



BSI Standards Publication

Execution of steel structures and aluminium structures

Part 4: Technical requirements for cold-formed structural steel elements and cold-formed structures for roof, ceiling, floor and wall applications

National foreword

This British Standard is the UK implementation of EN 1090-4:2018.

BSI, as a member of CEN, is obliged to publish EN 1090-4:2018 as a British Standard. However, attention is drawn to the fact that during the development of this European Standard, the UK committee CB/203 voted against its approval as a European Standard.

The UK committee voted against EN 1090-4:2018 due to concerns over:

- the relationship with BS EN 14782;
- the walkability test, which does not address the impact of someone stumbling and/or falling on to the profiled sheeting;
- the lack of a reference to the fragility test (the *ACR[M]001 Test for Non-Fragility of Large Element Roofing Assemblies*, does address the impact of someone stumbling and/or falling on to the profiled sheeting);
- the thickness limits for roof, floor, cladding and other types of cold-formed structural elements;
- the number, location and spacing of fasteners used to connect sheeting to the supporting members and
- the information that must be made available to those involved in modifications/remedial work where the cladding has been designed for stressed-skin action.

The UK committee draws users' attention to National Annex NA, which addresses some of these concerns and provides additional information.

This standard gives the technical requirements for the execution for cold-formed structural steel elements and cold-formed structures for roof, ceiling, floor and wall applications and is a supporting standard for the harmonised standard BS EN 1090-1:2009+A1:2011, *Execution of steel structures and aluminium structures - Part 1: Requirements for conformity assessment of structural components*. Conformity assessment to BS EN 1090-1:2009+A1:2011 requires that the manufacturer operates a certified factory production control system.

The UK participation in its preparation was entrusted to Technical Committee CB/203, Design & execution of steel structures.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2018
Published by BSI Standards Limited 2018

ISBN 978 0 580 85952 6

ICS 91.080.17; 91.010.30; 91.080.13

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2018.

Amendments/corrigenda issued since publication

Date	Text affected
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English Version

Execution of steel structures and aluminium structures -
Part 4: Technical requirements for cold-formed structural
steel elements and cold-formed structures for roof, ceiling,
floor and wall applications

Exécution des structures en acier et des structures en
aluminium - Partie 4 : Exigences techniques pour
éléments et structures en acier formés à froid pour
applications en toiture, plafond, paroi verticale et
plancher

Ausführung von Stahltragwerken und
Aluminiumtragwerken - Teil 4: Technische
Anforderungen an tragende, kaltgeformte Bauelemente
aus Stahl und tragende, kaltgeformte Bauteile für Dach-
, Decken-, Boden- und Wandanwendungen

This European Standard was approved by CEN on 6 February 2017.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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

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European foreword

This document (EN 1090-4:2018) has been prepared by Technical Committee CEN/TC 135 “Execution of steel structures and aluminium structures”, the secretariat of which is held by SN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2019, and conflicting national standards shall be withdrawn at the latest by January 2019.

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

This document is part of the EN 1090 series, which comprises the following parts:

- EN 1090-1, *Execution of steel structures and aluminium structures - Part 1: Assessment and verification of constancy of performance for structural components*
- EN 1090-2, *Execution of steel structures and aluminium structures - Part 2: Technical requirements for steel structures*
- EN 1090-3, *Execution of steel structures and aluminium structures - Part 3: Technical requirements for aluminium structures*
- EN 1090-4, *Execution of steel structures and aluminium structures - Part 4: Technical requirements for cold-formed structural steel elements and cold-formed structures for roof, ceiling, floor and wall applications*
- EN 1090-5, *Execution of steel structures and aluminium structures - Part 5: Technical requirements for cold-formed structural aluminium elements and cold-formed structures for roof, ceiling, floor and wall applications*

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies requirements for the execution, i.e. the manufacture and the installation, of cold-formed structural steel members and sheeting and cold-formed structures for roof, ceiling, floor, wall and cladding applications.

This European Standard applies to structures designed according to the EN 1993 series.

This European Standard applies to structural members and sheeting to be designed according to EN 1993-1-3.

This European Standard may be used for structures designed according to other design rules provided that conditions for execution comply with them and any necessary additional requirements are specified.

This European Standard also specifies requirements for the execution i.e. the manufacture and the installation of structures made from cold formed profiled sheeting for roof, ceiling, floor and wall applications under predominately static loading or seismic loading conditions and their documentation.

This European Standard covers sheeting of structural classes I and II according to EN 1993-1-3 used in structures.

This European Standard covers structural members of all structural classes according to EN 1993-1-3.

Structural sheeting are understood here to be:

- profiled sheet, such as trapezoidal, sinusoidal or liner trays (Figure 1), or

Structural members are understood here to be:

- members (linear profiled cross sections) that are produced by cold forming (Figure 2).

This European Standard also covers:

- not welded built-up sections (Figure 2b and 2c);
- cold-formed hollow sections including the welding of the longitudinal seam, not covered by EN 10219-1;
- perforated, punctured and micro profiled sheeting and members;

NOTE 1 Welded built-up sections, are not covered, the execution provisions are given in EN 1090-2.

This European Standard also covers spacer constructions between the outer and inner or upper and lower skins for roofs, walls and ceilings made from cold-formed profiled sheeting and the connections and attachments of the afore mentioned elements as long as all are involved in load transfer.

