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Execution of steel structures and aluminium structures — Reuse of structural steel

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

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Execution of steel structures and aluminium structures - Reuse of structural steel

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European foreword

This document (CEN/TS 1090-201:2024) has been prepared by Technical Committee CEN/TC 135 “Execution of steel structures and aluminium structures”, the secretariat of which is held by SN.

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Introduction

This document specifies requirements for the use of reclaimed structural components in steel structures designed according to the EN 1993 series and executed according to EN 1090-2.

This document presupposes that the work is carried out with the necessary knowledge and adequate equipment and resources to perform the work in accordance with the execution specification and the requirements of this document.

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1 Scope

This document gives complementary provisions to EN 1090-2 for the use of reclaimed structural components for the execution of steel structures to EXC1, EXC2 and EXC3 (see EN 1090-2). The provisions apply to products used in structures to be designed (see EN 1993-1-1) for quasi-static loading and not subject to fatigue loading.

NOTE 1 The conditions of implementation of this document in a country are at the discretion of the national Standardization Body. Non contradictory requirements, e.g. with regard to seismic loading, can be added.

This document gives requirements for the reusability assessment of reclaimed structural components and constituent products.

This document also gives requirements for the quality assessment of plates, hot rolled profiles and hot finished or cold formed hollow sections in carbon steel used as constituent products (see EN 1090-2). This includes the declaration of mechanical and geometrical properties as well as weldability.

NOTE 2 The properties to be declared are those listed as required relevant properties to be specified as described in EN 1090-2:2018+A1:2024, Clause 5.1.

The requirements on quality assessment in this document also apply to the assessment of the mechanical and geometrical properties as well as weldability of fabricated products. The recommendations for the assessment of connections however, and in particular of welds, are non exhaustive and only informative.

This document does not apply to cold-formed structural steel sections and sheeting as described in EN 1090-4, or mechanical fasteners.

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 1090-2:2018+A1:2024, *Execution of steel structures and aluminium structures - Part 2: Technical requirements for steel structures*

EN 1993-1-1, *Eurocode 3 - Design of steel structures - Part 1-1: General rules and rules for buildings*

EN ISO 6892-1, *Metallic materials - Tensile testing - Part 1: Method of test at room temperature (ISO 6892-1)*

EN 10219 (all parts), *Cold formed welded steel structural hollow sections of non-alloy and fine grain steels*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
constituent product
material or product used in manufacturing with properties which enter into structural calculations or otherwise relate to the mechanical resistance and stability of works and parts thereof, and/or their fire resistance, including aspects of durability and serviceability

3.2
fabricated structural component
structural component made of one or more constituent products including workmanship

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3.3
reclaimed structural component
structural component which is salvaged from a donor structure and is intended to be used again for fabrication and/or erection of a recipient structure

3.4
provenance
basic information on the previous use of a reclaimed structural component

3.5
type 1 structural steel
structural steel material produced in or after 1970 and with a set of relevant properties, including their variations, equivalent to one of the standard structural steel materials listed in EN 1993-1-1

3.6
type 2 structural steel
structural steel material produced before 1970 and with relevant properties that might significantly deviate from those of standard structural steel materials listed in EN 1993-1-1

3.7
test unit
group of individual reclaimed structural components with identical geometrical properties and same function for which relevant properties can be derived from testing a single or a few representative member(s)

3.8
location of a component
location of a reclaimed component in the donor structure (e.g. floor plan, façade)

3.9
function of a component
description of a reclaimed component indicating the major loads the component was subjected to in the donor structure (e.g. floor beam, column)

4 Deconstruction

An identification system shall be established prior to deconstruction in order to ensure that reclaimed structural components can be traced to their provenance, including function and location.

The information to be included in the identification system with regard to location and function of the reclaimed structural components should be consistent with the required information for grouping the components in test units, see 5.3.4.2.

NOTE An individual identification system by means of which each reclaimed structural component can be traced to its exact location in the donor structure provides the highest level of detailed information and allows more flexibility in later stages of the assessment process. A less detailed system can be justified economically where components are initially identified in groups, for instance by floor.

Deconstruction shall follow an established deconstruction plan to ensure stability at all times, and minimize damage.

Disassembled structural components intended for reuse shall be handled and stored in such a way that the likelihood of damage is minimized, see EN 1090-2:2018+A1:2024, 6.3 and 9.6.3.

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5 Assessment of reclaimed structural components

5.1 General

The suitability of reclaimed structural components for reuse shall first be established based on information on previous use and condition evaluation, see 5.2. A comprehensive quality assessment shall then be performed in order to determine or confirm relevant properties, see 5.3.

The extent and type of testing required for the quality assessment shall depend on the amount of information available and outcome of the reusability assessment, see 5.2.

The reusability assessment should be made in the early stages of the reclamation process, ideally before deconstruction, in order to evaluate the economic and technical feasibility of reuse.

The reusability and quality assessments, see 5.2 and 5.3, shall be documented in an inspection and test record, see 5.4.

