834.

Non destructive testing (NDT) methods shall be selected in accordance with EN 12062 deleted text. Generally ultrasonic testing or radiographic testing applies to butt welds and penetrant testing or magnetic particle inspection applies to fillet welds.

NDT, with the exception of visual inspection, shall be performed by personnel qualified according to Level 2 as defined in EN 473.

If the inspection plan requires a check of the fit-up before the welding of hollow sections prepared for branch welding, the following locations shall be given particular attention:

— for circular sections: the mid-toe, mid-heel and two mid-flank positions;
— for square or rectangular sections: the four corner positions.
EN 1090-2
Welding - Inspection and testing after welding

Table 23 — Minimum hold times

<table>
<thead>
<tr>
<th>Weld size (mm) (^a)</th>
<th>Heat input Q (kJ/mm) (^b)</th>
<th>Hold time (hours) (^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S235 to S460 ({A_1})</td>
</tr>
<tr>
<td>a or s (\leq 6)</td>
<td>All (\leq 3)</td>
<td>Cooling period only</td>
</tr>
<tr>
<td>6 &lt; a or s (\leq 12)</td>
<td>(&gt; 3)</td>
<td>8</td>
</tr>
<tr>
<td>a or s &gt; 12</td>
<td>(\leq 3) ({A_1} &gt; 3)</td>
<td>16</td>
</tr>
</tbody>
</table>

\(^a\) Size applies to the nominal throat thickness \(a\) of a fillet weld or the nominal material thickness \(s\) of a full penetration weld. For individual partial penetration butt welds the governing criterion is the nominal weld depth \(a\), but for pairs of partial penetration butt welds welded simultaneously it is the sum of the weld throats \(a\).

\(^b\) Heat input Q to be calculated in accordance with Clause 19 of EN 1011-1:1998.

\(^c\) The time between weld completion and commencement of NDT shall be stated in the NDT report. In the case of “cooling period only” this will last until the weld is cool enough for NDT to commence.
### Table 1 — Inspection documents for metallic products

<table>
<thead>
<tr>
<th>Constituent product</th>
<th>Inspection documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural steels (Tables 2 and 3)</td>
<td>according to Table B.1 of EN 10025-1:2004&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>Stainless steels (Table 4)</td>
<td>3.1</td>
</tr>
<tr>
<td>Steel castings</td>
<td>according to Table B.1 of EN 10340:2007</td>
</tr>
<tr>
<td>Welding consumables (Table 5)</td>
<td>2.2</td>
</tr>
<tr>
<td>Structural bolting assemblies</td>
<td>2.1&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Hot rivets</td>
<td>2.1&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Self-tapping and self-drilling screws and blind rivets</td>
<td>2.1</td>
</tr>
<tr>
<td>Studs for arc studs welding</td>
<td>2.1&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Expansion joints for bridges</td>
<td>3.1</td>
</tr>
<tr>
<td>High strength cables</td>
<td>3.1</td>
</tr>
<tr>
<td>Structural bearings</td>
<td>3.1</td>
</tr>
</tbody>
</table>

<sup>a</sup> For structural steel grade S355 JR or J0 inspection document 3.1 is required for EXC2, EXC3 and EXC4.

<sup>b</sup> EN 10025-1 requires that the elements included in the CEV formula shall be reported in the inspection document. The reporting of other added elements required by EN 10025-2 should include Al, Nb, and Ti.

<sup>c</sup> If a 3.1 certificate is required, this may be substituted by a manufacturing lot identification mark.
For EXC3 and EXC4, constituent products shall be traceable at all stages from receipt to hand over after incorporation in the works.

This traceability may be based on records for batches of product allocated to a common production process, unless traceability for each product is specified.

For EXC2, EXC3 and EXC4, if differing grades and/or qualities of constituent products are in circulation together, each item shall be designated with a mark that identifies its grade.

Methods of marking shall be in accordance with that for components given in 6.2.