This European Standard covers steel profiled sheeting for composite floors, e.g. during installation and in stage of pouring concrete.

Composite structural members where the interaction between dissimilar materials are an integral part of the structural behaviour such as sandwich panels and composite floors are not covered by this standard.

This European Standard does not cover the necessary analyses and detailing and execution rules for thermal insulation, moisture protection, noise control and fire protection.

This European Standard does not cover regulations of roof cladding and wall cladding, produced by traditional plumber methods or tinsmith methods.

Annex B of this standard concerns provisions which are not yet included in EN 1993-1-3. The guidelines in this annex may be wholly or partially superseded by future guidelines added to EN 1993.

This European Standard does not cover detailed requirements for water tightness or air permeability resistance and thermal aspects of sheeting.

NOTE 2 The structures covered in this standard can be for example

- single- or multi-skin roofs, whereby the load-bearing structure (lower skin) or the actual roof covering (upper skin) or both consist of cold-formed structural members and sheeting;
- single- or multi-skin walls whereby the load-bearing structure (inner skin), the actual cladding (outer skin) or both consist of cold-formed structural members and sheeting, or
- trusses from cold formed members.

NOTE 3 Structures can consist of an assembly of structural members and sheeting made of steel according to EN 1090-4 and of aluminium according to EN 1090-5.