5.2 Reusability assessment

5.2.1 Data collection

The following information about the structural components to be reused should be collected, analysed and recorded, if available:

a) Date and place of construction of the original building;

b) Information on fabricator, erector, designer, architect and other actors;

c) Drawings, models, photographic evidence for the as built structure;

d) Inspection documents, e.g. according to EN 10204 or similar standard in use at the time;

e) Information about the design such as calculation notes, loading history;

f) Building Owner's manual;

g) Operation and maintenance manual;

h) Inspection and maintenance records;

i) Records of interventions (e.g. expansions, modifications);

j) Records from any possible incident (e.g. fire, earthquake).

This information shall be used as basis for the choice of testing protocol, see 5.3.4.

At least the following information shall be recorded and included in the inspection and test record:

a) A description of the donor structure including its use and geographical location;

b) The age of the donor structure which may be obtained from records (e.g. building permit) or local/anecdotal information;

c) A listing of the structural components including their location and function;

d) The results of a condition evaluation, see 5.2.2.

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5.2.2 Condition evaluation

All structural components intended for reuse shall be subjected to visual inspection in order to identify any:

a) Global deformations indicating plastification;

b) Signs of direct exposure to high temperatures (e.g. soot, burnt or blistered paint), or;

c) Local damages, inclusive plastic deformations, and reduced cross sections (e.g. through holes, openings, cracks or excessive corrosion).

Structural components which are excessively deformed should not be reused. However, some deviation from the essential tolerances in EN 1090-2 may be accepted if it is correctly declared, see 5.3.2.

Structural components which have been directly exposed to fire but satisfy the relevant essential tolerances in EN 1090-2, may be reused if their yield strength does not exceed 355 MPa.

All surfaces should be visually inspected to ensure that there is no significant loss of section due to corrosion as compared to the measured section.

Local damages and/or reduced cross sections should be dealt with in one of the following ways:

a) the whole structural component is marked as unsuitable for use according to EN 1090-2, or;

b) the weakened part of the component is marked and removed at a later stage, allowing for reuse of a structural component with unreduced cross section, or;

c) the actual section properties are measured and documented, see 5.3.2, in order to be used for design purpose, or;

d) the damaged area is repaired, see 7.

In the case of structural hollow sections, the external surface of the weld seam should be visually inspected to confirm that there are no surface breaking defects. If the components are not made of type 1 structural steel, all weld seams should be entirely inspected by magnetic particle inspection or ultrasonic testing.

Repaired components should be considered as fabricated products.

NOTE The assessment of coatings is outside the scope of this document as it is expected that existing coatings on constituent products will generally be removed as part of the fabrication process. In the case of fabricated structural components however it might be of interest to reuse the structural components in their current condition and thus assess the condition of coatings. General recommendations to this purpose are given in the informative Annex B of this document.

5.3 Quality assessment

5.3.1 General

Reclaimed structural components which have passed the reusability assessment shall be subjected to a quality assessment in order to evaluate or confirm their relevant properties.

Where reclaimed structural components are to be used as constituent products the relevant properties to be specified shall be in accordance with EN 1090-2:2018+A1:2024, Clause 5.1:

a) Yield ($f_y = R_{eH}$) and tensile ($f_u = R_m$) strength;

b) Elongation;

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c) Tolerances on dimensions and shape;

d) Heat treatment delivery condition, and;

e) Weldability.

NOTE 1 Heat treatment delivery condition is only relevant for hollow sections.

Detailed requirements on the evaluation of each of these properties are given in 5.3.2 to 5.3.4.

Weldability should be specified as a declaration of the chemical composition in sufficient detail for the carbon equivalent to be calculated.

NOTE 2 The chemical composition of type 2 structural steel is likely to vary from current steelwork. The responsible welding coordinator can wish to undertake welding trials and increase pre- and post-weld testing.

If the reclaimed structural components are fabricated structural components, the relevant properties of all their individual parts shall be assessed and the quality of workmanship shall be in accordance with the requirements of EN 1090-2.

NOTE 3 The assessment of fabricated structural components presents challenges, particularly with regard to testing of welds, for which there are no practical and widely accepted solutions. General and non-exhaustive recommendations are given in the informative Annex C of this document.

5.3.2 Geometrical properties

The cross-sectional dimensions and tolerances of all members of the test unit shall be measured and declared.

The geometrical properties may be declared directly or as a nominal section designation.

If the dimensions are declared directly for all members of a test unit, the average measurements and their coefficients of variation should be declared.

NOTE 1 For the most common shapes, relevant standards are provided in EN 1090-2:2018+A1:2024, Tables 2, 3 and 4. Even alternative shapes can occur for which other standards in use at the time are relevant.

If the dimensions are declared as a nominal section designation, the measured values shall meet all the requirements on dimensions and tolerances in the relevant product standard.

All reclaimed structural components should meet the relevant essential tolerances according to EN 1090-2 and any project specific functional tolerances.

Alternatively, reclaimed structural components which do not meet the tolerance requirements in EN 1090-2 may still be reused if the deviations are documented so that they can be accounted for in the structural design.

NOTE 2 The relevant deviations depend on the type of product and some guidance is given in the relevant part of EN 1090-2.

Possible holes or damages which are not repaired should be documented so that they can be accounted for in the structural design.

5.3.3 Heat treatment delivery condition

Reclaimed hollow sections shall be assumed to be cold formed according to EN 10219-1 and EN 10219-2 if no clearer information is available.

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