If marking is required, unmarked constituent products shall be treated as non conforming product.
After completion of the type tests and achievement of the certification of its FPC the Manufacturer may issue the Declaration of Performance and the final CE marking
CPR 305/2011

DECLARATION OF PERFORMANCE

No. ............................

1. Unique identification code of the product-type: ................................................................................................................

2. Type, batch or serial number or any other element allowing identification of the construction product as required pursuant to Article 11(4):

..........................................................................................................................................................................................

3. Intended use or uses of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer:

..........................................................................................................................................................................................
..........................................................................................................................................................................................

4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required pursuant to Article 11(5):

..........................................................................................................................................................................................
..........................................................................................................................................................................................
## Declaration of performance

<table>
<thead>
<tr>
<th>Essential characteristics (see Note 1)</th>
<th>Performance (see Note 2)</th>
<th>Harmonised technical specification (see Note 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
CE Marking
Method of declaration of conformity 1, with Manufacturer Specification and no structural characteristic declared

CE conformity marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.

Identification number of the notified body

Name or identifying mark and registered address of the producer

Last two digits of the year in which the marking was affixed

Certificate number

No. of European standard

Description of product and
information on regulated characteristics

Welded steel beam – M 346

Tolerances on geometrical data: EN 1090-2.

Weldability: Steel S235J0 according to EN 10025-2.

Fracture toughness: 27 J at 0°C.

Reaction to fire: Material classified: Class A1.

Release of cadmium: NPD.

Emission of radioactivity: NPD.

Durability: Surface preparation according to EN 1090-2, preparation grade P3. Surface painted according to EN ISO 12944-5, S.1.09.

Structural characteristics:
Design: NPD.
CE Marking
Method of declaration of conformity 2, with Manufacturer Specification and Design and structural characteristic declared according to EN 1993 series

Roof trusses in steel, to be used in the new library in Berlin - M 201

Tolerances on geometrical data: EN 1090-2.

Weldability: S235J0 according to EN 10025-2.

Fracture toughness: 27 Joule at 0°C.

Reaction to fire: Material classified: Class A1.

Release of cadmium: NPD.

Emission of radioactivity: NPD.

Durability: Surface preparation according EN 1090-2, Preparation grade P3. Surface painted according to EN ISO 12944, see component specification for details.

Structural characteristics:
Load bearing capacity: Design according to EN 1993-1, see accompanying design brief and design calculations. NDPs for Germany apply. Reference: DC 102/3.
Deformation at serviceability limit state: NPD.
Fatigue strength: NPD.
Resistance to fire: Calculated value: R 30, see DC 102/3.
**CE Marking**

Method of declaration of conformity **3a**, with Purchaser Specification and Design and no structural characteristic declared by the Manufacturer.

<table>
<thead>
<tr>
<th>Identification number of the notified body</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name or identifying mark and registered address of the producer</td>
<td></td>
</tr>
<tr>
<td>Last two digits of the year in which the marking was affixed</td>
<td></td>
</tr>
<tr>
<td>Certificate number</td>
<td></td>
</tr>
<tr>
<td>No. of European standard</td>
<td></td>
</tr>
</tbody>
</table>

**Description of product and information on regulated characteristics**

- **EN 1090-1:2009+A1:2011**
  - Aluminium panels, to be used in the “New National Theatre, Luxembourg City – M 106
  - Tolerances on geometrical data: EN 1090-3.
  - Weldability: EN AW-6082 T6 and EN AW - 5083 Q, according to EN 1011-4 and EN 1999-1-1.
  - Fracture toughness: Not required for aluminium components.
  - Load bearing capacity: NPD.
  - Fatigue strength: NPD.
  - Resistance to fire: NPD.
  - Reaction to fire: Material classified: Class A1.
  - Release of cadmium: NPD.
  - Emission of radioactivity: NPD.
  - Durability: Uncoated, NPD.

**Structural characteristics:**
- **Design:** Provided by purchaser, doc. Ref. no 123.
- **Manufacturing:** According to component specification CS-M202, and EN 1090-3, execution class EXC2.