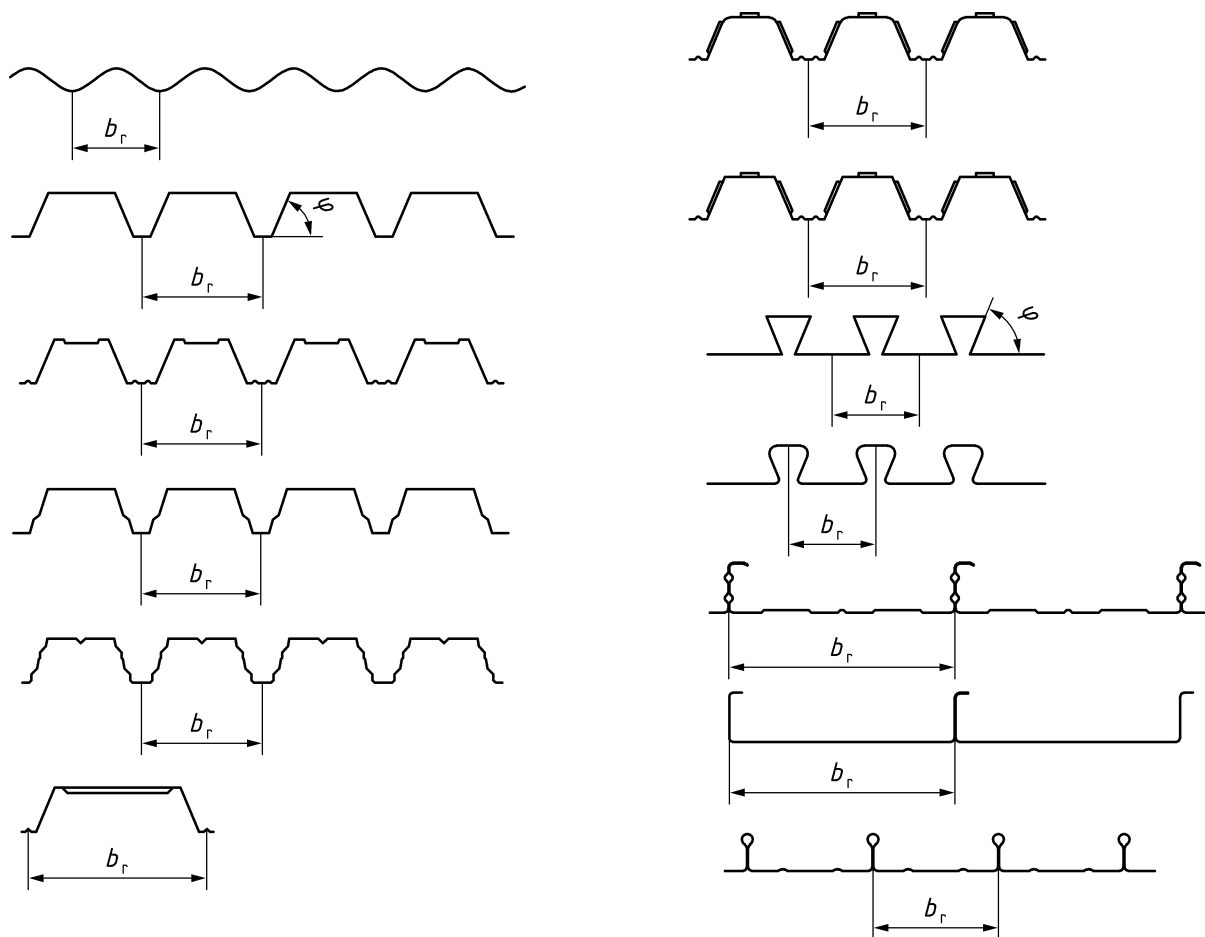


Figure 1 — Examples of profiled sheets

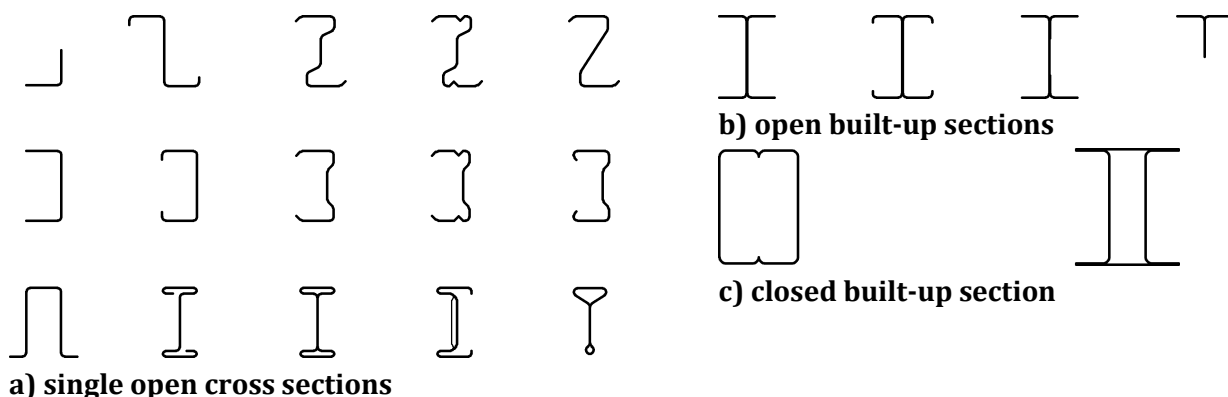


Figure 2 — Examples of linear profile cross sections

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 508-1, *Roofing and cladding products from metal sheet — Specification for self-supporting of steel, aluminium or stainless steel sheet — Part 1: Steel*

EN 508-3, *Roofing products from metal sheet — Specification for self-supporting products of steel, aluminium or stainless steel sheet — Part 3: Stainless steel*

EN 1090-1, *Execution of steel structures and aluminium structures — Part 1: Requirements for conformity assessment of structural elements*

EN 1090-2:2008+A1:2011, *Execution of steel structures and aluminium structures — Part 2: Technical requirements for steel structures*

EN 1991 (all parts), *Eurocode 1: Actions on structures — Part 1-1: General actions — Densities, self-weight, imposed loads for buildings*

EN 1993-1-1:2005, *Eurocode 3: Design of steel structures — Part 1-1: General rules and rules for buildings*

EN 1993-1-3:2006, *Eurocode 3 — Design of steel structures — Part 1-3: General rules — Supplementary rules for cold-formed members and sheeting*

EN 1993-1-4:2006, *Eurocode 3 — Design of steel structures — Part 1-4: General rules — Supplementary rules for stainless steels*

EN 1995-1-1, *Eurocode 5: Design of timber structures — Part 1-1: General — Common rules and rules for buildings*

EN 10143, *Continuously hot-dip coated steel sheet and strip — Tolerances on dimensions and shape*

EN 10152, *Electrolytically zinc coated cold rolled steel flat products for cold forming — Technical delivery conditions*

- EN 10162:2003, *Cold rolled steel sections — Technical delivery conditions — Dimensional and cross-sectional tolerances*
- EN 10169:2010+A1:2012, *Continuously organic coated (coil coated) steel flat products — Technical delivery conditions*
- EN 10204, *Metallic products — Types of inspection documents*
- EN 10346, *Continuously hot-dip coated steel flat products for cold forming — Technical delivery conditions*
- EN 13523-1, *Coil coated metals — Test methods — Part 1: Film thickness*
- EN 13523-6, *Coil coated metals — Test methods — Part 6: Adhesion after indentation (cupping test)*
- EN 13523-7:2014, *Coil coated metals — Test methods — Part 7: Resistance to cracking on bending (T-bend test)*
- EN 13523-8, *Coil coated metals — Test methods — Part 8: Resistance to salt spray (fog)*
- EN 13523-10, *Coil coated metals — Test methods — Part 10: Resistance to fluorescent UV radiation and water condensation*
- EN 13523-19, *Coil coated metals — Test methods — Part 19: Panel design and method of atmospheric exposure testing*
- EN 13523-21, *Coil coated metals — Test methods — Part 21: Evaluation of outdoor exposed panels*
- EN 13523-26, *Coil coated metals — Test methods — Part 26: Resistance to condensation of water*
- EN 62305-3, *Protection against lightning — Part 3: Physical damage to structures and life hazard (IEC 62305-3)*
- EN 62561-1, *Lightning Protection System Components (LPSC) — Part 1: Requirements for connection components (IEC 62561-1)*
- EN ISO 717-1, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation (ISO 717-1)*
- EN ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods (ISO 1461)*
- EN ISO 2081, *Metallic and other inorganic coatings — Electroplated coatings of zinc with supplementary treatments on iron or steel (ISO 2081)*
- EN ISO 2409, *Paints and varnishes — Cross-cut test (ISO 2409)*
- EN ISO 2808, *Paints and varnishes — Determination of film thickness (ISO 2808)*
- EN ISO 2810, *Paints and varnishes — Natural weathering of coatings — Exposure and assessment (ISO 2810)*
- EN ISO 3452-1, *Non-destructive testing — Penetrant testing — Part 1: General principles (ISO 3452-1)*

- EN ISO 3834 (all parts), *Quality requirements for fusion welding of metallic materials (ISO 3834)*
- EN ISO 4042, *Fasteners — Electroplated coatings (ISO 4042)*
- EN ISO 4136, *Destructive tests on welds in metallic materials — Transverse tensile test (ISO 4136)*
- EN ISO 5173, *Destructive tests on welds in metallic materials — Bend tests (ISO 5173)*
- EN ISO 6270-1, *Paints and varnishes — Determination of resistance to humidity — Part 1: Continuous condensation (ISO 6270-1)*
- EN ISO 6507 (all parts), *Metallic materials — Vickers hardness test — Part 1: Test method (ISO 6507)*
- EN ISO 8492, *Metallic materials — Tube — Flattening test (ISO 8492)*
- EN ISO 8493, *Metallic materials — Tube — Drift-expanding test (ISO 8493)*
- EN ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests (ISO 9227)*
- EN ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel (ISO 9712)*
- EN ISO 11654, *Acoustics — Sound absorbers for use in buildings — Rating of sound absorption (ISO 11654)*
- EN ISO 12944-2, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 2: Classification of environments (ISO 12944-2)*
- EN ISO 12944-4, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 4: Types of surface and surface preparation (ISO 12944-4)*
- EN ISO 12944-6, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 6: Laboratory performance test methods (ISO 12944-6)*
- EN ISO 12944-7, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 7: Execution and supervision of paint work (ISO 12944-7)*
- EN ISO 14554 (all parts), *Quality requirements for welding — Resistance welding of metallic (ISO 14554)*
- EN ISO 14713 (all parts), *Zinc coatings — Guidelines and recommendations for the protection against corrosion of iron and steel in structures (ISO 14713)*
- EN ISO 14731, *Welding coordination — Tasks and responsibilities (ISO 14731)*
- EN ISO 14732, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials (ISO 14732)*
- EN ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules (ISO 15607)*
- EN ISO 17639, *Destructive tests on welds in metallic materials — Macroscopic and microscopic examination of welds (ISO 17639)*
- EN ISO 17872:2007, *Paints and varnishes — Guidelines for the introduction of scribe marks through coatings on metallic panels for corrosion testing (ISO 17872:2007)*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

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

3.1.1

component I

component (usually the profile sheet) that is facing the head of the fastener (the swage head in the case of blind rivets)

3.1.2

component II

second component of a connection (usually the supporting member)

3.1.3

decking

load bearing sheet to support

EXAMPLE E.g. insulation and outer skin.

3.1.4

decking edge trim

fold added to the free end of an outstand plane element to restrain that element for local buckling and to ensure the geometry under access loads

3.1.5

edge trim

load-bearing flashings around a perimeter of a composite steel deck to retain the wet concrete during casting

3.1.6

fastening

fastener and the process of fastening and the final connected components

3.1.7

flashing

non-load bearing element, for example accessories and coverings in the areas of the skirting, eaves, gable end, ridge and corners

3.1.8

layout drawings

drawings which are showing the position of structural members and execution details

3.1.9

liner tray

profiled sheet with large lipped edge stiffener, suitable for interlocking with adjacent liner trays to form a plane of ribbed sheeting that is capable of supporting a parallel plane of profiled sheeting

3.1.10

penetration

opening in the decking made on-site

3.1.11

restraint

restriction of the lateral or rotational movement, or the torsional or warping deformation, of a member or element, that increases its buckling resistance to the same extent as a rigid support

3.1.12

saddle washer

oversized gasket that is adapted to the respective profile shape and are made of aluminium, steel or stainless steel with a seal bonded to it and an adapted corrosion protection to that of the profiled sheeting which can be used when profiled sheeting are connected via its top flange

3.1.13

structural cold formed component

load-bearing element made from steel sheet by cold rolling or press braking

3.1.14

trimmer

beam around an opening in a floor or roof or wall

3.2 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

<i>C</i>	corrosivity category
<i>D</i>	edge waviness of the side lap
<i>E</i>	modulus of elasticity
<i>F</i>	force
<i>I</i>	second moment of area
<i>K</i>	shear force of the fastener
<i>L</i>	span, distance
<i>M</i>	bending moment
<i>R</i>	end support reaction
<i>T</i>	shear flow
<i>V</i>	shear force of the structural component
<i>a</i>	distance between fastener and web of profiled sheet
<i>b</i>	width, width of spacing strip
<i>d</i>	hole diameter, nominal diameter of the fastener
<i>e</i>	distance of hole from edge, distance between fastener and centre line of flange of profiled sheet, distance between fasteners
<i>g</i>	self-weight of the roof including the self-weight of the profile
<i>h</i>	depth of profile

l	length of double layer
p	distances between holes
q_0	α times roof load
r	radius
t	thickness of bare metal of the sheet, hole pitch
Δ	deviation, tolerance
δ	deviation from straightness
φ	inclination of the web of profile

Indices

A	end support, centre-to-centre distance of the penetration from the end support or from the point of zero moment
B	internal, intermediate support
I	component 1, profiled sheet
II	component 2, supporting member / profiled sheet
L	longitudinal edge, left side
N	nominal sheet thickness $BD + \Delta$
R	rib edge, right side
S	tensile force from constraints due to shear reinforcement shear stiffness
U	bottom flange
V	shear load, thickness of the bare steel measured in the test
f	Width of flange — theoretical requirement used for static calculations
g	self-weight of roof
i	ideal distance between supports,
k	cantilever
n	nominal hole diameter required,
r	rib
s	stiffener at the web
t	tensile force
w	web

α ratio q_0/q

4 Specifications and documentation

4.1 Execution Specification

4.1.1 General

The necessary information and technical requirements for execution of each part of the works shall be agreed and complete before commencement of execution of that part of the works. There shall be procedures for making alterations to previously agreed execution specification. Execution specification consists of layout drawings and details, based on structural design and shall consider such of the following items as relevant:

- a) additional information, as listed in Annex F;
- b) execution classes, see 4.1.2;
- c) technical requirements regarding the safety of the works, see 4.2.3 and 9.7;
- d) preparation grades, if relevant, see EN 1090-2;
- e) tolerance classes, see 4.1.4.

NOTE The responsibilities between the parties involved can be regulated by member states.

4.1.2 Execution classes

Four execution classes 1 to 4, denoted EXC1 to EXC4, are given, for which requirement strictness increases from EXC1 to EXC4.

The execution specification shall specify the relevant execution class or classes.

NOTE The requirements for the selection of execution classes are given in EN 1993-1-1:2005, Annex C.

The list of requirements related to execution classes is given in EN 1090-2.

Members and sheeting complying with this standard may be used for EXC 1 to 3. In this European Standard for sheeting there is no differentiation in requirements between execution classes. EN 1090-2 does not apply.

4.1.3 Layout drawings

Layout drawings shall be part of the execution specification and are based on structural design.

Layout drawings and assembly instructions shall include the following details and shall be prepared for the execution:

- type and position of the structural members and sheeting;
- connection with the supporting member and arrangement of the fasteners;
- structural members and sheeting with profile designation and manufacturer's name, constituent product, nominal sheet thickness, manufactured length and corrosion protection;
- direction of lay of sheeting and special installation sequences;
- statically effective overlapping (moment-resisting connections), if relevant;

- execution tolerances;
- fasteners with type designation, name of manufacturer of the fasteners (not valid for bolts), type of washer and other fixing accessories, arrangement and separation distances, special assembly instructions depending on the type of connection, e.g. hole diameters, axial spacings and edge distances;
- type and details of the supporting member for the structural members and sheeting, such as material, centre to centre distances and dimensions, the inclination;
- details of the side and end overlappings and edges of the installed area;
- openings in the installed areas, including the necessary framing, e.g. for skylights, smoke and heat extractors and roof drainage, if relevant;
- superstructures or suspensions, e.g. for piping, bunched cables or suspended ceilings, if relevant;
- stating that all structural members and sheeting shall be fixed immediately after laying;
- details about any special installation measures, if relevant;
- special devices for installation, if relevant;
- any specific hazards related to construction should be identified;
- details about corrosion protection, e.g. contact surfaces between different metals or between metals and timber, concrete, masonry or plaster, if relevant;
- details about the condition and location of sealant strips, fillers for profiled sheets and special elements, if relevant;
- details about setting-down places for bundles of structural members and sheeting on roof areas and floors according to the static calculation;
- details about walkability, if relevant;
- details about weather integrity, if relevant;
- details about fire protection, if relevant;
- details about thermal insulation, if relevant;
- details about acoustics, if relevant;
- details about air tightness, if relevant.

Laying areas and parts of laying areas that are intended to act as a diaphragm to stabilize the structure or parts of the structure shall be marked on the layout drawings as 'diaphragm'.

4.1.4 Geometrical tolerances

Two types of geometrical tolerances are defined in 11:

- a) essential tolerances;

- b) functional tolerances, with two classes for which requirement strictness increases from class 1 to class 2 (see 11.4).

4.2 Installer's Documentation

4.2.1 General

It shall be specified if a quality documentation for installation is required.

The construction records shall document the state and progress of the construction works as well as all noteworthy incidents during construction.

Annex C contains a list of recommended items for the installation documentation.

4.2.2 Quality documentation

The following points shall be documented:

- a) organization chart and managerial staff responsible for each aspect of the execution;
- b) the procedures, methods and work instructions to be applied;
- c) an inspection plan specific to the works; see EN 1090-2, if applicable;
- d) a procedure for handling changes and modifications;
- e) a procedure for handling of nonconformities, requests for concessions and quality disputes;
- f) specified hold-points or requirement to witness inspections or tests, and any consequent access requirements.

4.2.3 Safety of the erection works

Method statements giving detailed work instructions shall comply with the technical requirements relating to the safety of the erection works as given in 9.7.

4.3 Detailed traceability documentation

Constituent products for manufacturing cold-formed steel structural members and sheeting shall be traceable at all stages, from purchasing the sheet material to installation of the manufactured products

This traceability may be based on documentary records for batches of product allocated to a common production process.

4.4 Execution documentation

Sufficient documentation shall be prepared during execution and as a record of the as-built structure to demonstrate that the works have been carried out according to the execution specification.

NOTE Member states can define type and content of such a statement.

5 Constituent products

5.1 General

This section defines the basic requirements with respect to the structural members and sheeting and the accompanying documents.

Constituent products to be used for the execution of cold-formed steel structures shall be according to 5.3.

If constituent products that are not covered by the standards listed in Clause 5.3 are to be used their properties shall be specified.

5.2 Identification, inspection documents and traceability

The properties of supplied constituent products shall be documented in a way that enables them to be compared to the specified properties.

For steel products made of materials given in 5.3, the inspection document shall be 3.1 according to EN 10204.

Constituent products shall be delivered and identified as follows:

- a) They shall be delivered in an appropriate packaging and labelled such that the content is readily identifiable.
- b) Labelling or accompanying documentation shall be in accordance with the requirements of the product standard and should contain the following information in a legible and durable form, attached to every packaged unit:
 - Manufacturer's name and works;
 - Batch designation or documentation number for traceability;
 - Designation of the structural member and sheeting;
 - Bundle weight;
 - Length, if relevant for lifting;
 - Number of products inside the package;
 - Thickness;
 - Steel grade or specific product reference;
 - Corrosion protection system.

It is recommended that labels be retained. See also Annex C.

5.3 Materials

Materials to be used in the manufacture of structural cold-formed members and sheeting shall have properties that conform to the required suitability for cold forming process.

Materials to be used for manufacturing of structural profiled sheets shall conform to the requirements of the relevant European product standards as listed in Table 1, if not otherwise specified (e.g. ETAs). Grades and coating system with full designation shall be specified together with any required options permitted by the product standard.

Carbon steels suitable for cold forming are listed in EN 1993-1-3 or in EN 10346. Stainless steels suitable for cold forming are listed in EN 508-3.

Deep drawing quality steels according to EN 10346 are not permitted for profiled sheets. The minimum yield strength for profiled sheets is 220 N/mm².

The finished product manufacturer shall buy base materials whose characteristics are declared by the base material supplier with an inspection certificate 3.1 according to EN 10204. Therefore the finished product manufacturer's system requires only a document check to ensure that the characteristics meet the product manufacturer's specifications. The inspection certificate 3.1 shall contain at least the following data in accordance with EN 10346:

- Name or mark of the manufacturer's work;
- Identification number;
- Indication of the type and grade of material;
- Indication of the nominal layer weight of the metallic protective layers, if relevant, in accordance with EN 10346;
- Nominal dimensions of the product ordered and nominal sheet thickness (t_N) (in mm respectively) and special tolerance (S) or normal tolerance (N) or a specific tolerance when specified in the execution specification (see 5.4);
- Coating system; full designation;
- Determined layer weight of the metal protective layer (g/m^2), in accordance with EN 10346 (in case of a steel manufacturer it may not be provided by him);
- Determined thickness of the organic coating visible side/rear side in μm (in case of a steel manufacturer it may not be provided by him);
- Determined values of the mechanical material properties (see also EN 10346)
 - Yield strength or 0,2 %-proof strength ($R_{eH}/R_{p0,2}$) in MPa;
 - Tensile strength (R_m) in MPa;
 - Elongation after fracture A_{80} mm in %;
 - Bend radius to thickness ratio, if relevant;
 - Adhesion of metallic coating.

In case of not having a 3.1 inspection document or the 3.1 document is incomplete the material shall be treated as a non-conforming product until it can be demonstrated that it meets the requirements of the specification.

Table 1 — Materials ^a for profiled sheeting

Steel grade	European Standard	Metallic coating ^c	Yield strength R _{p0,2} in N/mm ²	Ultimate tensile strength R _m in N/mm ²	Elongation A ₈₀ mm in % min.
S220GD ^b	EN 10346	+Z, +ZA, +AZ, +ZM	220	300	20
S250GD ^b	EN 10346	+Z, +ZA, +AZ, +ZM	250	330	19
S280GD	EN 10346	+Z, +ZA, +AZ, +ZM	280	360	18
S320GD	EN 10346	+Z, +ZA, +AZ, +ZM	320	390	17
S350GD	EN 10346	+Z, +ZA, +AZ, +ZM	350	420	16
S390GD	EN 10346	+Z, +ZA, +AZ, +ZM	390	460	16
S420GD	EN 10346	+Z, +ZA, +AZ, +ZM	420	480	15
S450GD	EN 10346	+Z, +ZA, +AZ, +ZM	450	510	14
S550GD	EN 10346	+Z, +ZA, +AZ, +ZM	550	560	- ^d
^a In some countries other materials may be permitted. ^b Profiled sheets made from these grades may not be permitted for use in some countries. ^c Other metallic coatings may also be used and their properties shall be specified by European Standards or ETAs. ^d Shall be specified by the manufacturer of the coil.					

5.4 Thickness tolerances

The execution specification shall specify the tolerance limit value or type for the thickness. This can be in accordance with the product standard for the steel sheet or strip concerned.

Tolerance types ("normal" tolerance (N) or "special" tolerance (S)) are given for continuously hot-dip metal coated steel sheet or strip in EN 10143.

In the structural design a smaller sheet thickness tolerance might be specified compared to the product standard concerned. In such a case this should be explicitly noted in the Execution Specification.

The thickness of the manufactured components shall be measured in those areas which are not influenced by the cold forming process.

5.5 Minimum nominal sheet thicknesses

5.5.1 Profiled sheets

The thicknesses shall be in accordance with the execution specification.

The minimum nominal sheet thicknesses shall not be less than shown below, if not otherwise specified:

Decking:	$t_N \geq 0,75 \text{ mm}$
Roof coverings:	$t_N \geq 0,50 \text{ mm}$
Floors:	
— as load-bearing parts:	$t_N \geq 0,75 \text{ mm}$
— as permanent formwork for load-bearing concrete floors:	$t_N \geq 0,75 \text{ mm}$
Walls and wall claddings:	
— outer skin:	$t_N \geq 0,50 \text{ mm}$
— single skin or inner skin for all spans:	$t_N \geq 0,50 \text{ mm}$
— liner trays:	$t_N \geq 0,75 \text{ mm}$

NOTE 1 Static calculations according to the Eurocodes give a nominal thickness required for design. The values above are based on execution experiences on the work-site.

NOTE 2 For aesthetic reasons, especially for wall applications, greater thicknesses may be necessary to prevent loss of flatness.

NOTE 3 In some countries the above listed values additionally depend on the cross section and the span of profile and can be lower than specified above.

5.5.2 Structural members

The thicknesses shall be in accordance with the execution specification.

The minimum nominal thicknesses for roof and wall structures shall not be less than shown below, if not otherwise specified:

— Purlin and cladding rail	$t_N \geq 0,88 \text{ mm}$
— Spacer profiles in roofs and walls:	$t_N \geq 0,75 \text{ mm}$
— Edge stiffening profiles:	$t_N \geq 1,00 \text{ mm}$
— Edge trim:	$t_N \geq 0,75 \text{ mm}$
— Restraint members:	$t_N \geq 0,88 \text{ mm}$

but at least the nominal thickness of the attached profiled sheets (exception: edge trim).

5.6 Geometrical tolerances

Geometrical tolerances are given in 11 and Annex D.

5.7 Mechanical fasteners

5.7.1 General

This clause specifies the requirements for screws, blind rivets and cartridge fired pins for structural members and sheeting with a thickness not greater than 4 mm. For other types of mechanical fasteners (e.g. bolts and nuts) or thicknesses greater than 4 mm, EN 1090-2 shall apply. Bolts M6, M8 or M10 are also accepted for non-preloaded bolt applications, if specified. The bolt manufacturing shall comply with the requirements specified in EN 1090-2.

Bolt sizes M6 up to M10 when using electroplated coating in joints between cold formed members, the risk on hydrogen embrittlement should be controlled. In general this is the case when the bolted connection complies with:

- Non-preloaded
- Bolt grade not higher than 8.8 (hardness below 320 HV)
- Application only in corrosion categories C1 (very low) and C2 (low) according to EN ISO 12944-2 (no additional hydrogen due to corrosion process)

For fully threaded non-preloaded bolts no requirements referring to the unthreaded parts of the shank applies (see EN 1090-2).

NOTE Contact between thread and hole edge is included in the calculation rule for hole bearing given in EN 1993-1-3.

5.7.2 Type of fasteners and materials

Fasteners according to European Standards or European Technical Assessments (ETA) shall be used. The type of fastener with designation of the relevant European Standard or ETA shall be specified.

NOTE For further information for mechanical fasteners for diaphragm application see EN 1993-1-3:2006, 10.3.4.

The fastener materials shall be adapted to the intended purpose, see EN 1993-1-3:2006, Annex B.

Fastenings are subdivided into:

- a) Thread-forming screws, these are subdivided into:
 - Thread-forming self-tapping screws, which produce their female threads in predrilled holes in a chipless manner.
 - Self-drilling self-tapping screws with a drill tip, with the drilling of a hole, the forming of the female thread and the tightening of the screw all taking place in a single operation.
 - Self-piercing screw with a piercing tip which forms the female thread without pre-drilling but by material displacement.
- b) Blind rivets that comprise a rivet sleeve and a rivet mandrel with a predetermined breaking point.
- c) Cartridge fired pins that are forced through the component being attached into the supporting member using a fastening tool. Details of the firing charge and driving forces are given by the relevant ETAs.
- d) Bolts and nuts and washers.
- e) Clinch connections. Details of clinch connections are given by the relevant ETAs.
- f) Spot welds

Fasteners that are completely or partially exposed to weathering or similar moisture loading (partially exposed does not mean short exposure to weathering during installation) shall be made from austenitic stainless steel or aluminium, if not otherwise specified, unless it can be proven by testing that the corrosion protection system of the exposed part of carbon steel fasteners corresponds the corrosion protection of the parts to be connected. This does not apply to welded-on drill tips. With fasteners that

are not made from stainless steel, the corrosion protection of the fasteners shall be adapted to the required corrosion protection of the parts to be connected by means of galvanizing and, if necessary, organic coating. The requirements in EN ISO 4042 shall be observed. In the case of electrolytic galvanizing, the coating thickness shall be at least 8 µm. Less thickness might be acceptable provided specific verification of the durability for the intended use of the fasteners is given.

For a rainproof connection or mounting, washers made of aluminium or austenitic stainless steel with a cured-on elastomer seal at least 1,6 mm thick shall be inserted under the head of the fastener. This seal shall be compressed by fastening of about 30 – 50 % of its thickness for getting a rainproof connection (see Figure 4). Alternatively the fasteners shall be associated with accessories ensuring a rainproof connection. For an accurate implementation, the specifications of the fastener manufacturer shall be followed

5.8 Accessories

Accessories are components that are absolutely necessary for the function of the construction but for which no analyses of the ultimate limit state or serviceability limit state shall be carried out, e.g. decking side trim, sealant strips, fillers for profiled sheets or flashings. They shall fulfil the same requirements for durability, corrosion protection and reaction to fire as the structural members and sheeting listed under 5.3 and 5.5 if not otherwise specified.

5.9 Surface protection

Verification of suitability of a corrosion protection system for a corrosivity category shall be carried out with reference to Clause 10 and Annex E of this standard.

NOTE Buildings are normally designed for duration high “H” (EN ISO 12944-1) if not otherwise specified.

EN 1993-1-4:2006, Annex A gives a material selection procedure for structural stainless steel in typical building environments.

5.10 External fire performance for roofing elements

External fire performance of structural profiled sheets can be determined in accordance with EN 14782.

5.11 Reaction to fire

See EN 1090-1.

5.12 Resistance to fire

See EN 1090-1.

5.13 Release of dangerous substances

See EN 1090-1.

5.14 Lightning protection

For structural members and sheeting made of metal that form part of the lightning protection system the recommendations given in EN 62305-3 shall apply.

6 Manufacturing

6.1 General

Structural members and sheeting shall be manufactured by cold forming from steel sheet or strip/coil. There shall be no cracks at the bended areas visible by the naked eye.

NOTE Product standards for flat products as well as EN 10162:2003, Annex A specify limit values for (bend radius)/(thickness) ratios as a function of the steel type and steel grade, above which one may expect that no by the eye visible cracks will occur.

When stainless steel sheet or strip shall be cold-formed, the forming equipment shall be cleaned in case also other steels are formed on the same equipment. Other possibilities shall be proven by testing.

For welding other than the longitudinal welded seam of hollow sections, EN 1090-2 applies.

6.2 Identification

At all stages of manufacturing each piece or package of similar pieces of steel components shall be identifiable by a suitable system.

6.3 Cold forming

Shaping by cold forming, produced either by roll forming or press braking shall conform to the requirements for cold formability given in the relevant product standard and shall be fabricated considering the requirements in Clause 10 and within the tolerances specified in Clause 11. Hammering shall not be used.

Shaped components with damaged surface coatings or lack of adhesion of the metallic coating shall be treated as non-conforming products. The minimum inside bend radii shall be specified to avoid damage.

6.4 Cutting

6.4.1 General

Cutting shall be carried out in such a way that the requirements for geometrical tolerances as specified in this European Standard are met.

NOTE Known and recognized cutting methods are for example; shearing, nibbling, sawing, thermal cutting and water jet techniques. Other methods are possible if appropriate, if they do not affect the corrosion protection and if the suitability is documented in the initial production control inspection of the manufacturer.

If a process does not conform, it shall not be used until corrected and checked again. If coated materials are to be cut, the method of cutting shall be selected to minimize the damage on the coating.

Burrs that could cause injury or prevent the proper alignment or bedding of sections or sheeting shall be removed.

6.4.2 Shearing and nibbling

The free edge surfaces shall be checked as necessary in order to remove significant defects. If grinding or machining is used after shearing or nibbling, the minimum depth of grinding or machining shall be 0,5 mm. The corrosion protection then shall be renewed.

6.4.3 Thermal cutting

The capability of thermal cutting shall be proved including the effect on the corrosion protection. Requirements of EN 1090-2 apply.

6.5 Punching

6.5.1 General

This clause specifies the requirements on punching of holes and notches in cold-formed steel members and sheeting with a sheet thickness of maximum 15 mm, if not otherwise specified.

Requirements of EN 1090-2 on dimensions of holes for connections with mechanical fasteners and pins apply.

NOTE Clearances defined in EN 1090-2:2008+A1:2011, Table 11 for nominal bolts diameter of 12 mm are also applicable to nominal bolt diameters from 6 to 10 mm.

Different holes in the same cold formed steel element may be classified for different execution classes.

6.5.2 Execution

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.

If not otherwise specified, holes may be punched full size without reaming for a sheet thickness:

- up to 4 mm for all execution classes
- up to 8 mm for EXC1, EXC2 and EXC3

In other cases punching without reaming is not permitted. The holes and notches shall be punched at least 2 mm undersize in diameter and reamed after punching.

If not otherwise specified, for details subject to high cyclic or seismic stresses for high seismic ductility class (DCH) (see EN 1993-1-1:2005, Annex C), punched holes in a sheet with thickness greater than 4 mm shall be reamed.

Punching without reaming may also be permitted, if specified in an applicable ETA.

For carbon steels with a yield strength greater than 460 N/mm² and if specified for other steel grades, the hardness of free edge surfaces shall be no more than 450 (HV 10).

If not otherwise specified, the check of the capability of the processes shall be as follows:

- a) Four samples shall be produced from procedure tests on constituent product encompassing the range of constituent products processed that are most susceptible to local hardening;
- b) Four local hardness tests shall be done on each sample in locations likely to be affected. The tests shall be in accordance with the EN ISO 6507- series.

If the execution specification requires steel material to be free from hardened material due to the punching process, holes shall not be punched full size but may be punched 2 mm diameter less than full size and then reamed or drilled.

Unless otherwise specified punched holes shall also conform to the following (Figure 3):

- i) The height of the clean-cut surface h_s shall be minimum 1/5 of the sheet thickness.
- ii) The hole clearance Δ_2 shall not exceed 1/10 of the sheet thickness.
- iii) The burrs Δ_1 shall not exceed 1/10 of the sheet thickness but smaller or equal 0,50 mm.

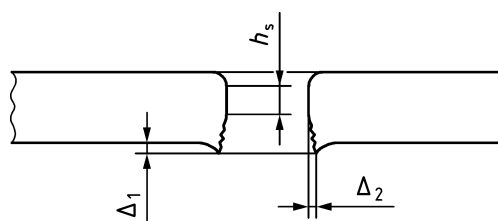


Figure 3 — Permitted distortions of punched holes

Notches and re-entrant corners shall be rounded off with a minimum radius r of: