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Steel structures — Execution of structural steelwork —

Part 3: **Fabrication**

Structures en acier – Exécution des charpentes et ossatures en acier —

Partie 3: Fabrication

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 167, *Steel and aluminium structures*.

This first edition cancels and replaces ISO 10721-2:1999, which has been technically revised.

A list of all parts in the ISO 17607 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Specific requirements for the achievement of structures that are optimal with respect to safety, the state of the economy, development and general values of a nation are given in the appropriate regional or national standards, if they exist.

Many nations do not have their own standards for structural steelwork. Some reference other national or regional standards. Some permit the project's standard to be selected by the owner, designer or constructor of the structure. Some do not require any standards to be followed.

The ISO 17607 series of standards on the execution of structural steelwork was developed to serve as a means to provide a set of requirements and guidance for projects that are constructed without a governing regional or national standard. The ISO 17607 series can also serve to reduce trade barriers.

Additional requirements to be addressed in the execution of structural steelwork, as structures or as fabricated components, can be found in the other parts of the series:

— ISO 17607-1 (General requirements and terms and definitions)

— ISO 17607-2 (Steels);

— ISO 17607-4 (Erection);

— ISO 17607-5 (Welding);

— ISO 17607-6 (Bolting).

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Steel structures — Execution of structural steelwork —

Part 3: Fabrication

1 Scope

This document defines the general requirements for fabrication in the execution of structural steelwork as structures or as fabricated components in conjunction with ISO 17607-1.

Additional requirements to be addressed in the execution of structural steelwork, as structures or as fabricated components, can be found in other parts of the ISO 17607 series.

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.

ISO 286-2, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 9013, *Thermal cutting — Classification of thermal cuts — Geometrical product specification and quality tolerances*

ISO 13920, *Welding — General tolerances for welded constructions — Dimensions for lengths and angles — Shape and position*

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

ISO 17607-1, *Steel structures — Execution of structural steelwork — Part 1: General requirements and vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17607-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Execution specification

See ISO 17607-1.

National standards and documents that provide technically equivalent conditions may be used, in whole or in part, in place of referenced ISO standards or requirements of this document. In these cases,

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the technically equivalent national standards and documents, and deviations from the requirements of this document shall be referenced in the execution specification.

The necessary information and technical requirements for execution of fabrication shall be agreed on and complete before commencement.

The execution specification shall include the following items as relevant:

a) for additional information, see A.1;

b) for additional information, see A.2;

c) requirements related to execution levels, see A.3;

d) identification and traceability requirements, see ISO 17607-1;

e) geometrical tolerances, see Clause 6.

There shall be procedures for making alterations to a previously agreed on execution specification.

5 Preparation and assembly

5.1 General

This clause specifies the requirements for identification and traceability, handling and storage, cutting, shaping, holing for structural bolting, temporary attachments, and assembly of steel products and sub-components for inclusion into components.

NOTE Provisions for welding and structural bolting are given in ISO 17607-5 and ISO 17607-6.

Structural steelwork shall be fabricated within the tolerances specified in Clause 6.

Equipment used in the fabrication process shall be maintained to ensure that use, wear and failure do not cause nonconformity in the fabrication process.

5.2 Identification and traceability

5.2.1 Identification

For identification, see ISO 17607-1.

Identification is required for execution levels 1 to 4 (EXL1, EXL2, EXL3, and EXL4) or as specified in the execution specification.

At all stages of fabrication, unassembled single items and constituent products shall be identifiable by a suitable method of identification for the purposes of proper assembly.

NOTE Examples of fabrication stages include storage, cutting, holing, fit-up, welding and painting or coating. Depending on the execution class, identification can vary from a visual marking or tag on each piece to designated locations for similar products.

The following requirements apply to hard stamped, punched or drilled marks used for marking single components or packages of similar components, unless otherwise specified:

a) They shall only be used for steel grades up to and including 500 MPa;

b) They shall only be used in areas, as specified in the execution specification, where the marking method would not affect the fatigue life.

If the use of hard stamps, punched or drilled marks is not permitted, it shall be specified whether soft or low stress stamps may be used.

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Any zones where identification marks are not permitted or shall not be visible after completion shall be specified in the execution specification.

The assembled component as it moves through the production, shipping and erection processes shall also be identifiable by suitable methods.

Identification documents shall be retained for all constituent products. The retention period shall be specified in the execution specification.

5.2.2 Traceability

For traceability see ISO 17607-1.

5.3 Handling and storage

Constituent products shall be handled and stored in conditions that are in accordance with the product manufacturer's recommendations.

Constituent products shall not be used beyond the shelf life specified by their manufacturer. Products that have been handled or stored in a way or for a length of time that could have led to significant deterioration shall be checked before use to ensure that they still conform with the relevant product standard and execution specification.

Structural steel components shall be packed, handled, and transported safely so that permanent deformation does not occur, and surface damage is minimised. Handling and storage preventive measures specified in Table 1 shall be applied as appropriate.

Table 1 — List of handling and storage preventive measures

Lifting
Protection of components from damage at the lifting points
Avoidance of single point lifting of long components by use of spreader beams
Bundling together lightweight components particularly prone to edge damage, twisting and distortion if handled as individual items. Care taken to avoid localized damage where components touch each other, to unstiffened edges at lifting points or other zones where a significant proportion of the weight of the bundle is imposed on a single unreinforced edge
Storage
Stacking of fabricated components stored before transportation or erection clear of the ground to be kept clean
Necessary supports to avoid permanent deformations
Storage of materials supplied with pre-finished decorative surfaces in accordance with relevant standards
Protection against corrosion
Avoidance of accumulation of water
Transport
Special measures needed for protecting fabricated components in transit

5.4 Cutting

5.4.1 General

Cutting shall be carried out in such a way that the requirements for geometrical tolerances, maximum hardness and smoothness of free edges as specified in this document are met.

NOTE Recognised cutting processes are sawing, shearing, nibbling, disc cutting, water jet techniques and thermal cutting.

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Hand thermal cutting shall be used only if it is not practical to use mechanically guided thermal cutting. For some cutting methods, precautions shall be taken if the cut edges are to be free edges (i.e. not to be subsequently welded) for components subject to fatigue, as specified in the execution specification.

If a process does not conform, it shall not be used until corrected and checked again. It may be used on a restricted range of constituent products that do produce conforming results.

If coated materials are to be cut, the method of cutting shall be selected to minimize any damage to the coating.

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

5.4.2 Shearing and nibbling

The free edge surfaces shall be checked and smoothed as necessary to remove nonconformities. If grinding or machining is required after shearing or nibbling, the minimum depth of grinding or machining shall be 0,5 mm. The restrictions on punching in 5.6.1.2 also apply to shearing and nibbling.

5.4.3 Thermal cutting

The capability of automated thermal cutting processes shall be checked annually as set out below.

Four samples shall be produced from the constituent product to be cut by the process:

a) a straight cut from the thickest constituent product;

b) a straight cut from the thinnest constituent product;

c) a re-entrant corner from a representative thickness;

d) a curved arc from a representative thickness.

Measurements shall be taken on each straight sample over at least a 200 mm length and checked against the required quality of the cut surface. The corner and curved samples shall be visually inspected to establish that they produce edges of equivalent quality to the straight cuts.

Alternatively, the capability of automated thermal cutting processes may be checked as given in Annex B.

The quality requirements for cut surfaces to be left as free edges (i.e. not to be subsequently incorporated into a weld) shall be according to Table 2 when assessed in accordance with ISO 9013, unless otherwise specified.

Alternatively, the reference for evaluation of cut surfaces may be the surface roughness gauge included in the AWS C4.1-77 set. When used, the roughness of thermal cut surfaces shall be evaluated by visually comparing the cut surface to the roughness represented on the roughness gauge. Surface roughness shall be no greater than that represented by Sample 3, except that for the ends of members not subject to calculated stress, copes in beams with the flange thickness not exceeding 50 mm (2 in), and for materials over 100 mm to 200 mm (4 in to 8 in) thick, surface roughness shall not exceed that represented by Sample 2.

When required by the execution specification, free edges that are to have surface preparation before paint coating shall have the hardened surface removed.

When required by the execution specification, free edges that are to be hot dip galvanized shall have the hardened surface removed.

NOTE Liquid metal assisted cracking (LMAC), or liquid metal embrittlement (LME) can occur where surfaces are thermally cut and receive hot dip galvanizing. See ISO 14713-2 and DASt-Richtlinie 022 [17] for guidance.

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Table 2 — Quality of the cut surfaces[a]

Execution level	Perpendicularity or angularity tolerance u	Mean height of the profile R_{z5}
EXL1	Cut edges to be free from significant irregularities and dross shall be removed	
EXL2	Range 5	Range 4
EXL3	Range 4	Range 4
EXL4	Range 4	Range 4

[a] Ranges are specified in ISO 9013

5.4.4 Hardness of free edge surfaces

The hardness of free edge surfaces of carbon steel groups 2.2 and 3, as listed in ISO/TR 15608, shall be no more than 450 (HV10) or 420 Brinell (HB). In this case, processes that are likely to produce local hardness (thermal cutting, shearing, nibbling and punching) shall have their capability checked. To achieve the required hardness of free edge surfaces, preheating of material shall be applied as necessary.

Unless otherwise specified in the execution specification, the check of the capability of the processes shall be as follows:

a) four samples shall be produced from procedure tests on constituent products encompassing the range of constituent products processed that are most susceptible to local hardening;

b) four local hardness tests shall be performed on each sample in locations likely to be affected. The tests shall be in accordance with ISO 6506-1 or ISO 6507-1.

NOTE The requirements for checking hardness after welding are included in procedure testing (see ISO 17607-5).

5.5 Shaping

5.5.1 General

Steel may be bent, pressed or forged to the required shape either by the hot or by the cold forming processes, provided the properties are not reduced below those specified for the material to be worked.

Requirements and recommendations for hot forming, cold forming and flame straightening of steels shall be as given in the relevant product standards or the recommendations of the steel manufacturer.

Cooling rates should be selected to prevent hardening and excessive grain coarsening

NOTE See CEN/TR 10347 for guidance.

If the relevant product standards or steel manufacturer's recommendations are not followed, then the process shall be qualified by procedure testing established in execution specification.

Cambering, straightening or shaping by controlled application of heat may be used under the conditions specified in 5.5.2 and 5.5.3.

Cambered, straightened or shaped components that exhibit cracking, lamellar tearing, or damage to surface coatings shall be treated as non-conforming products.

5.5.2 Hot forming (forging)

Shaping by hot forming (forging) shall conform to the requirements relating to hot forming of the relevant product standard and to the recommendations of the steel manufacturer.

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Hot forming of thermo-mechanically rolled or quenched and tempered steels shall not be used.

In the absence of recommendations from the steel manufacturer:

— For steel grades up to and including 360 MPa yield, the hot forming process shall take place in the range 600 °C to 650 °C. The temperature, timing and cooling rate shall be appropriate to the particular type of steel. During cooling, bending and forming in the range of 250 °C to 380 °C is not permitted.

— For steel grades above 360 MPa yield, the hot forming process shall take place in the temperature range 750 °C to 960 °C with subsequent cooling at air temperature. The cooling rate should be such as to prevent hardening as well as excessive grain coarsening. If this is not practicable, a subsequent normalizing treatment shall be carried out.

5.5.3 Flame (heat) straightening, cambering, and curving

If flame (heat) straightening, cambering, or curving is used it shall be performed by the local application of heat, ensuring that the maximum steel temperature recommended by the steel manufacturer is not exceeded.

In the absence of recommendations from the steel manufacturer:

— For steel grades up to and including 420 MPa yield, the maximum temperature for flame straightening shall not exceed 700 °C.

— For steel grades above 420 MPa yield, the maximum temperature for flame straightening shall not exceed 650 °C.

For fine grain and thermo-mechanically controlled processed (TMCP) steels, a documented procedure shall include requirements for:

a) maximum steel temperature and procedure of cooling allowed;

b) method of heating;

c) method used for temperature measurements;

d) results of mechanical tests carried out for the process qualification;

e) identification of workers entitled to apply the process.

NOTE See ISO/TR 15608 for guidance.

For fine grain and the TMCP steels, the procedure shall be qualified based on the results of tensile, impact and hardness tests. With respect to the thermally heated zone, the location used for temperature measurement and the locations and orientation for the test samples shall be specified.

5.5.4 Cold forming

5.5.4.1 General

Shaping by cold forming, produced either by roll forming, pressing or folding shall conform to the requirements for cold formability given in the relevant product standard. Hammering shall not be used.

Unless permitted by the steel manufacturer's recommendations, cold forming shall not be performed when the steel temperature is lower than 15 °C.

NOTE Cold forming leads to a reduction in the ductility. Information on cold forming prior to hot dip galvanizing is given in ISO 14713-2.

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5.5.4.2 Steel plates

For steel plates, unless otherwise specified in the execution specification, the minimum inside bend radii to be cold-formed shall be in accordance with Table 3.

Table 3 — Minimum inside bend radii for thickness and grade[a]

Specified minimum yield strength of steel MPa	Bend lines perpendicular to direction of final rolling				Bend lines parallel to direction of final rolling			
	Material thickness t (mm)							
	≤ 15	15 < ≤ 25	25 < ≤ 50	50 <	≤ 15	15 < ≤ 25	25 < ≤ 50	50 <
< 345	1,5t	1,5t	1,5t	2t	2,3t	2,3t	2,3t	3t
345 ≤ < 460			2t	2,5t			3t	4t
460 ≤ < 690			3t	3,5t			4,5t	5t
690 ≤	1,8t	2,3t	4,5t	5,5t	2,7t	3,5t	7t	8t

[a] At locations where plastic deformation capacity is required, the inside bending radius shall be minimum:

— 8t where the direction of the stress is parallel to bend line;

— 4t where the direction of stress is perpendicular to bend line.

5.5.4.3 Steel grades higher than 360 MPa yield

In the absence of recommendations from the steel manufacturer, for steel grades higher than 360 MPa yield, if a stress relief treatment is carried out after cold forming, the following two conditions shall be satisfied:

a) temperature range: 530 °C to 580 °C;

b) holding time: 2 min/mm of material thickness, but with a minimum time of 30 min.

NOTE Stress relief treatment at more than 580 °C, or for over an hour, can lead to deterioration of the mechanical properties.

If it is required to stress relieve steel grades higher than 360 MPa at higher temperatures or for longer times, the required minimum values of the mechanical properties shall be agreed on in advance with the steel manufacturer.

5.5.4.4 Cold-formed components

For cold-formed components, shaping by further cold forming shall conform with the following two conditions:

a) the surface coatings and the accuracy of profile shall not be impaired;

b) it shall be specified if constituent products require protective membranes to be applied before forming.

NOTE 1 Some coatings and finishes are particularly prone to abrasive damage, both during forming and subsequently during erection.

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Bending by cold forming of hollow section components may be used provided that hardness and geometry of the as-bent constituent product are checked.

NOTE 2 Bending by cold forming can cause alteration of section properties (e.g. concavity, ovality and wall thinning) and increased hardness.

5.5.4.5 Circular hollow sections

For circular hollow sections, unless process specific capability can be demonstrated in terms of maintaining cross sectional geometry, bending by cold forming shall conform with the following three conditions:

a) the ratio of the overall diameter of the tube to the wall thickness does not exceed 15;

b) the bend radius (at the centreline of the tube) is not less than 1,5d or d+100 mm, whichever is the larger, in which d is the overall diameter of the tube;

c) the longitudinal seam weld in the cross-section is positioned no further than d/5 from the centreline of the bend, measured in the direction of the plane of the bend.

5.6 Holing for structural bolting

5.6.1 Execution of holing

5.6.1.1 Methods

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

— cutting requirements relating to local hardness and quality of cut surface are fulfilled;

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

A round hole for a bolt or pin shall be cut with mechanical guidance, drilled full size, sub-punched 3 mm undersize and reamed to size, or punched full size.

A slotted hole shall be either cut with mechanical guidance, punched in one operation, or formed by punching or drilling two adjacent holes and completed by cutting.

5.6.1.2 Punching

Unless otherwise specified in the execution specification, bolt holes may be formed by punching without reaming except in

— quenched and tempered steel of 690 MPa tensile strength or greater with a thickness greater than 13 mm;

— plastic hinge locations in materials with a thickness greater than 13 mm;

— areas subject to fatigue;

— lap joints where the bolts are above Grade 8.8;

— joints designed to be slip resistant.

The execution specification shall identify areas subject to fatigue, plastic hinge rotation, or with slip-resistant joints.

Where untreated punched bolt holes are not permitted, holes may be punched at least 2 mm less than full size and then reamed or drilled until all trace of the original punched surface has been removed.

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At splices, the bolt holes in mating surfaces shall be punched in one direction in all components.

5.6.1.3 Thermal cutting (laser, plasma, oxyfuel)

Thermally cut bolt holes produced by mechanically guided means are permitted in statically loaded bolted joints. If permitted by the execution specification, bolt holes may be thermally cut in slip-resistant joints subject to fatigue loading.

Thermal cutting shall not be used in plastic hinging regions, where fatigue loading relies on shear/bearing transfer, or for open bolt holes.

Hand thermal cutting shall not be used for a bolt hole except as a site rectification measure for holes in column base plates. For other bolt holes, thermally cut holes may be produced freehand in statically loaded joints if permitted by the execution specification.

Thermal cutting may be used for other bolt holes 30 mm or larger in diameter, for foundation bolts, form separators and equipment piping, and for bolt holes for metal attachments, interior and exterior finish work, concrete placement, etc. The roughness of these bolt holes made by thermal cutting shall not exceed 100 µm Rz, and the accuracy of the bolt hole diameter shall be within ±2 mm. Occasional gouges not more than 1,5 mm in depth are permitted.

5.6.1.4 Water jet cutting

Unless otherwise specified in the execution specification, water jet cut holes shall satisfy the requirement of 5.4.3 and Figure 1.

5.6.1.5 Verification of method

The capability of holing processes shall be checked at least annually as follows:

— a representative number of samples shall be produced from procedure tests on constituent product encompassing the range of bolt hole diameters, constituent product thickness and grades processed;

— bolt hole sizes shall be checked at both ends of each hole using go/no-go gauges. Holes shall conform with the tolerance as specified in 5.6.2.

If the process does not conform, it shall not be used until corrected. It may be used on a restricted range of constituent products and bolt hole sizes that do produce conforming results.

5.6.1.6 Countersinking

When countersinking through more than one ply, the plies shall be held firmly together during countersinking.

5.6.1.7 Burrs

Burrs shall be removed from bolt holes before assembly.

For slip-resistant joints, when a grinder is used on the periphery of bolt holes for the removal or reduction of burrs after blasting, either:

a) the ground area adjacent to the bolt hole(s) shall be re-blasted, or

b) the as-ground surface shall be exposed until red rust generation has occurred.

If specified in the execution specification, burrs less than or equal to 1,5 mm in height are permitted to remain on faying surfaces of all joints. Burrs larger than 1,5 mm in height shall be removed or reduced to 1,5 mm or less from the faying surfaces of all joints.

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If bolt holes are drilled in one operation through parts clamped together which would not otherwise be separated after drilling, removing or reduction of burrs is necessary only from the outside surfaces.

5.6.1.8 Hole alignment

All matching holes for bolting assemblies or pins shall align with each other so that a gauge or drift, equal in diameter to that of the bolts, or the bolts or pins can be inserted freely through the assembled members in a direction perpendicular to the faces in contact.

Bolt holes for which elongation is not permitted shall be identified and not be used for alignment.

Except for oversize or slotted holes, when bolt holes on overlapping plates are out of alignment by 2 mm or less, holes may be enlarged to admit bolts by a moderate amount of reaming. The limitations on maximum allowable extent of reaming in any one direction shall be:

a) 0,5 mm for M16 and smaller where the connection is predominantly in shear;

b) 1,0 mm for larger than M16 where the connection is predominantly in shear;

c) 1,0 mm for M24 and smaller where the connection is predominantly in tension. Where a hardened washer is used, the extent of reaming may be increased to 2,0 mm;

d) 2,0 mm for larger than M24 where the connection is predominantly in tension. Where a thick hardened washer or plate washer is used, the extent of reaming may be increased to 3,0 mm.

NOTE 1 Correction of misalignment by reaming or using a hollow milling cutter is preferred.

When bolt holes on overlapping plates are out of alignment by more than the reaming limitations noted above, the corrective measure shall be as specified in the execution specification.

When correction of misalignment by cutting methods other than reaming or using a hollow milling cutter is unavoidable, the internal finish of all bolt holes formed by these other methods shall be specifically checked for consistency with 5.6.2.

Realigned bolt holes are acceptable with the oversize or slotted hole requirements, provided the load path has been verified to conform with the execution specification.

NOTE 2 Generally, bolt holes enlarged to oversize dimensions are acceptable only for slip-resistant joints. Slotted holes in shear-bearing joints are acceptable only when loaded in the direction normal to the load. Slotted holes in slip-resistant joints are acceptable without regard for loading direction. In many cases, corrections for misalignment can result in a reduction of strength.

5.6.2 Tolerances on hole diameter for bolts and pins (including width and surface roughness)

Unless otherwise specified in the execution specification, punched or drilled bolt holes shall conform with the following:

— holes: ±0,5 mm for bolt holes made to SI units (+ 1/32, - 0 inch for bolt holes made to US customary units);

— bolt holes for fit bolts and fitted pins: class H11 in accordance with ISO 286-2.

Unless otherwise specified in the execution specification, thermal cut and waterjet cut bolt holes shall conform with the following:

a) for circular bolt holes, the actual hole size shall not exceed the nominal hole size by more than 1 mm;

b) for slotted bolt holes, the width of the slot shall not exceed the nominal width by more than 1 mm;

c) gouges not exceeding 1,5 mm deep are permitted about the perimeter of the bolt hole;

d) the surface roughness profile of the bolt hole shall not exceed 25 µmRq.

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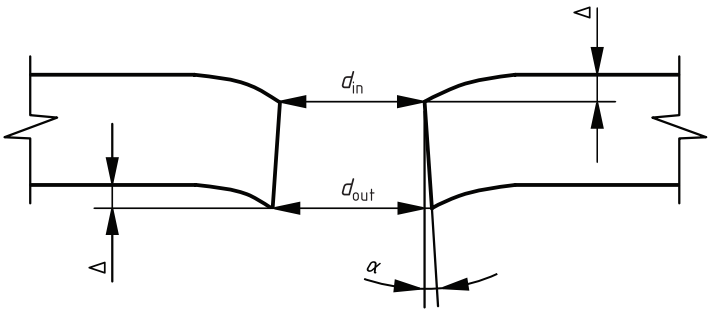
The bolt hole diameter shall be taken as the average of entry and exit diameters. The taper angle (α) and the deviation from flat surface (Δ_1, Δ_2) shall not exceed that given in Figure 1.



Key

d_{in}, d_{out}	measured hole diameter at entry and exit points
α	taper angle ≤ 4° (i.e. 7 %)
Δ_1, Δ_2	deviation from flat surface

$D = (d_{in} + d_{out})/2$
Max (Δ_1 or Δ_2) ≤ max (D/10; 2 mm)

Figure 1 — Permitted distortions of gouged, punched, thermally cut, or water jet cut holes

5.7 Temporary attachments

All connections for temporary attachments provided for fabrication or erection purposes shall meet the requirements of this document and any special requirements in the execution specification, including those related to fatigue, which shall be specified.

5.8 Assembly check

The fit between fabricated components that are inter-connected at multiple connection interfaces shall be checked using dimensional templates, accurate three-dimensional measurements or by trial assembly. Trial assembly, if required, shall be as specified in the execution specification.

6 Geometrical tolerances

6.1 Tolerance types

Geometrical tolerances shall be specified in the execution specification.

NOTE Information provided in Annexes C, D and E can be used to specify the geometrical tolerances in the execution specification.

The types and requirements for geometrical deviations and the quantitative values for different types of permitted deviations are given per country in Annexes C, D, and E for:

— buildings;

— bridges;

— crane runways.

The permitted deviations given do not include elastic deformations induced by the self-weight of the components.

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Special tolerances may be specified either for geometrical deviations already defined with quantitative values or for other types of geometrical deviations. If special tolerances are required in the execution specification, the following information shall be given as appropriate:

— amended values for tolerances already defined;

— defined parameters and permitted values for the geometrical deviations to be controlled;

— whether these special tolerances apply to all relevant components or only to particular components that are specified.

In each case, the requirements shall apply for final acceptance testing. If fabricated components are to form parts of a structure to be erected on site, the tolerances specified for the final checking of the erected structure shall be met in addition to those for the fabricated components.

6.2 Alternative criteria

If required by the execution specification:

a) for welded components, the following classes in accordance with ISO 13920 apply:

   1) class C for length and angular dimensions;

   2) class G for straightness, flatness and parallelism;

b) for non-welded components the same criteria as in (a) apply;

c) in other cases not covered by ISO 13920, for a dimension d, a permitted deviation $\pm\Delta$ equal to the greater of d / 500 or 5 mm may be used.

7 Inspection, testing, and correction

7.1 General

Inspection, testing and corrections shall be undertaken on the structural steelwork in accordance with requirements in the execution specification.

NOTE 1 See ISO 17607-1 for general requirements.

NOTE 2 See ISO 17607-5 for requirements related to weld inspection, testing, and correction.

NOTE 3 See ISO 17607-6 for requirements related to bolting inspection, testing, and correction.

7.2 Shop corrections

Shop corrections shall apply to repair of discontinuities identified during fabrication. All shop corrections shall follow written repair procedures. Repair procedures shall follow and meet all the applicable requirements of the national standards referenced in the execution specification.

For execution levels EXL1 and EXL2, all repairs may be conducted without any approval.

For EXL3, the following require approved or pre-approved repair procedures, unless noted otherwise in the execution specification, and shall be documented:

a) welds defects that require excavation into parent materials;

b) arc strikes and tack welds not incorporated into a final weld;

c) detected planar and laminar discontinuities;

d) roughness requiring welded restoration of cut edges;

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e) notches or gouges more than 5 mm deep;

f) notches or gouges where the nominal cross-sectional area is reduced by more than 2 %;

g) any other items specified in the execution specification.

For EXL4, all repair procedures shall be approved prior to commencing the work and shall be documented.

7.3 Acceptance criteria

The acceptance criteria shall be given in the execution specification.

7.4 Action on nonconformity

Action on nonconformity shall be in accordance with ISO 17607-1. Corrections shall be carried out using methods that are in accordance with this document.

If a component is handed over with uncorrected nonconformities, awaiting action, these shall be documented.

8 Architecturally exposed structural steel

Requirements of architecturally exposed structural steel (AESS) are addressed in ISO 17607-1.

9 Documents required to claim conformity to these requirements

9.1 General

Constructors may claim conformity with the requirements of this document either by:

— adoption of the ISO standards referenced in this document, as applicable; or

— adoption of other standards that provide technically equivalent conditions to the ISO documents listed in this document, as applicable; or

— adoption of other documents that provide technically equivalent conditions to the ISO documents listed in this document, as applicable.

Unless otherwise listed in the execution specification, it is the responsibility of the constructor to demonstrate that the standards or documents selected provide technically equivalent conditions to those in the corresponding ISO standards.

Prior to execution, adoption of other standards or documents shall be verified and approved by the specifier and shall be incorporated into the execution specifications.

9.2 Declaration of conformity

A constructor claiming conformity with these requirements shall list the applicable supporting standards or documents.

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Annex A
(normative)

Additional information, list of options and requirements related to the execution levels

A.1 List of required additional information

Table A.1 provides the additional information that is required in the text of this document as appropriate to fully define the requirements for execution of the work to be in accordance with this document (e.g. where the wording "shall be specified" is used).

Table A.1 — Additional information

Clause	Additional information required
4 – Execution specification	
4	necessary information and technical requirements for execution of fabrication
5 – Preparation and assembly	
5.2 – Identification and traceability	
5.2.1	whether soft or low stress stamps may be used
5.2.1	any zones where identification marks are not permitted or shall not be visible after completion
5.2.1	retention period for identification documents
5.3 – Handling and storage	
5.3	preventive measures for handling and storage
5.4 – Cutting	
5.4.3	removal of hardened surface when hot dip galvanized
5.5 – Shaping	
5.5.3	the location used for temperature measurement and the locations and orientation for the test samples
5.5.4.4	if constituent products require protective membranes to be applied before forming
5.6 – Holing for structural bolting	
5.6.1.2	areas subject to fatigue or plastic hinge rotation, with slip-resistant joints
5.6.1.8	when bolt holes on overlapping plates are out of alignment by more than the reaming limitations
5.6.1.8	re-aligned holes with the oversize or slotted hole requirements
5.7 – Temporary attachments	
5.7	connections for temporary attachments provided for fabrication or erection purposes
5.7 – Assembly check	
5.8	assembly check of fabricated components
6 – Geometrical tolerances	
6.1	geometrical tolerances for fabrication
7 – Inspection, testing, and correction	
7.1	inspection, testing, and correction
7.2	repair procedures
7.3	acceptance criteria
9 – Documents required to claim conformity to these requirements	
9.1	adoption of other standards or documents

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A.2 List of options

Table A.2 lists the items which may be specified in the execution specification to define requirements for the execution of the work where options are given in this document.

Table A.2 — List of options

Clause	Option(s) to be specified
5 – Preparation and assembly	
5.2.1	if identification is not required for specific execution level
5.4.3	quality requirements for cut surfaces
5.4.3	free edges that are to be hot dip galvanized or have surface preparation before coating
5.4.4	check of the capability of the processes: hardness of free edge surfaces
5.5.1	qualification procedure for shaping of steel
5.5.3	location used for temperature measurement and the locations and orientation for the test samples of fine grain and the TMCP steels
5.5.4.2	minimum inside bend radii of steel plates to be cold-formed
5.5.4.2	define locations where plastic deformation capacity is required
5.6.2	punched or drilled holes tolerance
5.6.2	thermal cut and waterjet cut holes tolerance
5.6.1.3	thermally cut bolt holes produced by mechanically guided means in statically loaded joints
5.6.1.3	thermally cut holes produced freehand in statically loaded joints
5.6.1.4	water jet cut holes
5.6.1.7	burrs height
5.8	trial assembly
6 – Geometrical tolerances	
6.1	special tolerances
6.2	alternative criteria
7 – Inspection, testing, and correction tolerances	
7.3	approved or pre-approved repair procedures
Annex B - Procedure for checking capability of automated thermal cutting process	
B.1	verification of the quality of the cut surfaces
Annex C – Geometric tolerances – Buildings	
	special tolerances
Annex E – Geometric tolerances – Crane runways	
	special tolerances

A.3 Requirements related to the execution levels

This clause lists requirements specific to each of the execution levels referenced in this document.

Items identified in bold letters in Table A.3 relate to the general system of control of execution and are amenable to a common choice of execution level across the whole of the structural steelwork (or a phase of the structural steelwork). The other items generally demand the selection of the appropriate execution level on a component-by-component or a connection detail-by-detail basis.

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Table A.3 — Requirements to each execution level

Clauses	EXL1	EXL2	EXL3	EXL4
5 – Preparation and assembly				
5.2 – Identification and traceability				
5.2.1 Identification	Yes	Yes	Yes	Yes
5.2.2 Traceability	ISO 17607-1	ISO 17607-1	ISO 17607-1	ISO 17607-1
5.4 – Cutting				
5.4.3 Thermal and water jet cutting	Table 2	Table 2	Table 2	Table 2
7 – Inspection, testing, and correction				
7.2 Shop corrections	repairs can be conducted without any approval	repairs can be conducted without any approval	Some repairs require approved or pre-approved procedures	all repair procedures shall be approved prior to commencing the work

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Annex B
(normative)

Procedure for checking capability of automated thermal cutting process

B.1 General

This annex provides procedures and guidance for testing and assessment of automated thermal cutting processes that shall be carried out in accordance with this document and ISO 9013.

This procedure may be applied to all automated thermal cutting processes including laser and plasma cutting.

NOTE Some different or additional parameters can be needed for control of laser and plasma cutting.

The basis for the procedure for checking the capability of automated thermal cutting processes follows the general rules for specification and qualification of welding procedures in ISO 15607.

The procedure is based on preparing a preliminary cutting procedure specification (pCPS) and verifying the quality of the cut surfaces produced using this pCPS to finalise a cutting procedure qualification record (CPQR). This CPQR is then used as the basis for control of cutting operations in production using cutting procedure specifications (CPSs).

Table B.1 gives an example of a pCPS and CPS. Table B.2 gives an example of a CPQR.

The CPQR includes a range of qualification within which it may be used. Ranges are given for the following variables:

— group of material;

— material thickness;

— pressures of gases;

— cutting speed and height (torch tip to steel surface);

— preheat temperature.

Unless otherwise specified in the execution specification, the verification of the quality of the cut surfaces may be done under the authority of the responsible welding coordinator acting as test investigator and assessor. A test report shall be produced summarizing the results of tests upon which the CPQR is based.

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Table B.1 — Example of a preliminary cutting procedure specification (pCPS)

Cutting process:	
Manufacturer of the cutting machine:	
Type of cut:	
Designation of the cutting torch:	
Designation of the cutting nozzle:	
Manufacturer of the cutting torch/nozzle:	
Standard:	
Material group:	

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Table B.1 *(continued)*

Thickness of the material:	
Type of fuel gas:	
Heating oxygen pressure[a]:	
Fuel gas pressure[a]:	
Cutting oxygen pressure[a]:	
Adjustment of the heating flame:	
Cutting speed:	
Cutting height:	
Preheat temperature:	
Angle of cut (if bevel not perpendicular):	
Thermal follow-up treatment (post-heat treatment):	
Type of pre-/post-heating torch:	
Designation of the heating torch:	
Manufacturer of the heating torch:	
Type of preheating fuel gas:	
Oxygen/ compressed air pressure:	
Fuel gas pressure:	
[a] Pressure measured at the inlet of the torch	
The manufacturer warrants that the thermal cut sample shown in attached drawing was produced under the above-named specifications. --- Manufacturer, name of the Responsible Welding Coordinator with signature and date	

Table B.2 — Example of cutting procedure qualification record (CPQR)

(p)CPS-No.:		CPQR-No.:				
Manufacturer of the thermal cut sample:						
Manufacturer's address:		Appendices	1	Cutting parameters		page
Standard:			2	Material test report		page
Date of manufacture:			3	Inspection report		page
Manufacturer:						
Specifications of the cutting procedure qualification record						
Cutting process:						
Manufacturer of the cutting machine:						
Type of cut:						
Designation of the cutting torch:						
Designation of the cutting nozzle:						
Manufacturer of the cutting torch/nozzle:						
Standard:						
Material group:						
Thickness of the material (mm):						
Type of fuel gas:						
Heating oxygen pressure[a]:						
Fuel gas pressure[a]:						
Cutting oxygen pressure[a]:						

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Table B.2 *(continued)*

Adjustment of the heating flame:	
Cutting speed:	
Cutting height:	
Preheat temperature:	
Thermal follow-up treatment:	
Type of pre-/post-heating torch:	
Designation of the heating torch:	
Manufacturer of the heating torch:	
Type of fuel gas:	
Oxygen/ compressed air pressure:	
Fuel gas pressure:	
[a] Pressure measured at the inlet of the torch	
This record confirms that the manufacturing of the thermal cut sample was satisfactorily prepared, produced and tested in accordance with the requirements of ISO 17607-3:20—, 5.4.3 and 5.4.4: EXL2 / EXL3 / EXL4	
Place and date of issue:	
Manufacturer's Welding Coordinator: Name, date, and signature:	
Examiner or examining body: Name, date and signature (if other than manufacturer's Welding Coordinator):	

B.2 Description of the qualifying procedure

B.2.1 General

Cutting of the test pieces shall be conducted in accordance with a preliminary cutting procedure specification (pCPS) where all of the parameters and influences relevant to the process are stated.

In accordance with ISO 9013, the perpendicularity and angularity tolerance, the average surface roughness as well as the hardness of the edges of cut may be determined. If the cutting process is to be used only for perpendicular cuts, then the angularity tolerance does not need to be determined. In this case, the use of a test piece as shown in Figure B.1 is recommended. If the cutting process is to be used for bevel cuts, then the angularity tolerance needs to be determined.

NOTE If bevel cuts are used to make welding preparations, it is possible that the angularity tolerance of a bevel cut will not be critical if the surface is subsequently dressed.

The test piece(s) shall have a straight cut, a sharp-edged corner as well as a curve-shaped bend. The edges of cut in the areas of the curve-shaped bend as well as of the sharp-edged corner shall have an acceptable quality in the area of the straight cut in relation to the perpendicularity and angularity tolerance respectively as well as to surface roughness. The above parameters shall be determined in the areas of the straight cut with the hardness test having to be particularly conducted in the areas with the highest travel speed, respectively.

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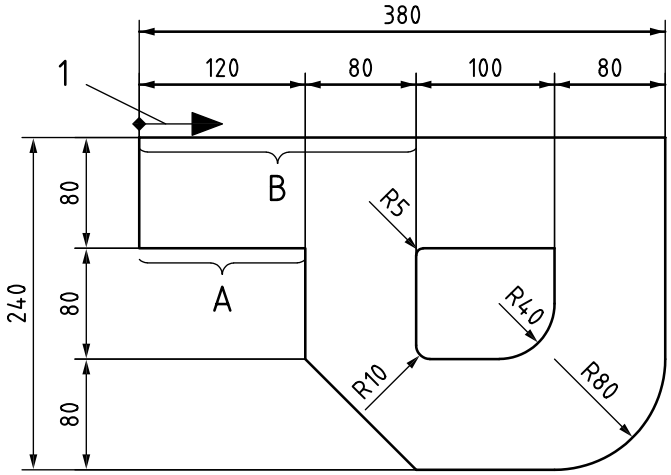
Dimensions in millimetres



Key

1 start point and direction of cutting

NOTE Surface profile measurements are taken on the straight area B over at least a 200 mm length and hardness are measured in area A and B on each sample and checked against the required quality class. The sharp corner and curved samples are inspected visually to establish that they produce edges of equivalent standard to the straight cuts.

Figure B.1 — Recommended shape of test piece and location of measurements

B.2.2 Average surface roughness R_{Z5}

The average surface roughness R_{Z5} shall be determined in accordance with ISO 9013.

At a spot representative of the straight flame cut the surface roughness shall be measured transverse of the groove path across a length of maximum 40 mm. See Figure B.2.

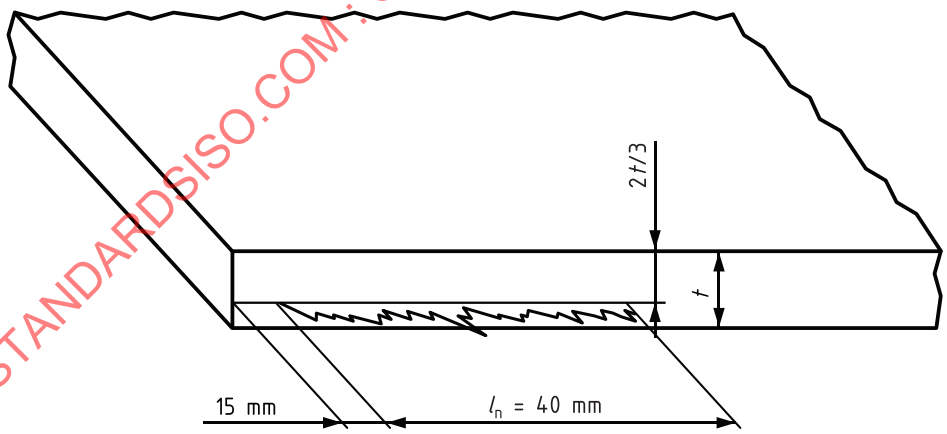


Figure B.2 — Recommended shape of test piece and location of measurements

The arithmetic average of the single profile elements of five adjacent single measurements (Z_{t1} to Z_{t5} as shown in Figure B.3) shall be used to calculate the average surface roughness R_{Z5}.

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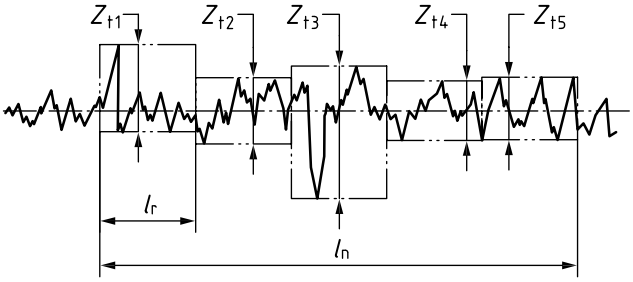

Figure B.3 — Determination of the average surface roughness R_{Z5}

To determine the average surface roughness R_{Z5}, a surface roughness tester suitable for high roughnesses shall be used. A sufficient and stable contact surface of the device shall be provided.

For plate thicknesses, *(t)* < 6 mm additional strips with a smooth surface shall be attached flush with the cut edge to the sides of the plate surfaces of the test piece to be tested using a clamp, to ensure sufficient contact.

The highest value of surface roughness R_{Z5} with the respective distance of the upper edge of the plate shall be determined and recorded.

Alternatively, the reference document for evaluation of cut surfaces shall be the surface roughness gauge included in AWS C4.1-77 set. The roughness of thermal cut surfaces shall be evaluated by visually comparing the cut surface to the roughness represented on the roughness gauge. Surface roughness shall be no greater than that represented by Sample 3, except that for the ends of members not subject to calculated stress, copes in beams with the flange thickness not exceeding 50 mm (2 in.), and for materials over 100 mm to 200 mm (4 in. to 8 in.) thick, surface roughness shall not exceed that represented by Sample 2.

B.2.3 Perpendicularity and angularity tolerance

The perpendicularity and angularity tolerance (*u*) shall be determined in accordance with ISO 9013 with respect to both vertical and bevel cuts. At a representative spot (highest measured value to be expected) of the straight flame cut the perpendicularity or angularity tolerance (*u*) may also be determined using a measuring microscope in a transverse section. When preparing the transverse section an edge of the cut free of burrs shall be provided.

For a better contrast during the measurement, the test piece may be etched using a suitable etching agent. Depending on the plate thickness, several exposures may be completed to form one figure and measured. The reduction of thickness of the cut (Δa) shall be recorded, which limits the area to be measured.

B.2.4 Hardness test

The hardness test on the flame cut edge shall be performed in accordance with ISO 6507-1 and ISO 6506-1.

The test pieces for the measurement of the hardness shall have plane, parallel contact surfaces. Grinding of the flame cut edges shall be conducted using grain size 600. The flame cut surface shall be ground such that some indentations of the flame cut surface are still visible. Hardness measurements shall be taken in the areas near the upper and lower edges as well as the centre of the plate thickness (see Figure B.4).

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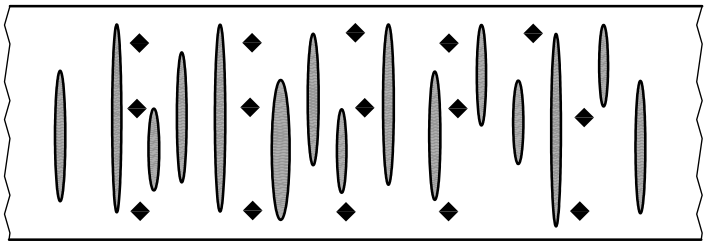

Figure B.4 — Measurement locations on ground flame cut surface

Depending on the plate thickness, either 5 or 15 measurements of the hardness distributed across the cross-section shall be conducted (see Table B.3). During the hardness test near the plate surfaces, the minimum distance in accordance with ISO 6507-1 and ISO 6506-1 as well as the melting of the surfaces shall be observed.

Table B.3 — Number and area of hardness measurements

Plate thickness t (mm)	Hardness measurements
$t \leq 5$	5 at centre of the plate thickness
$t > 5$	5, near upper side of the plate 5, near lower side of the plate 5, at centre of the plate thickness

B.3 Range of qualification

B.3.1 Material groups

Due to the hardening behaviour of the different materials, Table B.4 shall be used to determine the range of validity.

Independent of Table B.4, the preheating temperature can need adjustment for materials within the range but having a higher carbon equivalent than the test piece, to ensure that the increase in hardness of the cut surface is acceptable.

Table B.4 — Material groups

Test piece material group from ISO/TR 15608	Range material groups in accordance with ISO/TR 15608
1	1 [a], 2 [b]
1.4	1 [b], 2 [b]
2	1.1, 2 [b]
3	1 [a], 2 [b], 3 [b]
[a] Except for 1.4 and valid for steel with the same or lower determined minimum yield strength. [b] Valid for steel with the same or lower determined minimum yield strength.	

B.3.2 Material thickness

Testing of the thinnest and the thickest test piece shall qualify all material thicknesses within this scope of thickness.

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B.3.3 Pressures of gases

The qualification is valid within the following ranges:

— heating oxygen pressure: +0 % / −20 %;

— fuel gas pressure: + / −5 %;

— cutting oxygen pressure: +0 % / −15 %.

B.3.4 Cutting speed and height

The qualification is valid within the following ranges:

— cutting speed: +10 % / −0 %;

— cutting height between cutting head tip and plate: + / −10 %.

B.3.5 Preheat temperature

The qualification is valid within the following range:

— preheat temperature: + / −10 %.

B.4 Test report

The test report shall comprise the following information:

— reference to this document, i.e. ISO 17607-3:2023 and ISO 9013;

— number of the cutting specification pCPS;

— marking of the test piece;

— material specification;

— plate thickness;

— type and geometry of test piece;

— sketch with testing positions on the flame cut edge (if necessary);

— measuring instruments;

— tests conducted and assessment criteria;

— test results;

— evaluation of the test results.

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Annex C
(informative)

Geometric tolerances — Buildings

C.1 General

Permitted deviations for geometrical tolerances in buildings are divided into nine categories:

— welded profiles;

— press-braked profiles;

— flanges of welded profiles;

— flanges of welded box sections;

— web stiffeners and cruciform joints of profiles or box sections;

— components;

— fastener holes, notches and cut edges;

— column splices and baseplates;

— lattice components.

Permitted deviations are given in:

— Table C.1: Europe;

— Table C.2: Australia / New Zealand;

— Table C.3: Canada;

— Table C.4: China;

— Table C.5: Japan;

— Table C.6: Russian Federation;

— Table C.7: United Kingdom;

— Table C.8: United States.

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C.2 Tolerances for Europe

Unless otherwise noted, the reference standard for Table C.1 is EN 1090-2.

Definitions specific to Table C.1 are:

a) Essential tolerances:

Essential tolerances are essential for the mechanical resistance and stability of the completed structure and are therefore to be fulfilled.

b) Functional tolerances:

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Functional tolerances are those required to fulfil other criteria such as fit-up and appearance.

c) Class 1:

Tolerance Class 1 shall be applied unless otherwise specified in the execution specification.

d) Class 2:

Tolerance Class 2 can substitute Class 1 if smaller tolerance deviations are required, for example if glazed facades are to be fitted.

Table C.1 — Europe

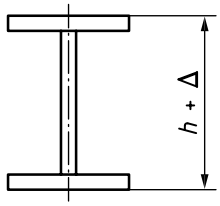
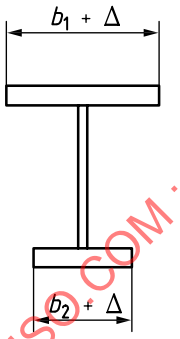
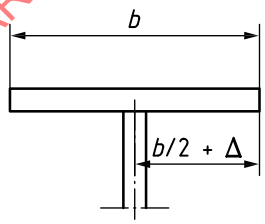
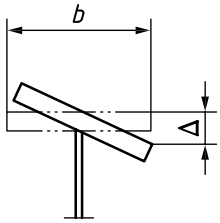
1. Welded profiles					
No	**Criterion**	**Parameter**	**Essential tolerances** **Permitted deviation Δ**	**Functional tolerances** **Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
1.1	Depth 	Overall depth h: $h \leq 900$ mm $900 < h \leq 1\,800$ mm $h > 1\,800$ mm	-Δ = h/50 (note negative sign)	Δ = ±3 mm Δ = ±h/300 Δ = ±6 mm	Δ = ±2 mm Δ = ±h/450 Δ = ±4 mm
1.2	Flange width 	Width $b = b_1$ or b_2	-Δ = b/100 (note negative sign)	+Δ = b/100 but |Δ| ≥ 3 mm	+Δ = b/100 but |Δ| ≥ 2 mm
1.3	Web eccentricity 	Position of web: — general case — flange parts in contact with structural bearings	No requirement	Δ = ±5 mm Δ = ±3 mm	Δ = ±4 mm Δ = ±2 mm
1.4	Squareness of flanges 	Position of web: — general case — flange parts in contact with structural bearings	No requirement	Δ = ±b/100 but |Δ| ≥ 5 mm Δ = ±b/400	Δ = ±b/100 but |Δ| ≥ 3 mm Δ = ±b/400

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Table C.1 *(continued)*

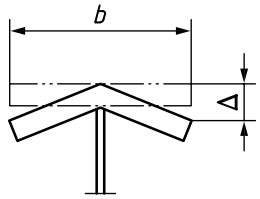
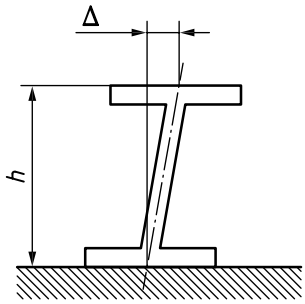
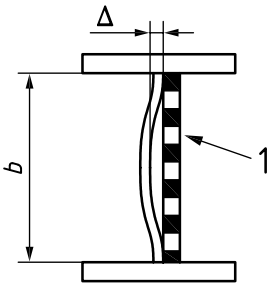
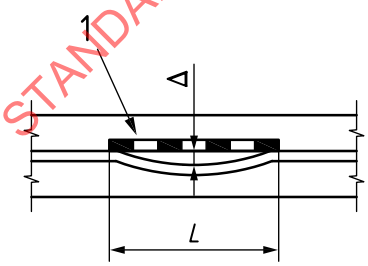
1.5	Flatness of flanges 	s Out of flatness: general case flange parts in contact with structural bearings	No requirement	Δ = ±b/150 but |Δ| ≥ 3 mm Δ = ±b/400	Δ = ±b/150 but |Δ| ≥ 2 mm Δ = ±b/400
1.6	Squareness of bearings 	Vertically of web at supports, for components without bearing stiffeners	Δ = ±h/200 but |Δ| ≥ t_w (t_w = web thickness)	Δ = ±h/300 but |Δ| ≥ 3 mm	Δ = ±h/500 but |Δ| ≥ 2 mm
1.7	Plate curvature  1 gauge length	Derivation Δ over plate height b	if $b/t \le 80$ Δ = ±b/200 if $80 < b/t \le 200$ Δ = ±b^2 / (16 000 t) if $b/t > 200$ Δ = ±b/80 but |Δ| ≥ t (t = plate thickness)	Δ = ±b/100 but |Δ| ≥ 5 mm	Δ = ±b/150 but |Δ| ≥ 3 mm
1.8	Web distortion 	Deviation Δ on gauge length L equal to web height b (see 1.7). NOTE: For components that are tapered or have variable web height b the permitted deviation is related to the mean web height at the location of the gauge.	Δ = ±b/100 but |Δ| ≥ t (t = plate thickness)	Δ = ±b/100 but |Δ| ≥ 5 mm	Δ = ±b/150 but |Δ| ≥ 3 mm
1.9	Web undulation	Deviation Δ on gauge length L equal to web height b (see 1.7).			

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Table C.1 *(continued)*

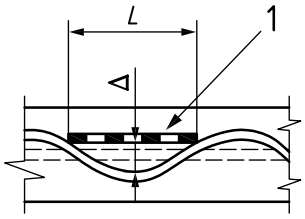
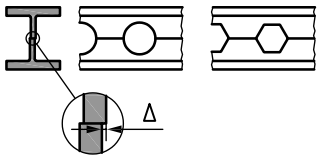
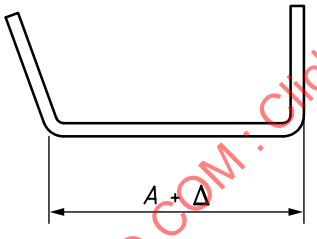
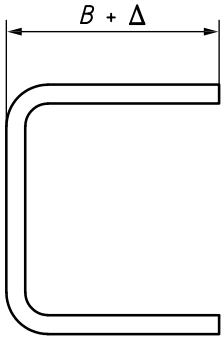
		NOTE: For components that are tapered or have variable web height b the permitted deviation is related to the mean web height at the location of the gauge.	$\Delta = \pm b/100$ but $\lvert\Delta\rvert \geq t$ (t = plate thickness)	$\Delta = \pm b/100$ but $\lvert\Delta\rvert \geq 5$ mm	$\Delta = \pm b/150$ but $\lvert\Delta\rvert \geq 3$ mm
1.10	Castellated beams and cellular beams [fabricated either from plate or from hot-rolled sections] with openings of inscribed nominal diameter D 	Misalignment of web post: across thickness overlap for opening of nominal radius r: $r = D/2 < 200$ mm $r = D/2 \geq 200$ mm	No requirement	$\Delta = 2$ mm $\Delta = 2$ mm $\Delta = r/100$ and $\Delta \leq 5$ mm	$\Delta = 2$ mm $\Delta = 2$ mm $\Delta = r/100$ and $\Delta \leq 5$ mm
NOTE	Notations such as $\Delta = \pm d/100$ but $\lvert\Delta\rvert \geq t$ mean that $\lvert\Delta\rvert$ is the larger of $d/100$ and t.				
2.	**Press-braked profiles**				
No	**Criterion**	**Parameter**	**Essential tolerances Permitted deviation Δ**	**Functional tolerances Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
2.1	Internal element width 	Width A between bends (component of thickness t): $t < 3$ mm: Length < 7 m Length ≥ 7 m $t \geq 3$ mm: Length < 7 m Length ≥ 7 m	-Δ = A/50 (note negative sign)	Δ = ±3 mm Δ = – 3 mm / +5 mm Δ = ±5 mm Δ = – 5 mm / +9 mm	Δ = ±2 mm Δ = – 2 mm / +4 mm Δ = ±3 mm Δ = – 3 mm / +6 mm
2.2	Outstanding element width 	Width B between a bend and a free edge (component of thickness t): Mill edge: $t < 3$ mm $t \geq 3$ mm Sheared edge: $t < 3$ mm $t \geq 3$ mm	-Δ = B/80 (note negative sign)	Δ = - 3 mm / + 6 mm Δ = - 5 mm / + 7 mm Δ = - 2 mm / + 5 mm Δ = - 3 mm / + 6 mm	Δ = - 2 mm / + 4 mm Δ = - 3 mm / + 5 mm Δ = - 1 mm / + 3 mm Δ = - 2 mm / + 4 mm
2.3	Straightness for component to be used unrestrained				

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Table C.1 *(continued)*

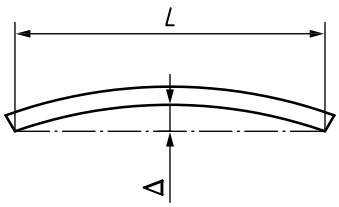
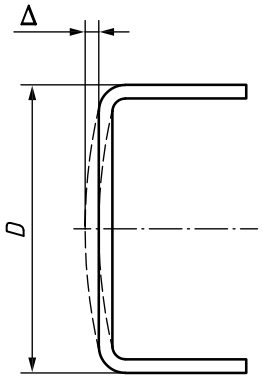
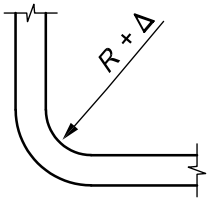
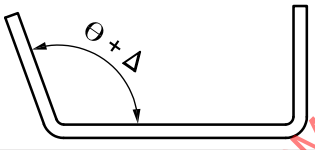
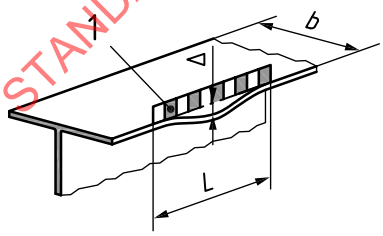
		Deviation Δ from straightness	Δ = ±L/1 000	No requirement (see 6.3)	—
2.4	Flatness 	Convexity or concavity	No requirement	Δ = ±D/50	Δ = ±D/100
2.5	Bend radius 	Internal bend radius R	No requirement	Δ = ±2 mm	Δ = ±1 mm
2.6	Shape 	Angle θ between adjacent components	No requirement	Δ = ±3°	Δ = ±2°
3.	**Flanges of welded profiles**				
No	**Criterion**	**Parameter**	**Essential tolerances Permitted deviation Δ**	**Functional tolerances Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
3.1	Flange distortion of I section  1 gauge length	Deviation Δ on gauge length L where L = flange and b = width t = flange thickness	Δ = ±b/150 if $b/t \leq 20$ Δ = ±b^2/(3 000 t) if $b/t > 20$	Δ = ±b/100	Δ = ±b/150
3.2	Flange undulation of I section				

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Table C.1 *(continued)*

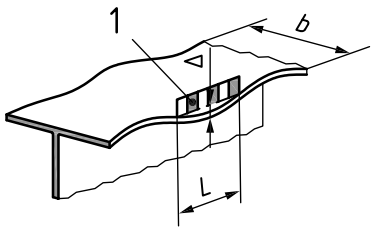
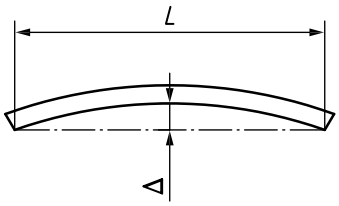
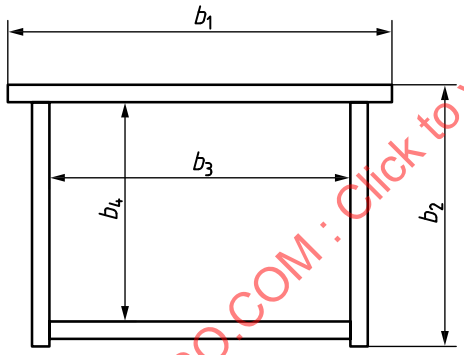
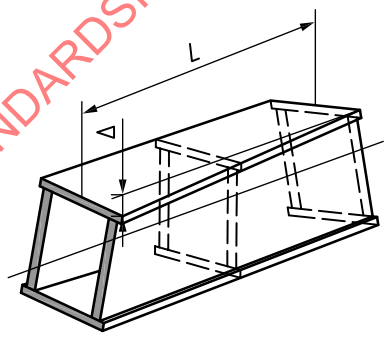
	 1 gauge length	Deviation Δ on gauge length L where L = flange and b = width t = flange thickness	$\Delta = \pm b/150$ if $b/t \leq 20$ $\Delta = \pm b^2/(3\,000\ t)$ if $b/t > 20$	$\Delta = \pm b/100$	$\Delta = \pm b/150$
3.3	Straightness for component to be used unrestrained 	Deviation Δ from straightness	$\Delta = \pm L/1\,000$	$\Delta = \pm L/1\,000$	$\Delta = \pm L/1\,000$
4.	**Flanges of welded box sections**				
No	**Criterion**	**Parameter**	**Essential tolerances Permitted deviation Δ**	**Functional tolerances Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
4.1	Section dimension 	Deviation in internal or external dimension $b < 900$ mm $900 \leq b < 1\,800$ mm $b \geq 1\,800$ mm $b = b_1, b_2, b_3$ or b_4	$-\Delta = b/100$ (note negative sign)	$\Delta = \pm 3$ mm $\Delta = \pm b/300$ $\Delta = \pm 6$ mm	$\Delta = \pm 2$ mm $\Delta = \pm b/450$ $\Delta = \pm 4$ mm
4.2	Twist 	Overall deviation Δ in a piece of length L	No requirement	$\Delta = \pm L/700$ but $\lvert\Delta\rvert \geq 4$ mm and $\lvert\Delta\rvert \leq 10$ mm	$\Delta = \pm L/1\,000$ but $\lvert\Delta\rvert \geq 3$ mm and $\lvert\Delta\rvert \leq 8$ mm
4.3	Out-of-plane imperfection of plate panel between web or stiffener, general case	Deviation Δ perpendicular to the plane of the plate			

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Table C.1 *(continued)*

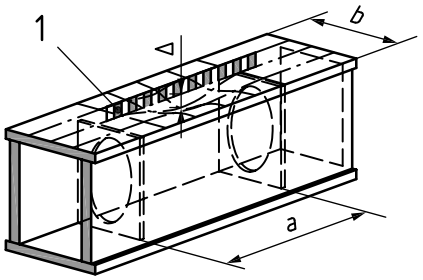
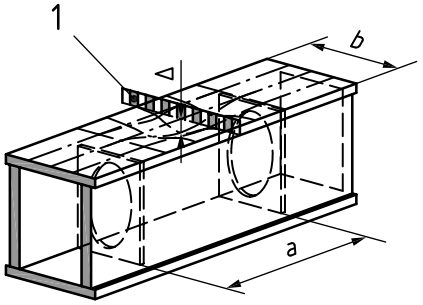
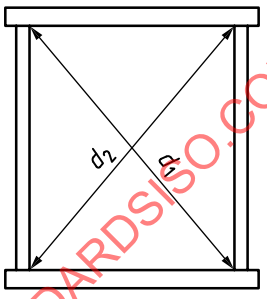
	 Key 1 straight edge gauge of length L	if $a \le 2b$, $L = a$ if $a > 2b$, $L = 2b$	$\Delta = \pm a/250$ $\Delta = \pm b/125$	$\Delta = \pm a/250$ $\Delta = \pm b/125$	$\Delta = \pm a/250$ $\Delta = \pm b/125$
4.4	Out-of-plane imperfections of plate panel between webs or stiffeners (special case with compression in the transverse direction – the general case applies unless this special case is specified)  Key 1 straight edge gauge of length L	Deviation Δ perpendicular to the plane of the plate if $b \le 2a$, $L = b$ if $b > 2a$, $L = 2a$	$\Delta = \pm b/250$ $\Delta = \pm a/125$	$\Delta = \pm b/250$ $\Delta = \pm a/125$	$\Delta = \pm b/250$ $\Delta = \pm a/125$
4.5	Squareness  $(d_1 + d_2)_{act} = (d_1 + d_2)$ actual $(d_1 + d_2)_{nom} = (d_1 + d_2)$ nominal	Difference Δ between diagonal dimensions at diaphragm positions: $\Delta = \lvert (d_1 - d_2)_{act} - (d_1 - d_2)_{nom} \rvert$ hence $\Delta = \lvert d_1 - d_2 \rvert_{act}$ if d_1 and d_2 are nominally the same	No requirement	$\Delta = \frac{(d_1 + d_2)_{nom}}{400}$ but $\lvert\Delta\rvert \ge 6$ mm	$\Delta = \frac{(d_1 + d_2)_{nom}}{600}$ but $\lvert\Delta\rvert \ge 4$ mm
5.	**Web stiffeners and cruciform joints of profiles or box sections**				
No	**Criterion**	**Parameter**	**Essential tolerances** **Permitted deviation Δ**	**Functional tolerances** **Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
5.1	In-plane straightness				

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Table C.1 *(continued)*

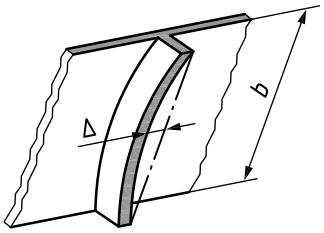
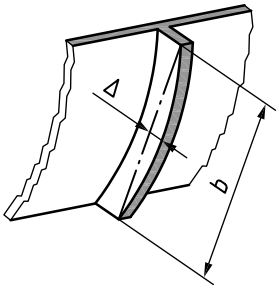
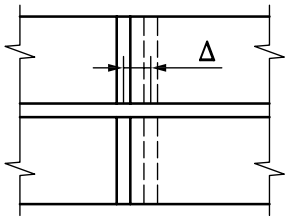
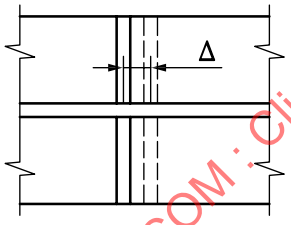
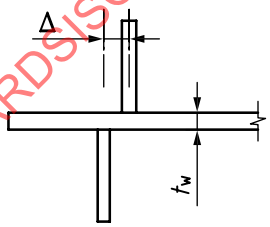
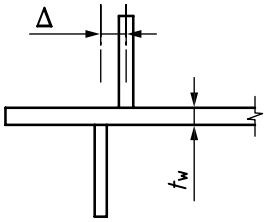
		Deviation Δ from straightness in the plane of the plate	Δ = ±b/250 but |Δ| ≥ 4 mm	Δ = ±b/250 but |Δ| ≥ 4 mm	Δ = ±b/375 but |Δ| ≥ 2 mm
5.2	Out-of-plane straightness 	Deviation Δ from straightness normal to the plane of the web	Δ = ±b/500 but |Δ| ≥ 4 mm	Δ = ±b/500 but |Δ| ≥ 4 mm	Δ = ±b/750 but |Δ| ≥ 2 mm
5.3	Location of web stiffeners 	Distance Δ from intended location	Δ = ±5 mm	Δ = ±5 mm	Δ = ±3 mm
5.4	Location of web stiffeners at support 	Distance Δ from intended location	Δ = ±3 mm	Δ = ±3 mm	Δ = ±2 mm
5.5	Eccentricity of web stiffeners 	Eccentricity between a pair of stiffeners: NOTE: For cruciform joints, the misalignment eccentricity is limited to ± t/2 where t is the larger of the thicknesses of the two plates attached either side of the web	Δ = ±t_w / 2	Δ = ±t_w / 2	Δ = ±t_w / 3
5.6	Eccentricity of web stiffeners at supports 	Eccentricity between a pair of stiffeners: NOTE: For cruciform joints, the misalignment eccentricity is limited to ±t/2 where t is the larger of the thicknesses of the two plates attached either side of the web	Δ = ±t_w / 3	Δ = ±t_w / 3	Δ = ±t_w / 4
NOTE Notations such as Δ = ±d/100 but |Δ| ≥ 5 mm mean that |Δ| is the larger of d/100 and 5 mm.					
6. Components					

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Table C.1 *(continued)*

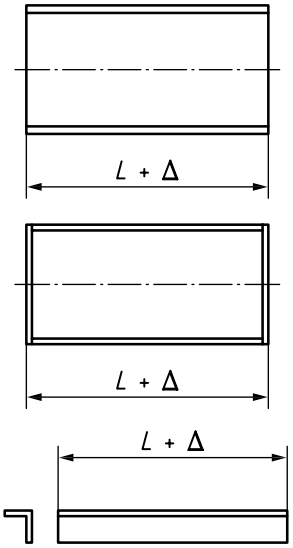
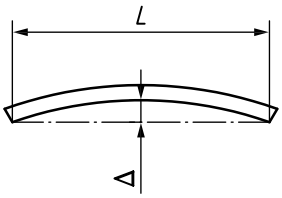
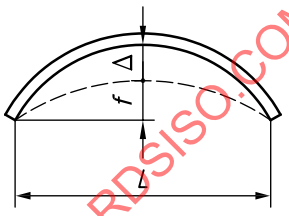
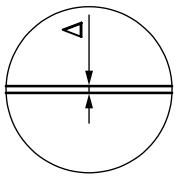
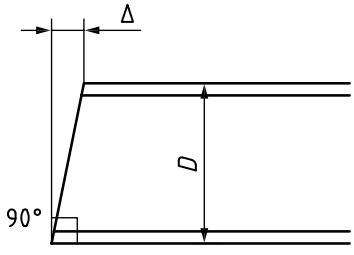
No	Criterion	Parameter		Functional tolerances Permitted deviation Δ	
				Class 1	Class 2
6.1	Length 	Cut length measured on the centreline (or on the corner for an angle): general case ends ready for full contact bearing NOTE: Length *L* measured including welded end plates as applicable.	No requirement No requirement	Δ = ±(*L*/5 000 + 2 mm) Δ = ±1 mm	Δ = ±(*L*/10 000 + 2 mm) Δ = ±1 mm
6.2	Length, where sufficient compensation with adjacent component is possible	Cut length measured on centreline.	No requirement	Δ = ±50 mm	Δ = ±50 mm
6.3	Straightness 	Distance Δ from rectangular axes of a fabricated or press-braked section	No requirement	Δ = ±*L*/1 000 but |Δ| ≥ 5 mm	Δ = ±*L*/1 000 but |Δ| ≥ 3 mm
6.4	Camber or intended curvature on plan 	Offset *f* at mid-length Vertical camber should be measured with the member on its side.	No requirement	Δ = ±*L*/500 but |Δ| ≥ 6 mm	Δ = ±*L*/1 000 but |Δ| ≥ 4 mm
6.5	Surfaces finished for full contact bearing 	Gap Δ between straight edge and surface. NOTE: No surface roughness criterion is specified	No requirement	Δ = 0,5 mm high spots not to be proud by more than 0,5 mm	Δ = 0,25 mm high spots not to be proud by more than 0,25 mm
6.6	Squareness of ends 	Squareness to longitudinal axis: ends intended for full contact bearing ends not intended for full contact bearing	No requirement No requirement	Δ = ±*D*/1 000 Δ = ±*D*/100	Δ = ±*D*/1 000 Δ = ±*D*/300 but |Δ| ≤ 10 mm

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Table C.1 *(continued)*

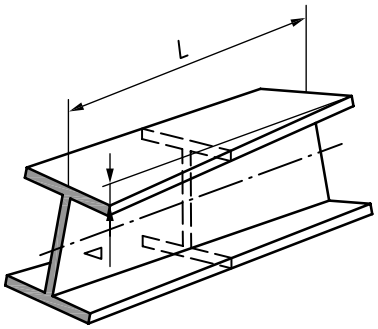
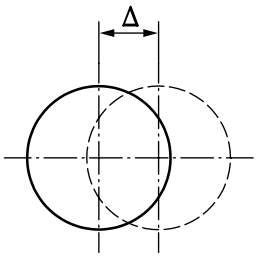
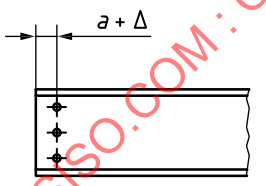
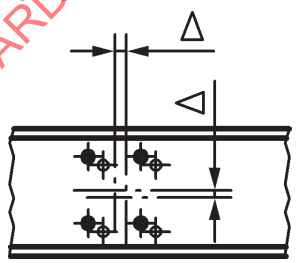
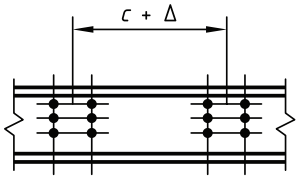
6.7	Twist 	Overall deviation Δ in a piece of length L NOTE: For box sections, see item 4.2.	No requirement	$\Delta = \pm L/700$ but $\lvert\Delta\rvert \geq 4$ mm and $\lvert\Delta\rvert \leq 20$ mm	$\Delta = \pm L/1\,000$ but $\lvert\Delta\rvert \geq 3$ mm and $\lvert\Delta\rvert \leq 15$ mm
NOTE	Notations such as $\Delta = \pm d/100$ but $\lvert\Delta\rvert \geq 5$ mm mean that $\lvert\Delta\rvert$ is the larger of $d/100$ and 5 mm.				
7.	**Fastener holes, notches and cut edges**				
No	**Criterion**	**Parameter**	**Essential tolerances Permitted deviation Δ**	**Functional tolerances Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
7.1	Position of holes for fasteners 	Deviation Δ of centreline of an individual hole from its intended position within a group of holes	Δ = ±2 mm	Δ = ±2 mm	Δ = ±1 mm
7.2	Position of holes for fasteners 	Deviation Δ in distance a between an individual hole of diameter d_0 and a cut end: if $a < 3\ d_0$ if $a < 3\ d_0$	- Δ = 0 mm (note negative sign) Δ = ±3 mm	- Δ = 0 mm + Δ = 3 mm Δ = ±3 mm	- Δ = 0 mm + Δ = 2 mm Δ = ±2 mm
7.3	Position of hole group 	Deviation Δ of a hole group from intended position	Δ = ±2 mm	Δ = ±2 mm	Δ = ±1 mm
7.4	Spacing of hole groups 	Deviation Δ in spacing c between centres of hole groups: general case where a single piece is connected by two groups of fasteners	No requirement	Δ = ±5 mm Δ = ±2 mm	Δ = ±2 mm Δ = ±1 mm
7.5	Twist of hole group				

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Table C.1 *(continued)*

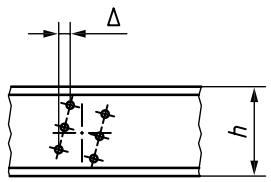
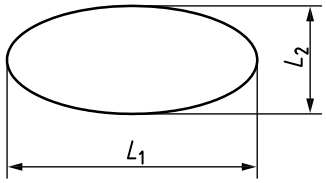
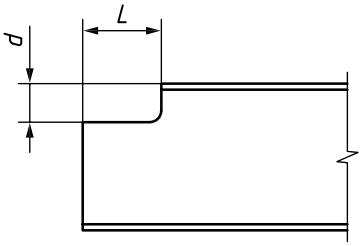
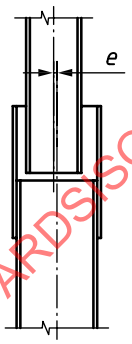
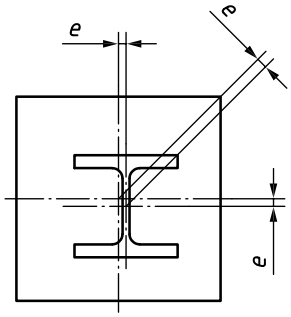
		Twist Δ: if $h \leq 1\,000$ mm if $h > 1\,000$ mm	No requirement	Δ = ±2 mm Δ = ±4 mm	Δ = ±1 mm Δ = ±2 mm
7.6	Ovalisation of holes 	$\Delta = L_1 - L_2$	No requirement	Δ = ±1 mm	Δ = ±0,5 mm
7.7	Notches 	Deviation Δ of notch depth and length: depth d length L	No requirement	- Δ = 0 mm + Δ ≤ 3 mm - Δ = 0 mm + Δ ≤ 3 mm	- Δ = 0 mm + Δ ≤ 2 mm - Δ = 0 mm + Δ ≤ 2 mm
8.	**Column splices and baseplates**				
No	**Criterion**	**Parameter**	**Essential tolerances** **Permitted deviation Δ**	**Functional tolerances** **Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
8.1	Column splice 	Non-intended eccentricity e about either axis	No requirement	5 mm	3 mm
8.2	Baseplate 	Non-intended eccentricity e in any direction	No requirement	5 mm	3 mm
9.	**Lattice components**				

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Table C.1 *(continued)*

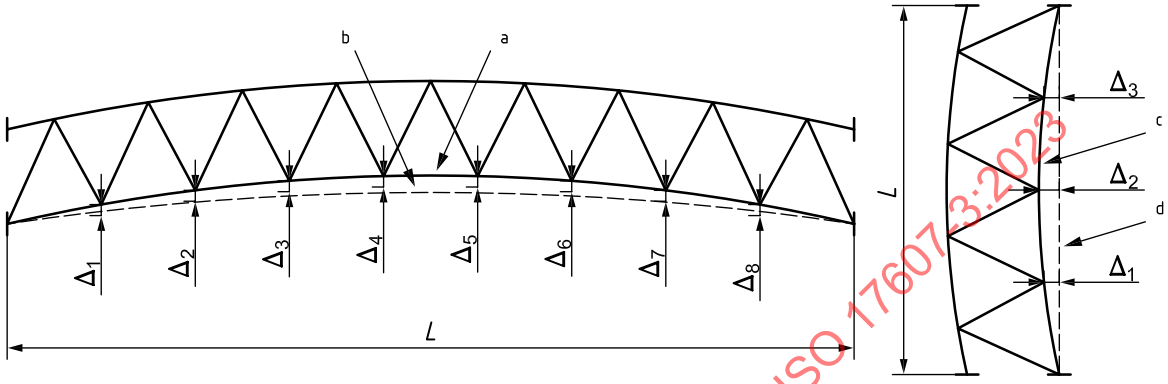
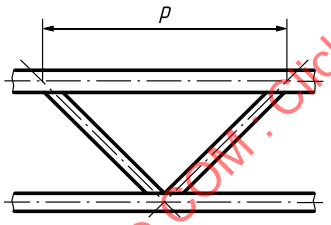
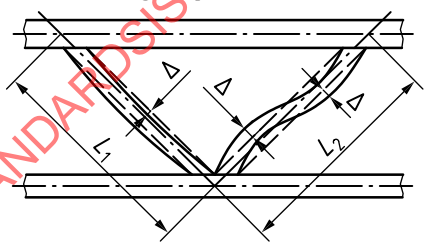
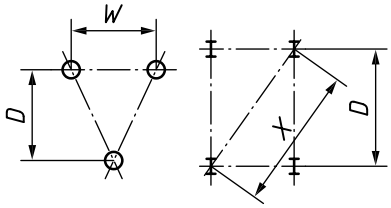
No	Criterion	Parameter	Essential tolerances Permitted deviation Δ	Functional tolerances Permitted deviation Δ	
			Class 1 and 2	Class 1	Class 2
9.1	**Straightness and camber** 				
	Key: *a* actual camber *b* intended camber *c* actual line *d* intended line	Deviation at each panel point, relative to a straight line or to the intended camber or curvature	$\Delta = \pm L/500$ but $\lvert\Delta\rvert \geq 12$ mm	$\Delta = \pm L/500$ but $\lvert\Delta\rvert \geq 12$ mm	$\Delta = \pm L/500$ but $\lvert\Delta\rvert \geq 6$ mm
9.2	Panel dimensions 	Deviation of individual distances *p* between intersections of centrelines at panel points	No requirement	Δ = ±5 mm	Δ = ±3 mm
		Cumulative deviation Σp of panel point position	No requirement	Δ = ±10 mm	Δ = ±6 mm
9.3	Straightness of bracing components 	Deviation of bracing lengths L_i (L_1 or L_2) from straightness	$\Delta = \pm L_i/1\,000$ but $\lvert\Delta\rvert \geq 4$ mm	$\Delta = \pm L_i/1\,000$ but $\lvert\Delta\rvert \geq 4$ mm	$\Delta = \pm L_i/1\,000$ but $\lvert\Delta\rvert \geq 3$ mm
9.4	Cross-section dimensions 	Deviation of distances *D*, *W*, and *X* if:			
		$s \leq 300$ mm	No requirement	Δ = ±3 mm	Δ = ±2 mm
		$300 < s < 1\,000$ mm		Δ = ±5 mm	Δ = ±4 mm
		$s \geq 1\,000$ mm		Δ = ±10 mm	Δ = ±6 mm
		where *s* = *D*, *W*, or *X* as appropriate			
9.5	Intersecting joints				

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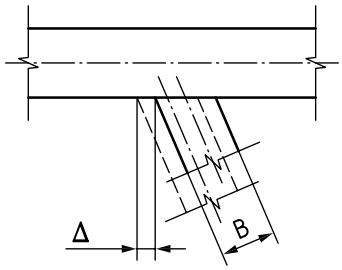
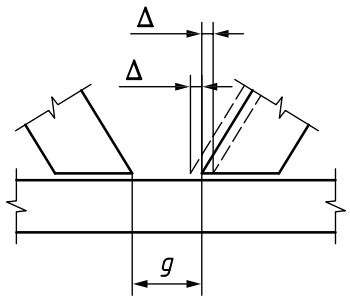
Table C.1 *(continued)*

		Eccentricity (relative to specified eccentricity)	No requirement	Δ = ±(*B*/20 + 5) mm	Δ = ±(*B*/20 + 5) mm
9.6	Gap joints 	Gap *g* between Bracing components: $g \geq (t_1 + t_2)$ where t_1 and t_2 are the wall thicknesses of braces	No requirement	Δ = ±5 mm	Δ = ±3 mm
NOTE Notations such as Δ = ±*L* /500 but |Δ| ≥ 12 mm mean that |Δ| is the larger of *L* /500 and 12 mm. Notation such as |Δ| = t_1 + t_2 but |Δ| ≤ 5 mm means that the smaller of the two values is required.						

C.3 Tolerances for Australia and New Zealand

Unless otherwise noted, the reference standard for Table C.2 is AS/NZS 5131.

Definitions specific to Table C.2 are:

a) Essential tolerances:

Basic limit for a geometrical tolerance necessary to satisfy the design assumptions for a structure in terms of design capacity and stability (see AS 4100, AS/NZS 5100.6 and NZS 3404).

b) Functional tolerances:

A tolerance which can be required to meet a function other than those of an essential tolerance, such as for appearance or fit-up.

c) Class 1:

Tolerance Class 1 shall be applied unless otherwise specified in the execution specification.

d) Class 2:

Tolerance Class 2 can substitute for Class 1 if smaller tolerance deviations are required, for example if glazed facades are to be fitted.

Table C.2 — Australia and New Zealand

1. Welded profiles					
No	**Criterion**	**Parameter**	**Essential tolerances Permitted deviation Δ**	**Functional tolerances Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
1.1	Depth				

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Table C.2 *(continued)*

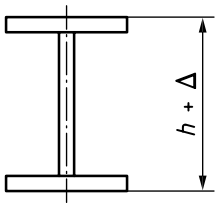
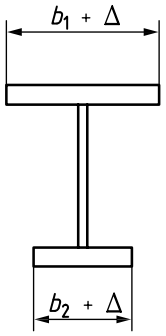
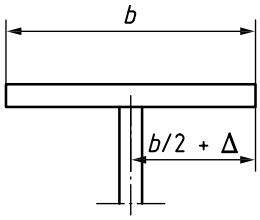
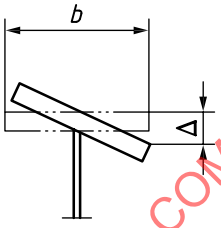
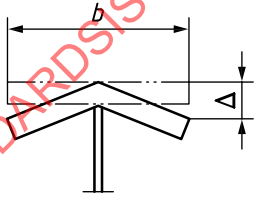
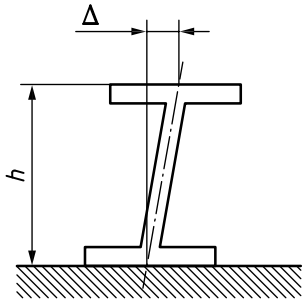
		Deviation (Δ) from nominal depth (h) $h \leq 900$ mm $900 < h \leq 1\,800$ mm $h > 1\,800$ mm	Δ = ±3 mm $\Delta = \pm\left[3 + \frac{(d-900)}{300}\right]$ mm Δ = ±6 mm	Δ = ±3 mm Δ = ±h/300 Δ = ±6 mm	Δ = ±2 mm Δ = ±h/450 Δ = ±4 mm
1.2	Flange width 		Δ = ±6 mm	+Δ = b/100 but |Δ| ≥ 3 mm	+Δ = b/100 but |Δ| ≥ 2 mm
1.3	Web eccentricity 		Δ = ±6 mm generally Δ = ±3 mm at bearing location	Δ = ±5 mm Δ = ±3 mm	Δ = ±4 mm Δ = ±2 mm
1.4	Squareness of flanges 	$b \leq 600$ mm $b > 600$ mm	Δ ≤ 3 mm Δ ≤ (b/200) mm	Δ = ±b/100 but |Δ| ≥ 5 mm Δ = ±b/100 but |Δ| ≥ 5 mm	Δ = ±b/100 But |Δ| ≥ 3 mm Δ = ±b/100 but |Δ| ≥ 3 mm
1.5	Flatness of flanges 	Out of flatness: $b \leq 450$ mm $b > 600$ mm general case flange parts in contact with structural bearings	 Δ ≤ (b/150) mm Δ = ±3 mm No requirement No requirement	 Δ = ±b/150 but |Δ| ≥ 3 mm Δ = ±b/400	 Δ = ±b/150 but |Δ| ≥ 2 mm Δ = ±b/400
1.6	Squareness of bearings 	Vertically of web at supports, for components without bearing stiffeners $h \leq 900$ mm $h > 900$ mm	 Δ = ±3mm Δ = ±h/200	Δ = ±h/300, but |Δ| ≥ 3 mm	Δ = ±h/500, but |Δ| ≥ 2 mm

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Table C.2 *(continued)*

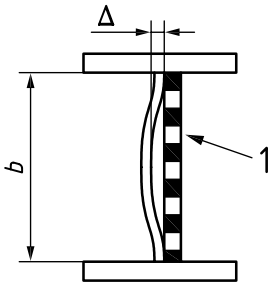
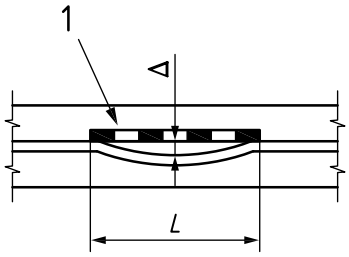
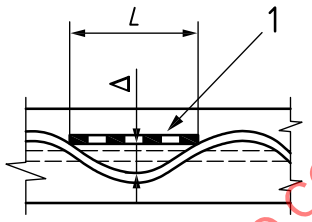
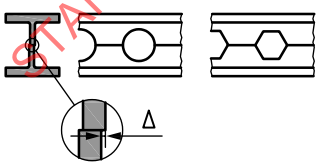
1.7	Plate curvature  1 gauge length	Derivation Δ over plate height b Unstiffened web Stiffened web General case	 $\Delta = \pm b/150$ $\Delta = \pm b/100$ 	$\Delta = \pm b/100$ but $\lvert\Delta\rvert \geq 5$ mm	$\Delta = \pm b/150$ but $\lvert\Delta\rvert \geq 3$ mm
1.8	Web distortion  1 gauge length	Deviation Δ on gauge length L equal to web height b. See 1.7. NOTE: For components that are tapered or have variable web height b the permitted deviation is related to the mean web height at the location of the gauge.	$\Delta = \pm b/100$ but $\lvert\Delta\rvert \geq t$ (t = plate thickness)	$\Delta = \pm b/100$ but $\lvert\Delta\rvert \geq 5$ mm	$\Delta = \pm b/150$ but $\lvert\Delta\rvert \geq 3$ mm
1.9	Web undulation  	Deviation Δ on gauge length L equal to web height b. See 1.7. NOTE: For components that are tapered or have variable web height b the permitted deviation is related to the mean web height at the location of the gauge.	$\Delta = \pm b/100$ but $\lvert\Delta\rvert \geq t$ (t = plate thickness)	$\Delta = \pm b/100$ but $\lvert\Delta\rvert \geq 5$ mm	$\Delta = \pm b/150$ but $\lvert\Delta\rvert \geq 3$ mm
1.10	Castellated beams and cellular beams (fabricated either from plate or from hot-rolled sections) with openings of inscribed nominal diameter D  	Misalignment of web post: across thickness overlap for opening of nominal radius r: $r = D/2 < 200$ mm $r = D/2 \geq 200$ mm	 No requirement	No requirement	No requirement
NOTE	Notations such as $\Delta = \pm d/100$ but $\lvert\Delta\rvert \geq t$ mean that $\lvert\Delta\rvert$ is the larger of $d/100$ and t.				
2.	**Press-braked profiles**				
No	**Criterion**	**Parameter**	**Essential tolerances** **Permitted deviation Δ**	**Functional tolerances** **Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
2.1	Internal element width				

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Table C.2 *(continued)*

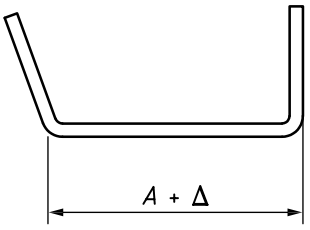
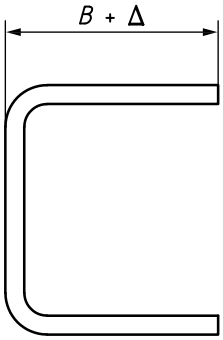
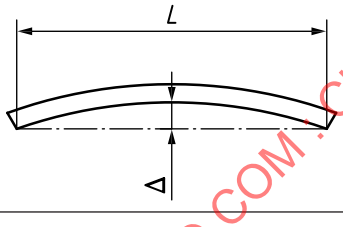
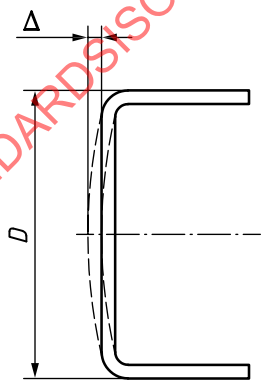
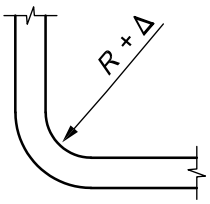
		Width A between bends (component of thickness t): t < 3 mm: Length < 7 m Length ≥ 7 m t ≥ 3 mm: Length < 7 m Length ≥ 7 m	-Δ = A/50 (note negative sign)	Δ = ±5 mm Δ = - 5 mm / + 9 mm Δ = ±3 mm Δ = - 3 mm / + 5 mm	Δ = ±2 mm Δ = - 2 mm / + 4 mm Δ = ±3 mm Δ = - 3 mm / + 6 mm
2.2	Outstanding element width 	Width B between a bend and a free edge (component of thickness t): Mill edge: t < 3 mm t ≥ 3 mm Sheared edge: t < 3 mm t ≥ 3 mm	-Δ = B/80 (note negative sign)	Δ = - 3 mm / + 6 mm Δ = - 5 mm / + 7 mm Δ = - 2 mm / + 5 mm Δ = - 3 mm / + 6 mm	Δ = - 2 mm / + 4 mm Δ = - 3 mm / + 5 mm Δ = - 1 mm / + 3 mm Δ = - 2 mm / + 4 mm
2.3	Straightness for component to be used unrestrained 	Deviation Δ from straightness	No requirement	Δ = ±L/750 but |Δ| ≥ 5 mm	Δ = ±L/750 but |Δ| ≥ 3 mm
2.4	Flatness 	Convexity or concavity	No requirement	Δ = ±D/50	Δ = ±D/100
2.5	Bend radius 	Internal bend radius R	No requirement	Δ = ±2 mm	Δ = ±1 mm
2.6	Shape				

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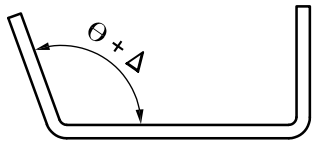
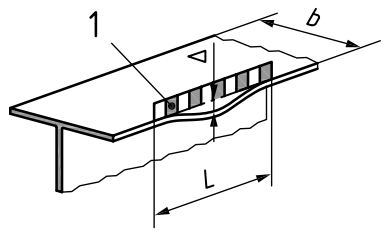
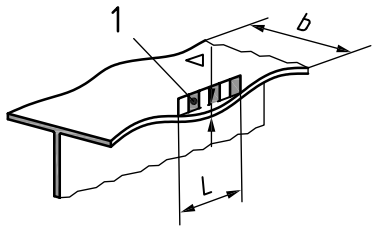
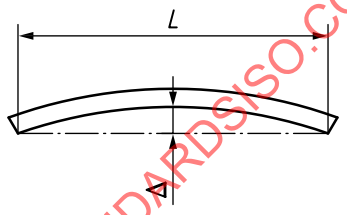
Table C.2 *(continued)*

		Angle θ between adjacent components	No requirement	Δ = ±3°	Δ = ±2°
3.	**Flanges of welded profiles**				

No	Criterion	Parameter	Essential tolerances Permitted deviation Δ	Functional tolerances Permitted deviation Δ	
			Class 1 and 2	Class 1	Class 2
3.1	Flange distortion of I section  1 gauge length	Deviation Δ on gauge length L, where L = flange b = width t = flange thickness	if $b/t \leq 20$ $\Delta = \pm b/150$ if $b/t > 20$ $\Delta = \pm b^2/(3\,000\ t)$	$\Delta = \pm b/100$	$\Delta = \pm b/150$
3.2	Flange undulation of I section  1 gauge length	Deviation Δ on gauge length L, where L = flange b = width t = flange thickness	if $b/t \leq 20$ $\Delta = \pm b/150$ if $b/t > 20$ $\Delta = \pm b^2/(3\,000\ t)$	$\Delta = \pm b/100$	$\Delta = \pm b/150$
3.3	Straightness for component to be used unrestrained  	Deviation Δ from straightness	$\Delta = \pm L/1\,000$	$\Delta = \pm L/1\,000$	$\Delta = \pm L/1\,000$
4.	**Flanges of welded box sections**				

No	Criterion	Parameter	Essential tolerances Permitted deviation Δ	Functional tolerances Permitted deviation Δ	
			Class 1 and 2	Class 1	Class 2
4.1	Section dimension	Deviation in internal or external dimension:			

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Table C.2 *(continued)*

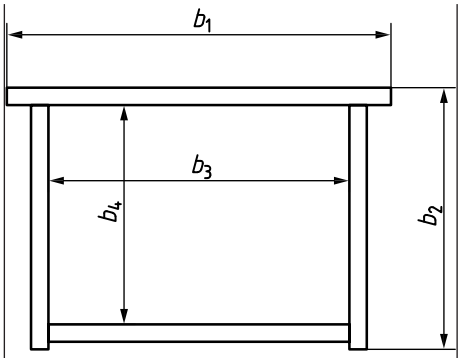
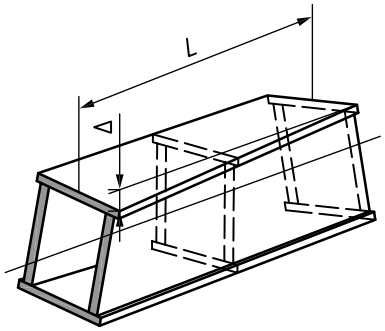
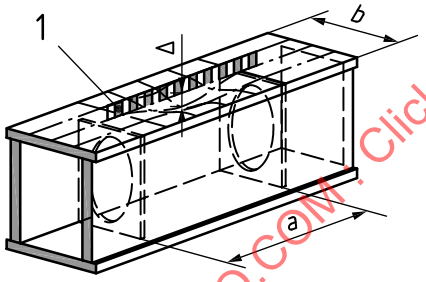
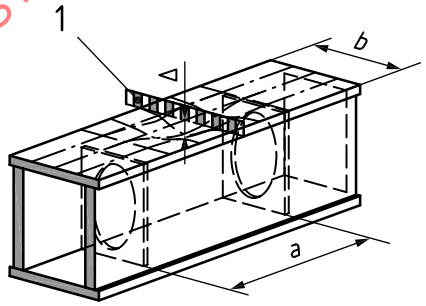
		$b \leq 300$ mm $300 < b \leq 900$ mm $900 < b \leq 1\,800$ mm $b > 1\,800$ mm $b = b_1, b_2, b_3$ or b_4	$\Delta = -(b/100) + 3$ mm $\Delta = \pm 3$ mm $\Delta = \pm b/300$ $\Delta = \pm 6$ mm	$\Delta = \pm 3$ mm $\Delta = \pm b/300$ $\Delta = \pm 6$ mm	$\Delta = \pm 2$ mm $\Delta = \pm b/450$ $\Delta = \pm 4$ mm
4.2	Twist 	Overall deviation Δ in a piece of length L	No requirement	$\Delta = \pm L/700$, but $\lvert\Delta\rvert \geq 4$ mm and $\lvert\Delta\rvert \leq 10$ mm	$\Delta = \pm L/1\,000$, but $\lvert\Delta\rvert \geq 3$ mm and $\lvert\Delta\rvert \leq 8$ mm
4.3	Out-of-plane imperfection of plate panel between web or stiffener, general case  1 straight edge gauge of length L	Deviation Δ perpendicular to the plane of the plate: if $a \leq 2b$, $L = a$ if $a > 2b$, $L = 2b$	$\Delta = \pm a/250$ $\Delta = \pm b/125$	$\Delta = \pm a/250$ $\Delta = \pm b/125$	$\Delta = \pm a/250$ $\Delta = \pm b/125$
4.4	Out-of-plane imperfections of plate panel between webs or stiffeners (special case with compression in the transverse direction – the general case applies unless this special case is specified)  1 straight edge gauge of length L	Deviation Δ perpendicular to the plane of the plate: if $a \leq 2b$, $L = a$ if $a > 2b$, $L = 2a$	$\Delta = \pm b/250$ $\Delta = \pm a/125$	$\Delta = \pm b/250$ $\Delta = \pm a/125$	$\Delta = \pm b/250$ $\Delta = \pm a/125$
4.5	Squareness				

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Table C.2 *(continued)*

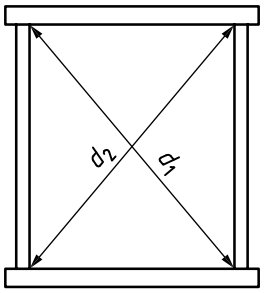
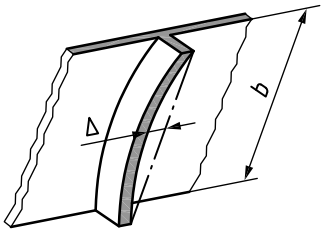
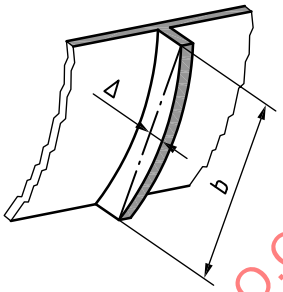
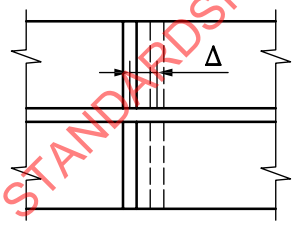
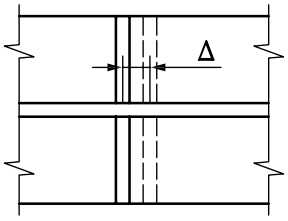
	 $(d_1 + d_2)_{act} = (d_1 + d_2)$ actual $(d_1 + d_2)_{nom} = (d_1 + d_2)$ nominal	Difference Δ between diagonal dimensions at diaphragm positions: $\Delta = \lvert (d_1 - d_2)_{act} - (d_1 - d_2)_{nom} \rvert$ hence $\Delta = \lvert d_1 - d_2 \rvert_{act}$ if d_1 and d_2 are nominally the same	$\Delta = \frac{(d_1 + d_2)_{nom}}{400}$ but $\lvert\Delta\rvert \geq 5$ mm	$\Delta = \frac{(d_1 + d_2)_{nom}}{400}$ but $\lvert\Delta\rvert \geq 6$ mm	$\Delta = \frac{(d_1 + d_2)_{nom}}{600}$ but $\lvert\Delta\rvert \geq 4$ mm
5.	**Web stiffeners and cruciform joints of profiles or box sections**				
No	**Criterion**	**Parameter**	**Essential tolerances** **Permitted deviation Δ**	**Functional tolerances** **Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
5.1	In-plane straightness 	Deviation Δ from straightness in the plane of the plate	$\Delta = \pm b/250$ but $\lvert\Delta\rvert \geq 4$ mm	$\Delta = \pm b/250$ but $\lvert\Delta\rvert \geq 4$ mm	$\Delta = \pm b/375$ but $\lvert\Delta\rvert \geq 2$ mm
5.2	Out-of-plane straightness 	Deviation Δ from straightness normal to the plane of the web	$\Delta = \pm b/500$ but $\lvert\Delta\rvert \geq 4$ mm	$\Delta = \pm b/500$ but $\lvert\Delta\rvert \geq 4$ mm	$\Delta = \pm b/750$ but $\lvert\Delta\rvert \geq 2$ mm
5.3	Location of web stiffeners 	Distance Δ from intended location	$\Delta = \pm 5$ mm	$\Delta = \pm 5$ mm	$\Delta = \pm 3$ mm
5.4	Location of web stiffeners at support 	Distance Δ from intended location	$\Delta = \pm 3$ mm	$\Delta = \pm 3$ mm	$\Delta = \pm 2$ mm
5.5	Eccentricity of web stiffeners	Eccentricity between a pair of stiffeners:			

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Table C.2 *(continued)*

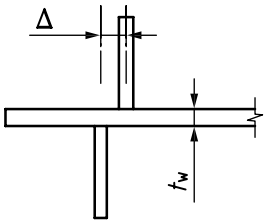
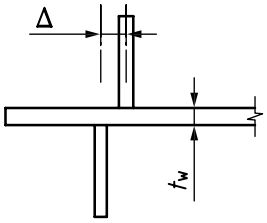
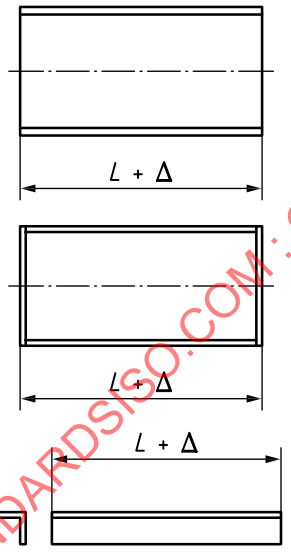
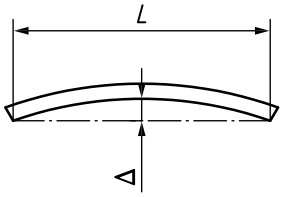
		NOTE: For cruciform joints, the misalignment eccentricity is limited to $\pm t/2$, where t is the larger of the thicknesses of the two plates attached either side of the web.	$\Delta = \pm t_w / 2$	$\Delta = \pm t_w / 2$	$\Delta = \pm t_w / 3$
5.6	Eccentricity of web stiffeners at supports 	Eccentricity between a pair of stiffeners: NOTE: For cruciform joints, the misalignment eccentricity is limited to $\pm t/2$, where t is the larger of the thicknesses of the two plates attached either side of the web.	$\Delta = \pm t_w / 3$	$\Delta = \pm t_w / 3$	$\Delta = \pm t_w / 4$
NOTE	Notations such as $\Delta = \pm d/100$ but $\lvert\Delta\rvert \geq 5$ mm mean that $\lvert\Delta\rvert$ is the larger of $d/100$ and 5 mm.				
6.	**Components**				
No	**Criterion**	**Parameter**	**Essential tolerances** **Permitted deviation Δ**	**Functional tolerances** **Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
6.1	Length 	Cut length measured on the centreline (or on the corner for an angle): general case ends ready for full contact bearing NOTE: Length L measured including welded end plates as applicable.	No requirement No requirement	Δ = ±(L/5 000 + 2 mm) Δ = ±1 mm	Δ = ±(L/10 000 + 2 mm) Δ = ±1 mm
6.2	Length, where sufficient compensation with adjacent component is possible	Cut length measured on centreline	No requirement	Δ = ±50 mm	Δ = ±50 mm
6.3	Straightness 	Distance Δ from rectangular axes of a fabricated or press-braked section	No requirement	Δ = ±L/750 but |Δ| ≥ 5 mm	Δ = ±L/750 but |Δ| ≥ 3 mm
6.4	Camber or intended curvature on plan	Offset f at mid-length			

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Table C.2 *(continued)*

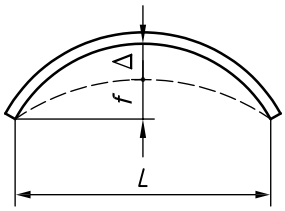
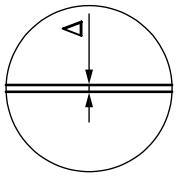
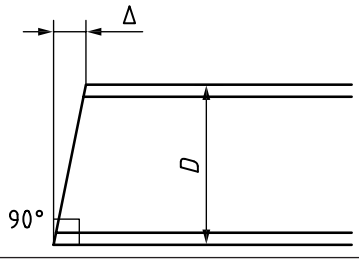
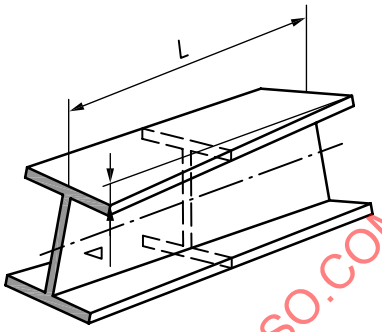
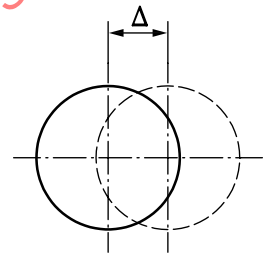
		Vertical camber should be measured with the member on its side.	No requirement	Δ = ±L/500 but |Δ| ≥ 6 mm	Δ = ±L/1 000 but |Δ| ≥ 4 mm
6.5	Surfaces finished for full contact bearing 	Gap Δ between straight edge and surface. NOTE: No surface roughness criterion is specified.	No requirement	Δ = 0,5 mm high spots not to be proud (do not protrude) by more than 0,5 mm	Δ = 0,25 mm high spots not to be proud (do not protrude) by more than 0,25 mm
6.6	Squareness of ends 	Squareness to longitudinal axis: ends intended for full contact bearing ends not intended for full contact bearing	No requirement No requirement	Δ = ±D/1 000 Δ = ±D/100	Δ = ±D/1 000 Δ = ±D/300 but |Δ| ≤ 10 mm
6.7	Twist 	Overall deviation Δ in a piece of length L NOTE: For box sections, see item 4.2.	No requirement	Δ = ±L/700 but |Δ| ≥ 4 mm and |Δ| ≤ 20 mm	Δ = ±L/1 000 but |Δ| ≥ 3 mm and |Δ| ≤ 15 mm
NOTE	Notations such as Δ = ±d/100 but |Δ| ≥ 5 mm mean that |Δ| is the larger of d/100 and 5 mm.				
7.	**Fastener holes, notches and cut edges**				
No	**Criterion**	**Parameter**	**Essential tolerances Permitted deviation Δ**	**Functional tolerances Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
7.1	Position of holes for fasteners 	Deviation Δ of centreline of an individual hole from its intended position within a group of holes	Δ = ±2 mm	Δ = ±2 mm	Δ = ±1 mm
7.2	Position of holes for fasteners				

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Table C.2 *(continued)*

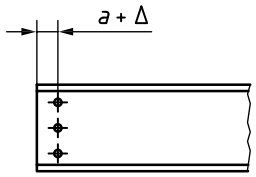
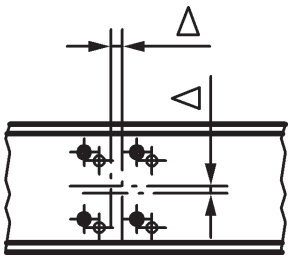
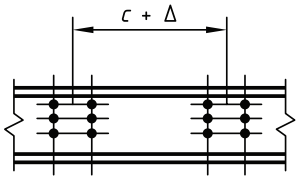
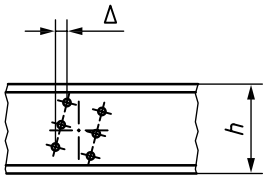
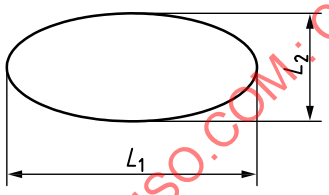
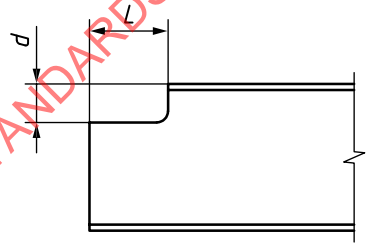
		Deviation Δ in distance a between an individual hole and a cut end	Δ = - 0 mm Δ = + 3 mm	Δ = ±3 mm	Δ = ±2 mm
7.3	Position of hole group 	Deviation Δ of a hole group from intended position	Δ = ±2 mm	Δ = ±2 mm	Δ = ±1 mm
7.4	Spacing of hole groups 	Deviation Δ in spacing c between centres of hole groups: general case where a single piece is connected by two groups of fasteners	 No requirement 	 Δ = ±5 mm Δ = ±2 mm	 Δ = ±2 mm Δ = ±1 mm
7.5	Twist of hole group 	Twist Δ if $h \leq 1\,000$ mm if $h > 1\,000$ mm	 No requirement 	 Δ = ±2 mm Δ = ±4 mm	 Δ = ±1 mm Δ = ±2 mm
7.6	Ovalisation of holes 	$\Delta = L_1 - L_2$	No requirement	Δ = ±1 mm	Δ = ±0,5 mm
7.7	Notches 	Deviation Δ of notch depth and length: — depth d — length L	 No requirement 	 - Δ = 0 mm + Δ ≤ 3 mm - Δ = 0 mm + Δ ≤ 3 mm	 - Δ = 0 mm + Δ ≤ 2 mm - Δ = 0 mm + Δ ≤ 2 mm
8.	**Column splices and baseplates**				
No	**Criterion**	**Parameter**	**Essential tolerances Permitted deviation Δ**	**Functional tolerances Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
8.1	Column splice				

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Table C.2 *(continued)*

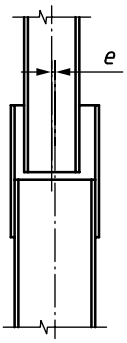
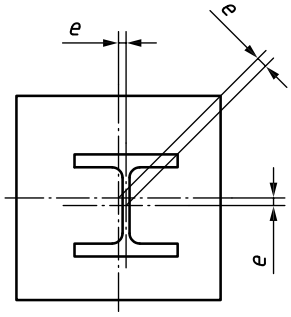
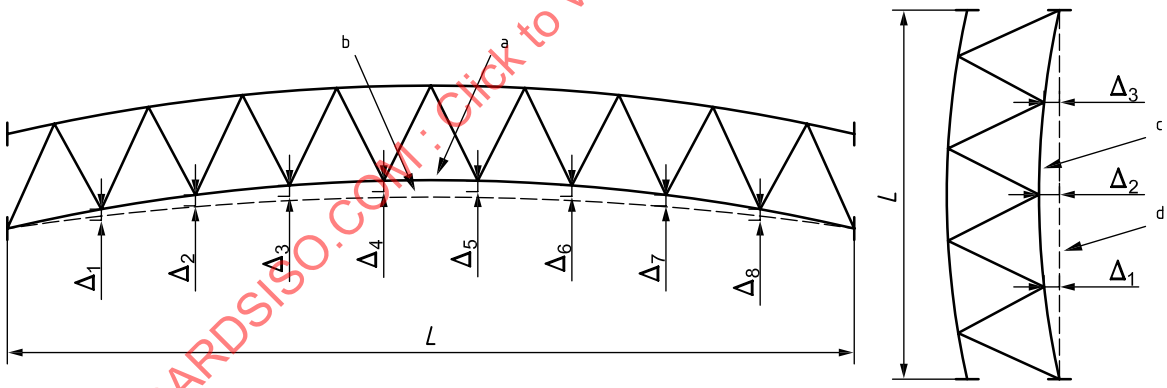
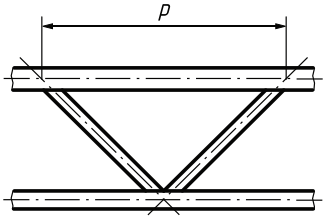
		Non-intended eccentricity e about either axis	No requirement	$e \leq 5$ mm	$e \leq 3$ mm
8.2	Baseplate 	Non-intended eccentricity e in any direction	No requirement	$e \leq 5$ mm	$e \leq 3$ mm
9	**Lattice components**				
No	**Criterion**	**Parameter**	**Essential tolerances Permitted deviation Δ**	**Functional tolerances Permitted deviation Δ**	
			Class 1 and 2	**Class 1**	**Class 2**
9.1	Straightness and camber  NOTE: Deviations measured after welding, with the component lying flat on its side.				
	Key: a actual camber b intended camber c actual line d intended line	Deviation at each panel point, relative to a straight line or to the intended camber or curvature	$\Delta = \pm L/500$ but $\lvert\Delta\rvert \geq 12$ mm	$\Delta = \pm L/500$ but $\lvert\Delta\rvert \geq 12$ mm	$\Delta = \pm L/500$ but $\lvert\Delta\rvert \geq 6$ mm
9.2	Panel dimensions 	Deviation of individual distances p between intersections of centrelines at panel points	No requirement	$\Delta = \pm 5$ mm	$\Delta = \pm 3$ mm
		Cumulative deviation Σp of panel point position	No requirement	$\Delta = \pm 10$ mm	$\Delta = \pm 6$ mm
9.3	Straightness of bracing components				

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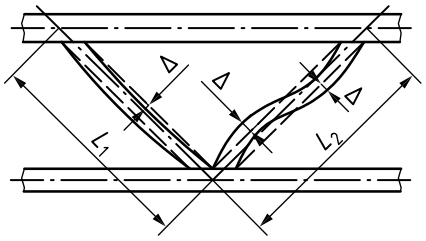
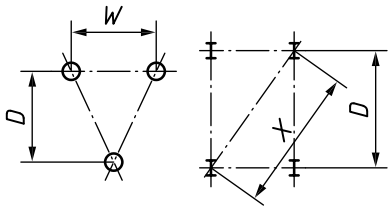
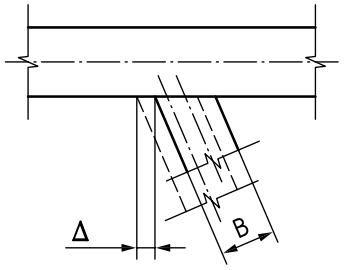
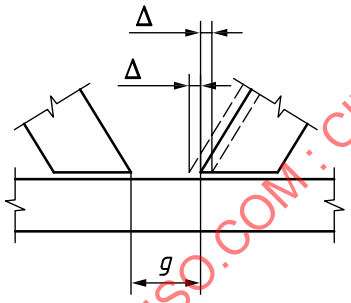
Table C.2 *(continued)*

		Deviation of bracing lengths L_i (L_1 or L_2) from straightness	$\Delta = \pm L_i/750$ but $\lvert\Delta\rvert \geq 4$ mm	$\Delta = \pm L_i/500$ but $\lvert\Delta\rvert \geq 6$ mm	$\Delta = \pm L_i/1\,000$ but $\lvert\Delta\rvert \geq 3$ mm
9.4	Cross-section dimensions 	Deviation of distances D, W, and X if: $s \leq 300$ mm $300 < s < 1\,000$ mm $s \geq 1\,000$ mm where $s = D$, W, or X as appropriate	No requirement	$\Delta = \pm 3$ mm $\Delta = \pm 5$ mm $\Delta = \pm 10$ mm	$\Delta = \pm 2$ mm $\Delta = \pm 4$ mm $\Delta = \pm 6$ mm
9.5	Intersecting joints 	Eccentricity (relative to specified eccentricity)	No requirement	$\Delta = \pm(B/20 + 5)$ mm	$\Delta = \pm(B/40 + 3)$ mm
9.6	Gap joints 	Gap g between bracing components: $g \geq (t_1 + t_2)$ where t_1 and t_2 are the wall thicknesses of braces	No requirement	$\Delta = \pm 5$ mm	$\Delta = \pm 3$ mm
NOTE: Notations such as $\Delta = \pm L/500$ but $\lvert\Delta\rvert \geq 12$ mm mean that $\lvert\Delta\rvert$ is the larger of $L/500$ and 12 mm. Notation such as $\lvert\Delta\rvert \geq t_1 + t_2$ but $\lvert\Delta\rvert \leq 5$ mm means that the smaller of the two values is required.					

C.4 Tolerances for Canada

The reference standard for Table C.3 is CSA W59 and CSA S16.

Fabrication tolerances are tolerances allowed from the nominal dimensions and geometry, such as cutting to length, finishing of ends, cutting of bevel angles, and out-of-straightness such as camber and sweep for fabricated members.

Table C.3 — Canada

1.	**Welded profiles**		
No	**Criterion**	**Parameter**	**Tolerance**
1.1	Depth	Deviation (Δ) from nominal depth (h)	

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Table C.3 *(continued)*

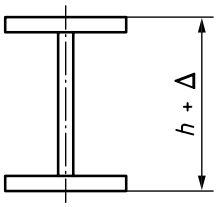
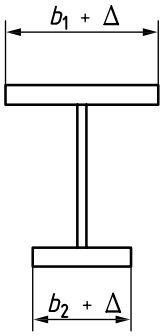
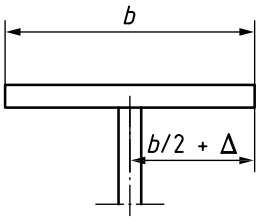
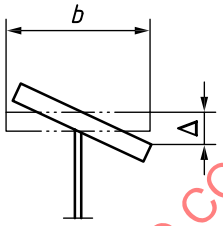
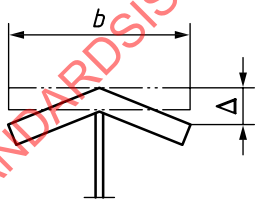
		$h \leq 900$ mm $900 < h \leq 2\,000$ mm	Δ = +5 mm (over) Δ = -3 mm (under) Δ = +5 mm (over) Δ = -5 mm (under)
1.2	Flange width 	Deviation (Δ) from nominal width (b): $h \leq 900$ mm $900 < h \leq 2\,000$ mm	 Δ = + 6 mm (over) Δ = - 5 mm (under) Δ = + 6 mm (over) Δ = - 5 mm (under)
1.3	Web eccentricity 	Lateral deviation between centre-line of web and centreline of flange	Δ = ±6 mm max.
1.4	Squareness of flanges 	—	Δ ≤ b/100, or 6 mm, whichever is greater
1.5	Flatness of flanges 	—	Δ ≤ b/100, or 6 mm, whichever is greater
1.6	Squareness of bearings	—	No requirement
1.7	Plate curvature	Statically loaded nontubular structures	

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Table C.3 *(continued)*

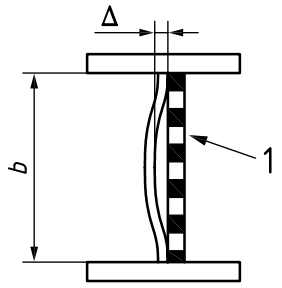
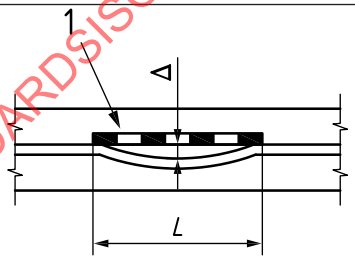
		Intermediate stiffeners on both sides of web:	
		$b/t < 150$	$\Delta \leq b/100$
		$b/t \geq 150$	$\Delta \leq b/80$
		Intermediate stiffeners on one side only of web:	
		$b/t < 100$	$\Delta \leq b/100$
		$b/t \geq 100$	$\Delta \leq b/67$
		No intermediate stiffeners:	
		$b/t \geq 100$	$\Delta \leq b/150$
	1 gauge length	Cyclically loaded nontubular structures	
		Intermediate stiffeners on both sides of web:	
		Interior girders:	
		$b/t < 150$	$\Delta \leq b/115$
		$b/t \geq 150$	$\Delta \leq b/92$
		Fascia girders:	
		$b/t < 150$	$\Delta \leq b/130$
		$b/t \geq 150$	$\Delta \leq b/105$
		Intermediate stiffeners on one side only of web:	
		Interior girders:	
		$b/t < 100$	$\Delta \leq b/100$
		$b/t \geq 100$	$\Delta \leq b/67$
		Fascia girders	
		$b/t < 100$	$\Delta \leq b/120$
		$b/t \geq 100$	$\Delta \leq b/80$
		No intermediate stiffeners	$\Delta \leq b/150$
1.8	Web distortion	Static loading	
		Intermediate stiffeners on both sides of web t = web thickness, mm D = depth of web, mm d = least panel dimension, mm	

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Table C.3 *(continued)*

	1 gauge length	$t = 8$, $D < 1\,200$, $d = 600$ $D \geq 1\,200$, $d = 480$ $t = 9$, $D < 1\,350$, $d = 600$ $D \geq 1\,350$, $d = 480$ $t = 10$, $D < 1\,500$, $d = 600$ $D \geq 1\,500$, $d = 480$ $t = 12$, $D < 1\,800$, $d = 600$ $D \geq 1\,800$, $d = 480$ $t = 14$, $D < 2\,100$, $d = 600$ $D \geq 2\,100$, $d = 480$ $t = 16$, $D < 2\,400$, $d = 600$ $D \geq 2\,400$, $d = 480$	$\Delta \leq 6$ mm
		$t = 8$, $D < 1\,200$, $d = 800$ $D \geq 1\,200$, $d = 640$ $t = 9$, $D < 1\,350$, $d = 800$ $D \geq 1\,350$, $d = 640$ $t = 10$, $D < 1\,500$, $d = 800$ $D \geq 1\,500$, $d = 640$ $t = 12$, $D < 1\,800$, $d = 800$ $D \geq 1\,800$, $d = 640$ $t = 14$, $D < 2\,100$, $d = 800$ $D \geq 2\,100$, $d = 640$ $t = 16$, $D < 2\,400$, $d = 800$ $D \geq 2\,400$, $d = 640$	$\Delta \leq 8$ mm
		$t = 8$, $D < 1\,200$, $d = 1\,000$ $D \geq 1\,200$, $d = 800$ $t = 9$, $D < 1\,350$, $d = 1\,000$ $D \geq 1\,350$, $d = 800$ $t = 10$, $D < 1\,500$, $d = 1\,000$ $D \geq 1\,500$, $d = 800$ $t = 12$, $D < 1\,800$, $d = 1\,000$ $D \geq 1\,800$, $d = 800$ $t = 14$, $D < 2\,100$, $d = 1\,000$ $D \geq 2\,100$, $d = 800$ $t = 16$, $D < 2\,400$, $d = 1\,000$ $D \geq 2\,400$, $d = 800$	$\Delta \leq 10$ mm
		$t = 8$, $D < 1\,200$, $d = 1\,200$ $D \geq 1\,200$, $d = 960$ $t = 9$, $D < 1\,350$, $d = 1\,200$ $D \geq 1\,350$, $d = 960$ $t = 10$, $D < 1\,500$, $d = 1\,200$ $D \geq 1\,500$, $d = 960$ $t = 12$, $D < 1\,800$, $d = 1\,200$ $D \geq 1\,800$, $d = 960$ $t = 14$, $D < 2\,100$, $d = 1\,200$ $D \geq 2\,100$, $d = 960$ $t = 16$, $D < 2\,400$, $d = 1\,200$ $D \geq 2\,400$, $d = 960$	$\Delta \leq 12$ mm

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Table C.3 *(continued)*

			t = 8, D < 1 200, d = 1 120 t = 9, D < 1 350, d = 1 120 t = 10, D < 1 500, d = 1 400 D ≥ 1 500, d = 1 120 t = 12, D < 1 800, d = 1 400 D ≥ 1 800, d = 1 120 t = 14, D < 2 100, d = 1 400 D ≥ 2 100, d = 1 120 t = 16, D < 2 400, d = 1 400 D ≥ 2 400, d = 1 120	Δ ≤ 14 mm
			t = 8, D < 1 200, d = 1 280 t = 9, D < 1 350, d = 1 280 t = 10, D < 1 500, d = 1 280 t = 12, D < 1 800, d = 1 600 D ≥ 1 800, d = 1 280 t = 14, D < 2 100, d = 1 600 D ≥ 2 100, d = 1 280 t = 16, D < 2 400, d = 1 600 D ≥ 2 400, d = 1 280	Δ ≤ 16 mm
			t = 8, D < 1 200, d = 1 440 t = 9, D < 1 350, d = 1 440 t = 10, D < 1 500, d = 1 440 t = 12, D < 1 800, d = 1 800 D ≥ 1 800, d = 1 440 t = 14, D < 2 100, d = 1 800 D ≥ 2 100, d = 1 440 t = 16, D < 2 400, d = 1 800 D ≥ 2 400, d = 1 440	Δ ≤ 18 mm
			t = 8, D < 1 200, d = 1 600 t = 9, D < 1 350, d = 1 600 t = 10, D < 1 500, d = 1 600 t = 12, D < 1 800, d = 1 600 t = 14, D < 2 100, d = 2 000 D ≥ 2 100, d = 1 600 t = 16, D < 2 400, d = 2 000 D ≥ 2 400, d = 1 600	Δ ≤ 20 mm
			t = 8, D < 1 200, d = 1 760 t = 9, D < 1 350, d = 1 760 t = 10, D < 1 500, d = 1 760 t = 12, D < 1 800, d = 1 760 t = 14, D < 2 100, d = 1 760 t = 16, D < 2 400, d = 2 200 D ≥ 2 400, d = 1 760	Δ ≤ 22 mm

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Table C.3 *(continued)*

t = 8, D < 1 200, d = 1 920 t = 9, D < 1 350, d = 1 920 t = 10, D < 1 500, d = 1 920 t = 12, D < 1 800, d = 1 760 t = 14, D < 2 100, d = 1 920 t = 16, D < 2 400, d = 2 400 D ≥ 2 400, d = 1 920	Δ ≤ 24 mm
t = 8, D < 1 200, d = 2 080 t = 9, D < 1 350, d = 2 080 t = 10, D < 1 500, d = 2 080 t = 12, D < 1 800, d = 2 080 t = 14, D < 2 100, d = 2 080 t = 16, D < 2 400, d = 2 080	Δ ≤ 26 mm
Static loading Intermediate stiffeners on one side of web t = web thickness, mm D = depth of web, mm d = least panel dimension, mm	
t = 8, D < 800, d = 600 D ≥ 800, d = 402 t = 9, D < 900, d = 600 D ≥ 900, d = 402 t = 10, D < 1 000, d = 600 D ≥ 1 000, d = 402 t = 12, D < 1 200, d = 600 D ≥ 1 200, d = 402 t = 14, D < 1 400, d = 600 D ≥ 1 400, d = 402 t = 16, D < 1 600, d = 600 D ≥ 1 600, d = 402	Δ ≤ 6 mm
t = 8, D < 800, d = 800 D ≥ 800, d = 536 t = 9, D < 900, d = 800 D ≥ 900, d = 536 t = 10, D < 1 000, d = 800 D ≥ 1 000, d = 536 t = 12, D < 1 200, d = 800 D ≥ 1 200, d = 536 t = 14, D < 1 400, d = 800 D ≥ 1 400, d = 536 t = 16, D < 1 600, d = 800 D ≥ 1 600, d = 536	Δ ≤ 8 mm

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Table C.3 *(continued)*

			$t = 8, D < 800, d = 670$ $t = 9, D < 900, d = 670$ $t = 10, D < 1\,000, d = 1\,000$ $D \geq 1\,000, d = 670$ $t = 12, D < 1\,200, d = 1\,000$ $D \geq 1\,200, d = 670$ $t = 14, D < 1\,400, d = 1\,000$ $D \geq 1\,400, d = 670$ $t = 16, D < 1\,600, d = 1\,000$ $D \geq 1\,600, d = 670$	$\Delta \leq 10$ mm
			$t = 8, D < 800, d = 804$ $t = 9, D < 900, d = 804$ $t = 10, D < 1\,000, d = 804$ $t = 12, D < 1\,200, d = 1\,200$ $D \geq 1\,200, d = 804$ $t = 14, D < 1\,400, d = 1\,200$ $D \geq 1\,400, d = 804$ $t = 16, D < 1\,600, d = 1\,200$ $D \geq 1\,600, d = 804$	$\Delta \leq 12$ mm
			$t = 8, D < 800, d = 938$ $t = 9, D < 900, d = 938$ $t = 10, D < 1\,000, d = 938$ $t = 12, D < 1\,200, d = 938$ $t = 14, D < 1\,400, d = 1\,400$ $D \geq 1\,400, d = 938$ $t = 16, D < 1\,600, d = 1\,400$ $D \geq 1\,600, d = 938$	$\Delta \leq 14$ mm
			$t = 8, D < 800, d = 1\,070$ $t = 9, D < 900, d = 1\,070$ $t = 10, D < 1\,000, d = 1\,070$ $t = 12, D < 1\,200, d = 1\,070$ $t = 14, D < 1\,400, d = 1\,070$ $t = 16, D < 1\,600, d = 1\,600$ $D \geq 1\,600, d = 1\,070$	$\Delta \leq 16$ mm
			$t = 8, D < 800, d = 1\,210$ $t = 9, D < 900, d = 1\,210$ $t = 10, D < 1\,000, d = 1\,210$ $t = 12, D < 1\,200, d = 1\,210$ $t = 14, D < 1\,400, d = 1\,210$ $t = 16, D < 1\,600, d = 1\,210$	$\Delta \leq 18$ mm

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Table C.3 *(continued)*

			t = 8, D < 800, d = 1 340 t = 9, D < 900, d = 1 340 t = 10, D < 1 000, d = 1 340 t = 12, D < 1 200, d = 1 340 t = 14, D < 1 400, d = 1 340 t = 16, D < 1 600, d = 1 340	Δ ≤ 20 mm
			t = 8, D < 800, d = 1 470 t = 9, D < 900, d = 1 470 t = 10, D < 1 000, d = 1 470 t = 12, D < 1 200, d = 1 470 t = 14, D < 1 400, d = 1 470 t = 16, D < 1 600, d = 1 470	Δ ≤ 22 mm
			t = 8, D < 800, d = 1 610 t = 9, D < 900, d = 1 610 t = 10, D < 1 000, d = 1 610 t = 12, D < 1 200, d = 1 610 t = 14, D < 1 400, d = 1 610 t = 16, D < 1 600, d = 1 610	Δ ≤ 24 mm
			t = 8, D < 800, d = 1 740 t = 9, D < 900, d = 1 740 t = 10, D < 1 000, d = 1 740 t = 12, D < 1 200, d = 1 740 t = 14, D < 1 400, d = 1 740 t = 16, D < 1 600, d = 1 740	Δ ≤ 26 mm
			Cyclic loading Intermediate stiffeners on both sides of web Interior girders t = web thickness, mm D = depth of web, mm d = least panel dimension, mm	
			t = 8, D < 1 200, d = 690 D ≥ 1 200, d = 552 t = 9, D < 1 350, d = 690 D ≥ 1 350, d = 552 t = 10, D < 1 500, d = 690 D ≥ 1 500, d = 552 t = 12, D < 1 800, d = 690 D ≥ 1 800, d = 552 t = 14, D < 2 100, d = 690 D ≥ 2 100, d = 552 t = 16, D < 2 400, d = 690 D ≥ 2 400, d = 552	Δ ≤ 6 mm

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Table C.3 *(continued)*

			t = 8, D < 1 200, d = 920 D ≥ 1 200, d = 736 t = 9, D < 1 350, d = 920 D ≥ 1 350, d = 736 t = 10, D < 1 500, d = 920 D ≥ 1 500, d = 736 t = 12, D < 1 800, d = 920 D ≥ 1 800, d = 736 t = 14, D < 2 100, d = 920 D ≥ 2 100, d = 736 t = 16, D < 2 400, d = 920 D ≥ 2 400, d = 736	Δ ≤ 8 mm
			t = 8, D < 1 200, d = 1 150 D ≥ 1 200, d = 920 t = 9, D < 1 350, d = 1 150 D ≥ 1 350, d = 920 t = 10, D < 1 500, d = 1 150 D ≥ 1 500, d = 920 t = 12, D < 1 800, d = 1 150 D ≥ 1 800, d = 920 t = 14, D < 2 100, d = 1 150 D ≥ 2 100, d = 920 t = 16, D < 2 400, d = 1 150 D ≥ 2 400, d = 920	Δ ≤ 10 mm
			t = 8, D < 1 200, d = 1 100 t = 9, D < 1 350, d = 1 100 t = 10, D < 1 500, d = 1 380 D ≥ 1 500, d = 1 100 t = 12, D < 1 800, d = 1 380 D ≥ 1 800, d = 1 100 t = 14, D < 2 100, d = 1 380 D ≥ 2 100, d = 1 100 t = 16, D < 2 400, d = 1 380 D ≥ 2 400, d = 1 100	Δ ≤ 12 mm
			t = 8, D < 1 200, d = 1 290 t = 9, D < 1 350, d = 1 290 t = 10, D < 1 500, d = 1 290 t = 12, D < 1 800, d = 1 610 D ≥ 1 800, d = 1 290 t = 14, D < 2 100, d = 1 610 D ≥ 2 100, d = 1 290 t = 16, D < 2 400, d = 1 610 D ≥ 2 400, d = 1 290	Δ ≤ 14 mm

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Table C.3 *(continued)*

			$t = 8$, $D < 1\,200$, $d = 1\,470$ $t = 9$, $D < 1\,350$, $d = 1\,470$ $t = 10$, $D < 1\,500$, $d = 1\,470$ $t = 12$, $D < 1\,800$, $d = 1\,470$ $t = 14$, $D < 2\,100$, $d = 1\,840$ $D \geq 2\,100$, $d = 1\,470$ $t = 16$, $D < 2\,400$, $d = 1\,840$ $D \geq 2\,400$, $d = 1\,470$	$\Delta \leq 16$ mm
			$t = 8$, $D < 1\,200$, $d = 1\,660$ $t = 9$, $D < 1\,350$, $d = 1\,660$ $t = 10$, $D < 1\,500$, $d = 1\,660$ $t = 12$, $D < 1\,800$, $d = 1\,660$ $t = 14$, $D < 2\,100$, $d = 2\,070$ $D \geq 2\,100$, $d = 1\,660$ $t = 16$, $D < 2\,400$, $d = 2\,070$ $D \geq 2\,400$, $d = 1\,660$	$\Delta \leq 18$ mm
			$t = 8$, $D < 1\,200$, $d = 1\,840$ $t = 9$, $D < 1\,350$, $d = 1\,840$ $t = 10$, $D < 1\,500$, $d = 1\,840$ $t = 12$, $D < 1\,800$, $d = 1\,840$ $t = 14$, $D < 2\,100$, $d = 1\,840$ $t = 16$, $D < 2\,400$, $d = 2\,300$ $D \geq 2\,400$, $d = 1\,840$	$\Delta \leq 20$ mm
			$t = 8$, $D < 1\,200$, $d = 2\,020$ $t = 9$, $D < 1\,350$, $d = 2\,020$ $t = 10$, $D < 1\,500$, $d = 2\,020$ $t = 12$, $D < 1\,800$, $d = 2\,020$ $t = 14$, $D < 2\,100$, $d = 2\,020$ $t = 16$, $D < 2\,400$, $d = 2\,020$	$\Delta \leq 22$ mm
			$t = 8$, $D < 1\,200$, $d = 2\,210$ $t = 9$, $D < 1\,350$, $d = 2\,210$ $t = 10$, $D < 1\,500$, $d = 2\,210$ $t = 12$, $D < 1\,800$, $d = 2\,210$ $t = 14$, $D < 2\,100$, $d = 2\,210$ $t = 16$, $D < 2\,400$, $d = 2\,210$	$\Delta \leq 24$ mm
			$t = 8$, $D < 1\,200$, $d = 2\,390$ $t = 9$, $D < 1\,350$, $d = 2\,390$ $t = 10$, $D < 1\,500$, $d = 2\,390$ $t = 12$, $D < 1\,800$, $d = 2\,390$ $t = 14$, $D < 2\,100$, $d = 2\,390$ $t = 16$, $D < 2\,400$, $d = 2\,390$	$\Delta \leq 26$ mm

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Table C.3 *(continued)*

		Cyclic loading intermediate stiffeners on both sides of web Fascia girders t = web thickness, mm D = depth of web, mm d = least panel dimension, mm	
		t = 8, D < 1 200, d = 780 D ≥ 1 200, d = 630 t = 9, D < 1 350, d = 780 D ≥ 1 350, d = 630 t = 10, D < 1 500, d = 780 D ≥ 1 500, d = 630 t = 12, D < 1 800, d = 780 D ≥ 1 800, d = 630 t = 14, D < 2 100, d = 780 D ≥ 2 100, d = 630 t = 16, D < 2 400, d = 780 D ≥ 2 400, d = 630	Δ ≤ 6 mm
		t = 8, D < 1 200, d = 1 040 D ≥ 1 200, d = 840 t = 9, D < 1 350, d = 1 040 D ≥ 1 350, d = 840 t = 10, D < 1 500, d = 1 040 D ≥ 1 500, d = 840 t = 12, D < 1 800, d = 1 040 D ≥ 1 800, d = 840 t = 14, D < 2 100, d = 1 040 D ≥ 2 100, d = 840 t = 16, D < 2 400, d = 1 040 D ≥ 2 400, d = 840	Δ ≤ 8 mm
		t = 8, D < 1 200, d = 1 050 t = 9, D < 1 350, d = 1 300 D ≥ 1 350, d = 1 050 t = 10, D < 1 500, d = 1 300 D ≥ 1 500, d = 1 050 t = 12, D < 1 800, d = 1 300 D ≥ 1 800, d = 1 050 t = 14, D < 2 100, d = 1 300 D ≥ 2 100, d = 1 050 t = 16, D < 2 400, d = 1 300 D ≥ 2 400, d = 1 050	Δ ≤ 10 mm

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Table C.3 *(continued)*

			$t = 8$, $D < 1\,200$, $d = 1\,260$ $t = 9$, $D < 1\,350$, $d = 1\,260$ $t = 10$, $D < 1\,500$, $d = 1\,260$ $t = 12$, $D < 1\,800$, $d = 1\,560$ $D \geq 1\,800$, $d = 1\,260$ $t = 14$, $D < 2\,100$, $d = 1\,560$ $D \geq 2\,100$, $d = 1\,260$ $t = 16$, $D < 2\,400$, $d = 1\,560$ $D \geq 2\,400$, $d = 1\,260$	$\Delta \leq 12$ mm
			$t = 8$, $D < 1\,200$, $d = 1\,470$ $t = 9$, $D < 1\,350$, $d = 1\,470$ $t = 10$, $D < 1\,500$, $d = 1\,470$ $t = 12$, $D < 1\,800$, $d = 1\,470$ $t = 14$, $D < 2\,100$, $d = 1\,820$ $D \geq 2\,100$, $d = 1\,470$ $t = 16$, $D < 2\,400$, $d = 1\,820$ $D \geq 2\,400$, $d = 1\,470$	$\Delta \leq 14$ mm
			$t = 8$, $D < 1\,200$, $d = 1\,680$ $t = 9$, $D < 1\,350$, $d = 1\,680$ $t = 10$, $D < 1\,500$, $d = 1\,680$ $t = 12$, $D < 1\,800$, $d = 1\,680$ $t = 14$, $D < 2\,100$, $d = 2\,080$ $D \geq 2\,100$, $d = 1\,680$ $t = 16$, $D < 2\,400$, $d = 2\,080$ $D \geq 2\,400$, $d = 1\,680$	$\Delta \leq 16$ mm
			$t = 8$, $D < 1\,200$, $d = 1\,890$ $t = 9$, $D < 1\,350$, $d = 1\,890$ $t = 10$, $D < 1\,500$, $d = 1\,890$ $t = 12$, $D < 1\,800$, $d = 1\,890$ $t = 14$, $D < 2\,100$, $d = 1\,890$ $t = 16$, $D < 2\,400$, $d = 2\,340$ $D \geq 2\,400$, $d = 1\,890$	$\Delta \leq 18$ mm
			$t = 8$, $D < 1\,200$, $d = 2\,100$ $t = 9$, $D < 1\,350$, $d = 2\,100$ $t = 10$, $D < 1\,500$, $d = 2\,100$ $t = 12$, $D < 1\,800$, $d = 2\,100$ $t = 14$, $D < 2\,100$, $d = 2\,100$ $t = 16$, $D < 2\,400$, $d = 2\,100$	$\Delta \leq 20$ mm
			$t = 8$, $D < 1\,200$, $d = 2\,310$ $t = 9$, $D < 1\,350$, $d = 2\,310$ $t = 10$, $D < 1\,500$, $d = 2\,310$ $t = 12$, $D < 1\,800$, $d = 2\,310$ $t = 14$, $D < 2\,100$, $d = 2\,310$ $t = 16$, $D < 2\,400$, $d = 2\,310$	$\Delta \leq 22$ mm

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Table C.3 *(continued)*

		t = 8, D < 1 200, d = 2 520 t = 9, D < 1 350, d = 2 520 t = 10, D < 1 500, d = 2 520 t = 12, D < 1 800, d = 2 520 t = 14, D < 2 100, d = 2 520 t = 16, D < 2 400, d = 2 520	Δ ≤ 24 mm
		t = 8, D < 1 200, d = 2 730 t = 9, D < 1 350, d = 2 730 t = 10, D < 1 500, d = 2 730 t = 12, D < 1 800, d = 2 730 t = 14, D < 2 100, d = 2 730 t = 16, D < 2 400, d = 2 730	Δ ≤ 26 mm
		Cyclic loading Intermediate stiffeners on one side of web Interior girders t = web thickness, mm D = depth of web, mm d = least panel dimension, mm		
		t = 8, D < 800, d = 600 D ≥ 800, d = 402 t = 9, D < 900, d = 600 D ≥ 900, d = 402 t = 10, D < 1 000, d = 600 D ≥ 1 000, d = 402 t = 12, D < 1 200, d = 600 D ≥ 1 200, d = 402 t = 14, D < 1 400, d = 600 D ≥ 1 400, d = 402 t = 16, D < 1 600, d = 600 D ≥ 1 600, d = 402	Δ ≤ 6 mm
		t = 8, D < 800, d = 800 D ≥ 800, d = 536 t = 9, D < 900, d = 800 D ≥ 900, d = 536 t = 10, D < 1 000, d = 800 D ≥ 1 000, d = 536 t = 12, D < 1 200, d = 800 D ≥ 1 200, d = 536 t = 14, D < 1 400, d = 800 D ≥ 1 400, d = 536 t = 16, D < 1 600, d = 800 D ≥ 1 600, d = 536	Δ ≤ 8 mm

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Table C.3 *(continued)*

			$t = 8, D < 800, d = 670$ $t = 9, D < 900, d = 670$ $t = 10, D < 1\,000, d = 1\,000$ $D \geq 1\,000, d = 670$ $t = 12, D < 1\,200, d = 1\,000$ $D \geq 1\,200, d = 670$ $t = 14, D < 1\,400, d = 1\,000$ $D \geq 1\,400, d = 670$ $t = 16, D < 1\,600, d = 1\,000$ $D \geq 1\,600, d = 670$	$\Delta \leq 10$ mm
			$t = 8, D < 800, d = 804$ $t = 9, D < 900, d = 804$ $t = 10, D < 1\,000, d = 804$ $t = 12, D < 1\,200, d = 1\,200$ $D \geq 1\,200, d = 804$ $t = 14, D < 1\,400, d = 1\,200$ $D \geq 1\,400, d = 804$ $t = 16, D < 1\,600, d = 1\,200$ $D \geq 1\,600, d = 804$	$\Delta \leq 12$ mm
			$t = 8, D < 800, d = 938$ $t = 9, D < 900, d = 938$ $t = 10, D < 1\,000, d = 938$ $t = 12, D < 1\,200, d = 938$ $t = 14, D < 1\,400, d = 1\,400$ $D \geq 1\,400, d = 938$ $t = 16, D < 1\,600, d = 1\,400$ $D \geq 1\,600, d = 938$	$\Delta \leq 14$ mm
			$t = 8, D < 800, d = 1\,070$ $t = 9, D < 900, d = 1\,070$ $t = 10, D < 1\,000, d = 1\,070$ $t = 12, D < 1\,200, d = 1\,070$ $t = 14, D < 1\,400, d = 1\,070$ $t = 16, D < 1\,600, d = 1\,600$ $D \geq 1\,600, d = 1\,070$	$\Delta \leq 16$ mm
			$t = 8, D < 800, d = 1\,210$ $t = 9, D < 900, d = 1\,210$ $t = 10, D < 1\,000, d = 1\,210$ $t = 12, D < 1\,200, d = 1\,210$ $t = 14, D < 1\,400, d = 1\,210$ $t = 16, D < 1\,600, d = 1\,210$	$\Delta \leq 18$ mm

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Table C.3 *(continued)*

		t = 8, D < 800, d = 1 340 t = 9, D < 900, d = 1 340 t = 10, D < 1 000, d = 1 340 t = 12, D < 1 200, d = 1 340 t = 14, D < 1 400, d = 1 340 t = 16, D < 1 600, d = 1 340	Δ ≤ 20 mm
		t = 8, D < 800, d = 1 470 t = 9, D < 900, d = 1 470 t = 10, D < 1 000, d = 1 470 t = 12, D < 1 200, d = 1 470 t = 14, D < 1 400, d = 1 470 t = 16, D < 1 600, d = 1 470	Δ ≤ 22 mm
		t = 8, D < 800, d = 1 610 t = 9, D < 900, d = 1 610 t = 10, D < 1 000, d = 1 610 t = 12, D < 1 200, d = 1 610 t = 14, D < 1 400, d = 1 610 t = 16, D < 1 600, d = 1 610	Δ ≤ 24 mm
		t = 8, D < 800, d = 1 740 t = 9, D < 900, d = 1 740 t = 10, D < 1 000, d = 1 740 t = 12, D < 1 200, d = 1 740 t = 14, D < 1 400, d = 1 740 t = 16, D < 1 600, d = 1 740	Δ ≤ 26 mm
		Cyclic loading Intermediate stiffeners on one side of web Fascia girders t = web thickness, mm D = depth of web, mm d = least panel dimension, mm	
		t = 8, D < 800, d = 720 D ≥ 800, d = 480 t = 9, D < 900, d = 720 D ≥ 900, d = 480 t = 10, D < 1 000, d = 720 D ≥ 1 000, d = 480 t = 12, D < 1 200, d = 720 D ≥ 1 200, d = 480 t = 14, D < 1 400, d = 720 D ≥ 1 400, d = 480 t = 16, D < 1 600, d = 720 D ≥ 1 600, d = 480	Δ ≤ 6 mm

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Table C.3 *(continued)*

			$t = 8$, $D < 800$, $d = 640$ $t = 9$, $D < 900$, $d = 640$ $t = 10$, $D < 1\,000$, $d = 960$ $D \geq 1\,000$, $d = 640$ $t = 12$, $D < 1\,200$, $d = 960$ $D \geq 1\,200$, $d = 640$ $t = 14$, $D < 1\,400$, $d = 960$ $D \geq 1\,400$, $d = 640$ $t = 16$, $D < 1\,600$, $d = 960$ $D \geq 1\,600$, $d = 640$	$\Delta \leq 8$ mm
			$t = 8$, $D < 800$, $d = 800$ $t = 9$, $D < 900$, $d = 800$ $t = 10$, $D < 1\,000$, $d = 800$ $t = 12$, $D < 1\,200$, $d = 1\,200$ $D \geq 1\,200$, $d = 800$ $t = 14$, $D < 1\,400$, $d = 1\,200$ $D \geq 1\,400$, $d = 800$ $t = 16$, $D < 1\,600$, $d = 1\,200$ $D \geq 1\,600$, $d = 800$	$\Delta \leq 10$ mm
			$t = 8$, $D < 800$, $d = 960$ $t = 9$, $D < 900$, $d = 960$ $t = 10$, $D < 1\,000$, $d = 960$ $t = 12$, $D < 1\,200$, $d = 960$ $t = 14$, $D < 1\,400$, $d = 960$ $t = 16$, $D < 1\,600$, $d = 1\,440$ $D \geq 1\,600$, $d = 960$	$\Delta \leq 12$ mm
			$t = 8$, $D < 800$, $d = 1\,120$ $t = 9$, $D < 900$, $d = 1\,120$ $t = 10$, $D < 1\,000$, $d = 1\,120$ $t = 12$, $D < 1\,200$, $d = 1\,120$ $t = 14$, $D < 1\,400$, $d = 1\,120$ $t = 16$, $D < 1\,600$, $d = 1\,120$	$\Delta \leq 14$ mm
			$t = 8$, $D < 800$, $d = 1\,280$ $t = 9$, $D < 900$, $d = 1\,280$ $t = 10$, $D < 1\,000$, $d = 1\,280$ $t = 12$, $D < 1\,200$, $d = 1\,280$ $t = 14$, $D < 1\,400$, $d = 1\,280$ $t = 16$, $D < 1\,600$, $d = 1\,280$	$\Delta \leq 16$ mm
			$t = 8$, $D < 800$, $d = 1\,440$ $t = 9$, $D < 900$, $d = 1\,440$ $t = 10$, $D < 1\,000$, $d = 1\,440$ $t = 12$, $D < 1\,200$, $d = 1\,440$ $t = 14$, $D < 1\,400$, $d = 1\,440$ $t = 16$, $D < 1\,600$, $d = 1\,440$	$\Delta \leq 18$ mm

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Table C.3 *(continued)*

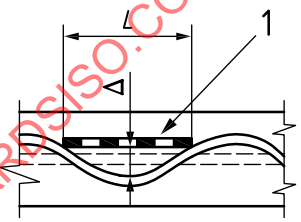
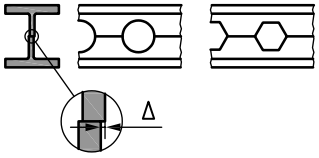
		t = 8, D < 800, d = 1 600 t = 9, D < 900, d = 1 600 t = 10, D < 1 000, d = 1 600 t = 12, D < 1 200, d = 1 600 t = 14, D < 1 400, d = 1 600 t = 16, D < 1 600, d = 1 600	Δ ≤ 20 mm
		t = 8, D < 800, d = 1 760 t = 9, D < 900, d = 1 760 t = 10, D < 1 000, d = 1 760 t = 12, D < 1 200, d = 1 760 t = 14, D < 1 400, d = 1 760 t = 16, D < 1 600, d = 1 760	Δ ≤ 22 mm
		t = 8, D < 800, d = 1 920 t = 9, D < 900, d = 1 920 t = 10, D < 1 000, d = 1 920 t = 12, D < 1 200, d = 1 920 t = 14, D < 1 400, d = 1 920 t = 16, D < 1 600, d = 1 920	Δ ≤ 24 mm
		t = 8, D < 800, d = 2 080 t = 9, D < 900, d = 2 080 t = 10, D < 1 000, d = 2 080 t = 12, D < 1 200, d = 2 080 t = 14, D < 1 400, d = 2 080 t = 16, D < 1 600, d = 2 080	Δ ≤ 26 mm
1.9	Web undulation  1 gauge length	See 1.8 Web distortion (above)	
1.10	Castellated beams and cellular beams (fabricated either from plate or from hot-rolled sections) with openings of inscribed nominal diameter D  		No requirement
2.	**Press-braked profiles**		
No	**Criterion**	**Parameter**	**Tolerance**
2.1	Internal element width		No requirement

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Table C.3 *(continued)*

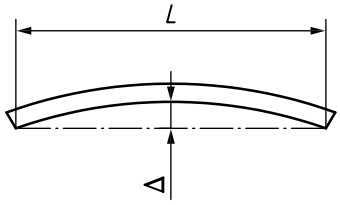
2.2	Outstanding element width		No requirement
2.3	Straightness for component to be used unrestrained		No requirement
2.4	Flatness		No requirement
2.5	Bend radius		No requirement
2.6	Shape		No requirement
3.	**Flanges of welded profiles**		
No	**Criterion**	**Parameter**	**Tolerance**
3.1	Flange distortion of I section		No requirement
3.2	Flange undulation of I section		No requirement
3.3	Straightness for component to be used unrestrained 	Straightness of columns and compression members in trusses: Length ≤ 14 000 mm Length > 14 000 m Beam and girder straightness (No camber specified).	$\Delta \leq (L/1\,000)$, but not over 10, mm $\Delta \leq 10 + (L - 14{,}000)/1\,000$, mm $\Delta \leq L/1\,000$, mm
4.	**Flanges of welded box sections**		
No	**Criterion**	**Parameter**	**Tolerance**
4.1	Section dimension		No requirement
4.2	Twist		No requirement
4.3	Out-of-plane imperfection of plate panel between web or stiffener, general case		No requirement
4.4	Out-of-plane imperfections of plate panel between webs or stiffeners (special case with compression in the transverse direction – the general case applies unless this special case is specified)		No requirement
4.5	Squareness		No requirement
5.	**Web stiffeners and cruciform joints of profiles or box sections**		
No	**Criterion**	**Parameter**	**Tolerance**
5.1	In-plane straightness		No requirement
5.2	Out-of-plane straightness		No requirement
5.3	Location of web stiffeners		No requirement
5.4	Location of web stiffeners at support		No requirement
5.5	Eccentricity of web stiffeners		No requirement
5.6	Eccentricity of web stiffeners at supports		No requirement
6.	**Components**		
No	**Criterion**	**Parameter**	**Tolerance**
6.1	Length	Length of members with both ends finished for contact bearing.	$\Delta = \pm 1$ mm

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Table C.3 *(continued)*

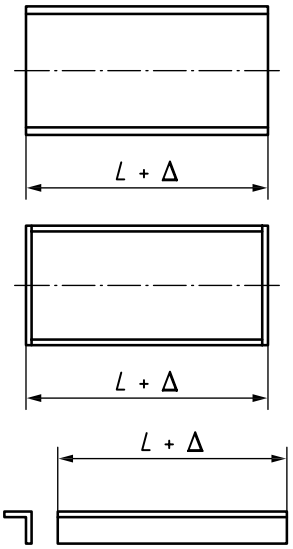
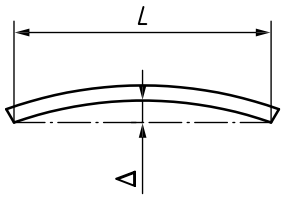
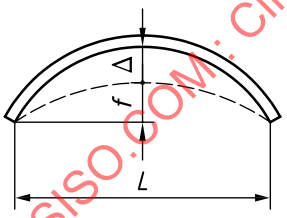
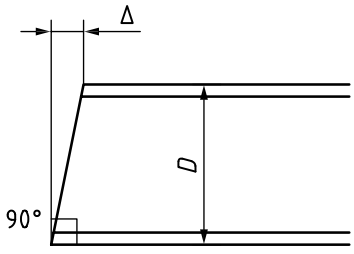
		Members without ends finished for contact bearing that are to be framed to other steel parts of the structure: $L \leq 10\,000$ mm $L > 10\,000$ mm	 $\Delta = \pm 2$ mm $\Delta = \pm 4$ mm
6.2	Length, where sufficient compensation with adjacent component is possible		No requirement
6.3	Straightness 	Welded beams or girders without specified camber or sweep Welded columns and compression members in trusses $L \leq 14\,000$ mm $L > 14\,000$ mm	$\Delta \leq L/1\,000$, mm $\Delta \leq L/1\,000 \leq 10$, mm $\Delta \leq 10+(L-4\,000)/1\,000$, mm
6.4	Camber or intended curvature on plan 	Beams and girders with specified camber Beam and girder camber (top flange is embedded in concrete without a designed concrete haunch) At midspan $L < 30\,000$ mm $L \geq 30\,000$ mm At interior supports At intermediate points, where a = distance in metres from inspection point to nearest support S = span length in metres b = 10 mm for spans < 30 m b = 20 mm for spans ≥ 30 m	$\Delta \leq 6 + L/4\,000$, mm $\Delta = -0, +10$ mm $\Delta = -0, +40$ mm $\Delta = \pm 3$ mm $\Delta = \pm[4(a)b(1-a/S)]/S$, *mm*
6.5	Surfaces finished for full contact bearing		No requirement
6.6	Squareness of ends 		$\Delta = 0{,}016\,D$, mm

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Table C.3 *(continued)*

6.7	Twist		No requirement
7.	**Fastener holes, notches and cut edges**		
No	**Criterion**	**Parameter**	**Tolerance**
7.1	Position of holes for fasteners		No requirement
7.2	Position of holes for fasteners		No requirement
7.3	Position of hole group		No requirement
7.4	Spacing of hole groups		No requirement
7.5	Twist of hole group		No requirement
7.6	Ovalisation of holes		No requirement
7.7	Notches		No requirement
8.	**Column splices and baseplates**		
No	**Criterion**	**Parameter**	**Tolerance**
8.1	Column splice		No requirement
8.2	Baseplate		No requirement
9.	**Lattice components**		
No	**Criterion**	**Parameter**	**Tolerance**
9.1	Straightness and camber		No requirement
9.2	Panel dimensions		No requirement
9.3	Straightness of bracing components		No requirement
9.4	Cross-section dimensions		No requirement
9.5	Intersecting joints		No requirement
9.6	Gap joints		No requirement

C.5 Tolerances for China

The reference standard for Table C.4 is GB 50205.

NOTE GB 50205 is a standard for acceptance of construction quality of steel structures.

Table C.4 — China

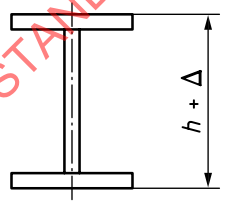
1.	**Welded profiles**		
No	**Criterion**	**Parameter**	**Tolerance**
1.1	Depth 	Overall depth h: $h < 500$ mm $500 \leq h \leq 1\,000$ mm $h > 1\,000$ mm	 $\Delta = \pm 2$ mm $\Delta = \pm 3$ mm $\Delta = \pm 4$ mm
1.2	Flange width		

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Table C.4 *(continued)*

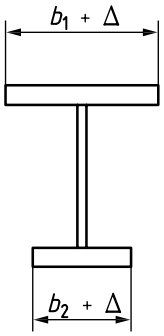
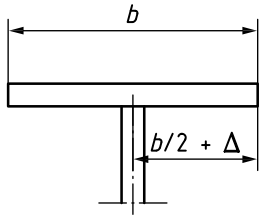
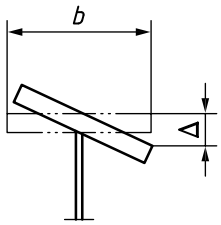
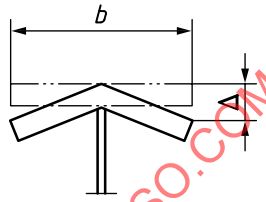
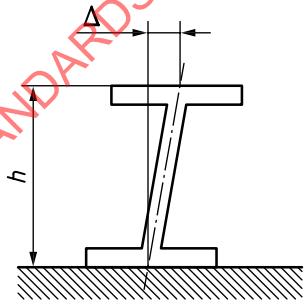
		Width $b = b_1$ or b_2	$\Delta = \pm 3$ mm
1.3	Web eccentricity 	Position of web: General case Flange parts in contact with structural bearings	 $\Delta_{Max} = 2$ mm $\Delta_{Max} = 2$ mm
1.4	Squareness of flanges 	Position of web: General case Flange parts in contact with structural bearings	 $\Delta = b/100$, mm $\Delta_{Max} = 3$ mm $\Delta = b/100$, mm $\Delta_{Max} = 3$ mm
1.5	Flatness of flanges 	Out of flatness: General case Flange parts in contact with structural bearings	 $\Delta = b/100$, mm $\Delta_{Max} = 3$ mm $\Delta = b/100$, mm $\Delta_{Max} = 3$ mm
1.6	Squareness of bearings 	Width b	$\Delta = b/10$, mm $\Delta_{Max} = 3$ mm
1.7	Plate curvature		

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Table C.4 *(continued)*

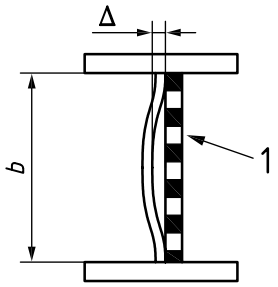
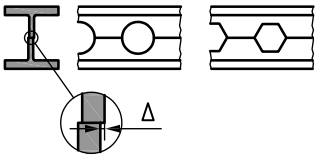
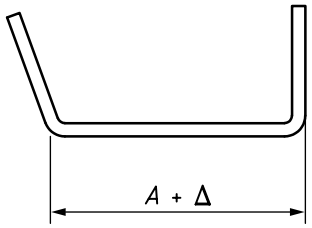
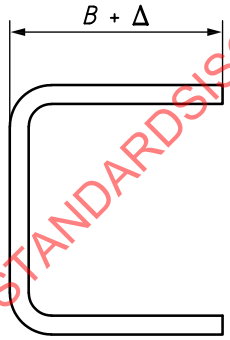
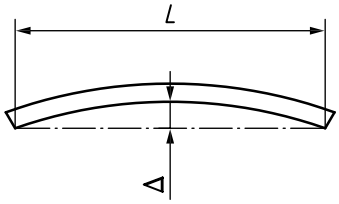
	 1 gauge length	Derivation Δ over plate height *b* thickness of web *t*: $t \leq 6$ mm $6 > t < 14$ mm $t \geq 14$ mm	 $\Delta_{Max} = 4$ mm $\Delta_{Max} = 3$ mm $\Delta_{Max} = 2$ mm
1.8	Web distortion	—	No requirements
1.9	Web undulation	—	No requirements
1.10	Castellated beams and cellular beams (fabricated either from plate or from hot-rolled sections) with openings of inscribed nominal diameter *D* 	Component of thickness *t*	$\Delta = t/10$, mm $\Delta_{Max} = 3$ mm
2.	**Press-braked profiles**		
No	**Criterion**	**Parameter**	**Tolerance**
2.1	Internal element width 		Δ = ±2 mm
2.2	Outstanding element width 		Δ = ±2 mm
2.3	Straightness for component to be used unrestrained 	Each 3 000 mm in scope Δ	$\Delta_{Max} = 6$ mm
2.4	Flatness		

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Table C.4 *(continued)*

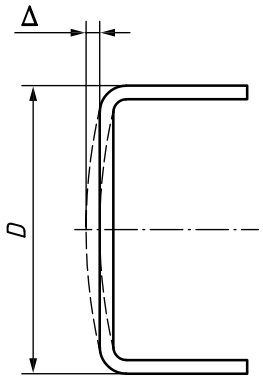
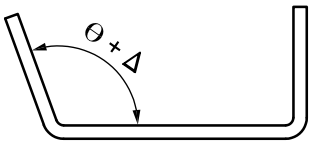
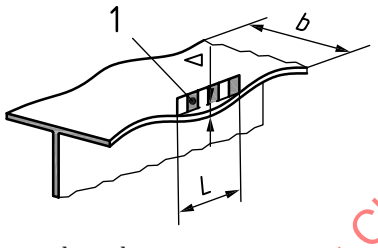
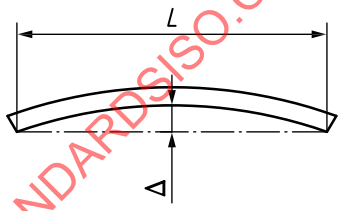
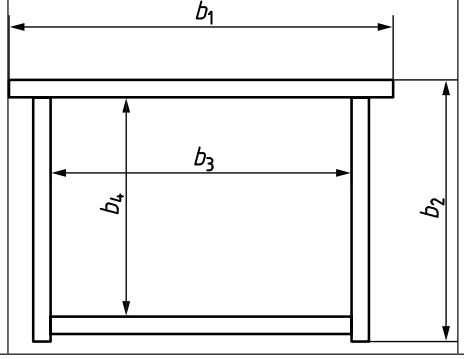
			Δ_{Max} = 1,5 mm
2.5	Bend radius		No requirements
2.6	Shape 		Δ_{Max} = 2,0°
3.	**Flanges of welded profiles**		
No	**Criterion**	**Parameter**	**Tolerance**
3.1	Flange distortion of I section		No requirements
3.2	Flange undulation of I section  1 gauge length		Δ = L/250, mm Δ_{max} = 5 mm
3.3	Straightness for component to be used unrestrained 	Deviation Δ from straightness	Δ = L/1 000, mm Δ_{Max} = 10 mm
4.	**Flanges of welded box sections**		
No	**Criterion**	**Parameter**	**Tolerance**
4.1	Section dimension 	Deviation in internal or external dimension $b = b_1, b_2, b_3$ or b_4	Δ_{Max} = ±2 mm

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Table C.4 *(continued)*

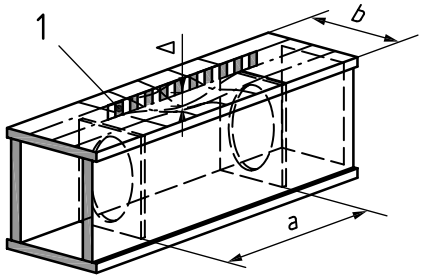
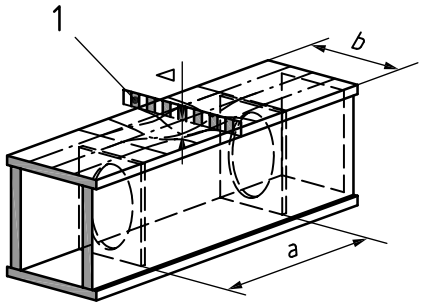
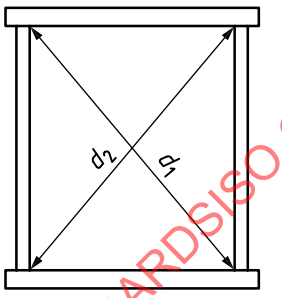
4.2	Twist		No requirements
4.3	Out-of-plane imperfection of plate panel between web or stiffener, general case  1 gauge length	Deviation Δ perpendicular to the plane of the plate	Δ = a/250, mm Δ_{Max} = 8 mm
4.4	Out-of-plane imperfections of plate panel between webs or stiffeners (special case with compression in the transverse direction – the general case applies unless this special case is specified)  1 gauge length	Deviation Δ perpendicular to the plane of the plate	Δ = a/250, mm Δ_{Max} = 8 mm
4.5	Squareness  	Difference Δ between diagonal dimensions at diaphragm positions	Δ_{Max} = 3 mm
5.	**Web stiffeners and cruciform joints of profiles or box sections**		
No	**Criterion**	**Parameter**	**Tolerance**
5.1	In-plane straightness		No requirement
5.2	Out-of-plane straightness		No requirement
5.3	Location of web stiffeners		No requirement
5.4	Location of web stiffeners at support		No requirement
5.5	Eccentricity of web stiffeners		No requirement
5.6	Eccentricity of web stiffeners at supports		No requirement
6.	**Components**		
No	**Criterion**	**Parameter**	**Tolerance**
6.1	Length		

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Table C.4 *(continued)*

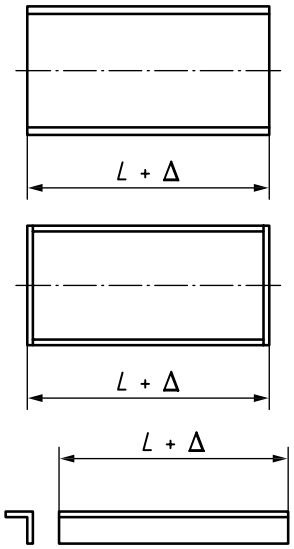
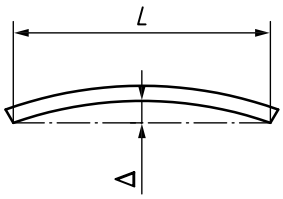
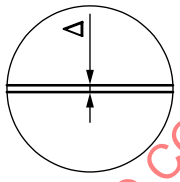
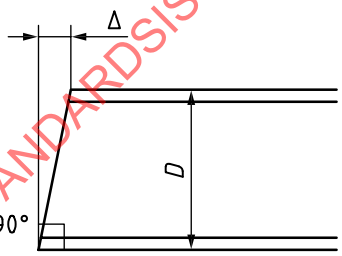
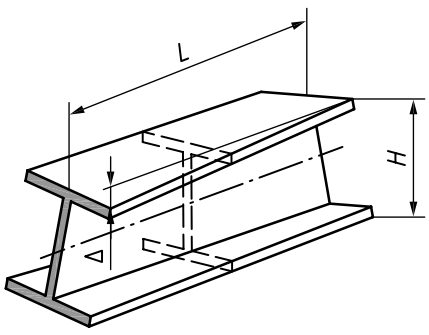
			Δ = ±3 mm
6.2	Length, where sufficient compensation with adjacent component is possible		No requirement
6.3	Straightness 		Δ = L/1 000, mm Δ_{Max} = 10 mm
6.4	Camber or intended curvature on plan		No requirement
6.5	Surfaces finished for full contact bearing 		Δ = 0,3 mm
6.6	Squareness of ends 	Length L	Δ = L/1 500, mm Δ_{Max} = 2 mm
6.7	Twist 	Overall depth H	Δ = H/250, mm Δ_{Max} = 5 mm

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Table C.4 *(continued)*

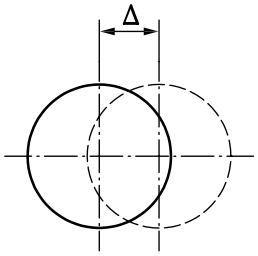
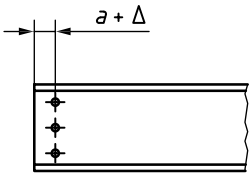
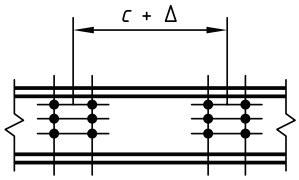
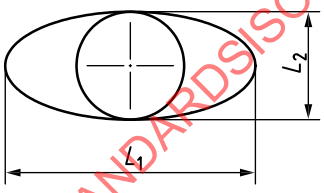
7.	**Fastener holes, notches and cut edges**		
No	**Criterion**	**Parameter**	**Tolerance**
7.1	Position of holes for fasteners 	Deviation Δ of any two holes within a group of holes: ≤ 500 mm 501-1 200 mm 1 201-3 000 mm > 3 000 mm Deviation Δ of end holes of two adjacent groups: ≤ 500 mm 501-1 200 mm 1 201-3 000 mm > 3 000 mm	 Δ = ±1 mm Δ = ±1,5 mm No requirement No requirement Δ = ±1,5 mm Δ = ±2 mm Δ = ±2,5 mm Δ = ±3 mm
7.2	Position of holes for fasteners 		Δ = ±1 mm
7.3	Position of hole group		No requirement
7.4	Spacing of hole groups 		Δ = ±2 mm
7.5	Twist of hole group		No requirement
7.6	Ovalisation of holes 	$\Delta_{Max} = L_1 - L_2$	Δ_{Max} = 2 mm
7.7	Notches		No requirement
8.	**Column splices and baseplates**		
No	**Criterion**	**Parameter**	**Tolerance**
8.1	Column splice		

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Table C.4 *(continued)*

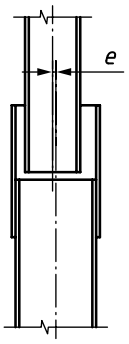
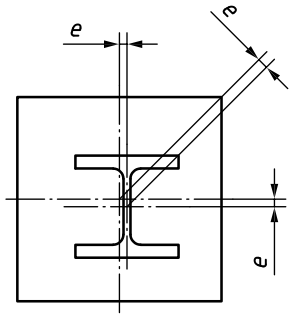
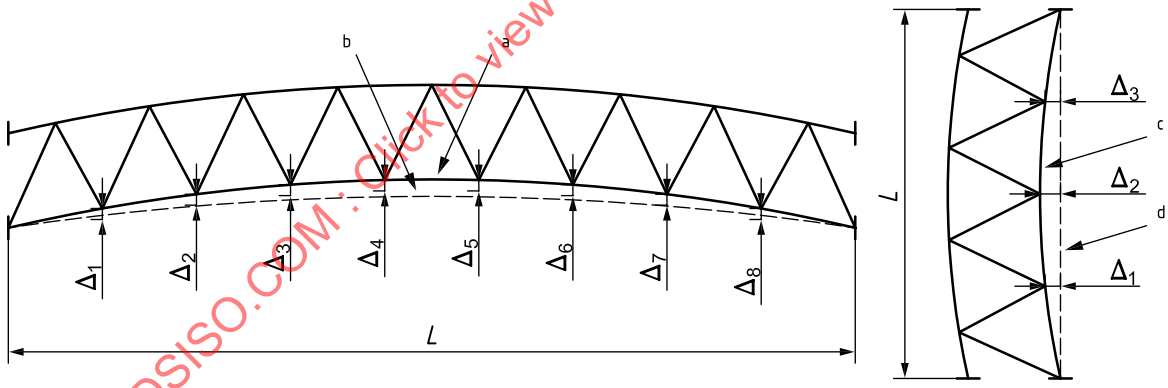
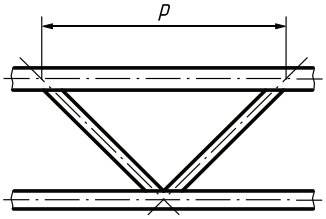
		$\Delta_{Max = e}$	Δ_{Max} = 1 mm
8.2	Baseplate 	$\Delta_{Max = e}$	Δ_{Max} = 5 mm
9.	**Lattice components**		
No	**Criterion**	**Parameter**	**Tolerance**
9.1	Straightness and camber  Note Deviations measured after welding, with the component lying flat on its side.		
	Key: *a* actual camber *b* intended camber *c* actual line *d* intended line	Arching is not required in the design Arching is required in design	Δ_{Max} = - 5 mm Δ_{Max} = 10 mm $\lvert\Delta\rvert_{Max} = L/5\ 000$, mm
9.2	Panel dimensions 	Deviation of individual distances *p* between intersections of centrelines at panel points: $p \leq 5\ 000$ mm $p > 5\ 000$ mm	 $\lvert\Delta\rvert_{Max}$ = 2 mm $\lvert\Delta\rvert_{Max}$ = 3 mm
9.3	Straightness of bracing components		No requirement
9.4	Cross-section dimensions	Deviation of distances *D*, *W*:	

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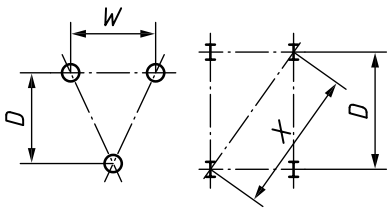
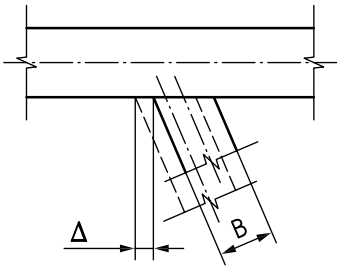
Table C.4 *(continued)*

		$H \leq 5\,000$ mm $H > 5\,000$ mm $B \leq 5\,000$ mm $B > 5\,000$ mm	$\lvert\Delta\rvert_{Max} = 2$ mm $\lvert\Delta\rvert_{Max} = 3$ mm $\lvert\Delta\rvert_{Max} = 2$ mm $\lvert\Delta\rvert_{Max} = 3$ mm
9.5	Intersecting joints 	$B \leq 200$ mm $B > 200$ mm	$\Delta_{Max} = 2$ mm $\Delta_{Max} = 2$ mm
9.6	Gap joints		No requirement

C.6 Tolerances for Japan

The reference standard for Table C.5 is JASS6.

a) The tolerances shown in this subclause are classified into limit tolerances and control tolerances.

b) The limit tolerance is a maximum or minimum value for the acceptance criteria and shall not be exceeded, as a rule.

c) The control tolerance is a target value defined as a criterion for fabrication or erection so that 95 % or more products may be accepted and in the receiving inspection of dimensional accuracy, an accepted value to judge each product with the purpose of judging whether the inspection lot will be accepted or rejected.

d) When the limit tolerance of dimensional accuracy is exceeded in the receiving inspection, the product shall be rejected and re-fabricated, as a rule. However, when re-fabrication is impossible, remedial works equivalent to re-fabrication shall be made and the product shall be re-inspected.

e) When the control tolerances are exceeded but are within the limit tolerances, repair or scrapping of product shall not be required. In sampling inspection using the control tolerance as the acceptance criteria, when the inspected lot is rejected, all the remaining products of the same lot shall be inspected.

f) In spite of the inspection lot, with regard to the products that exceed the limit tolerance, discussion with the engineer, and remedial work, re-fabrication or other necessary measures shall be taken.

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Table C.5 — Japan

1.	**Welded profiles**			
No	**Criterion**	**Parameter**	**JASS6 - additional rules 6**	
			Limit tolerance	**Control tolerance**
1.1	Depth	Overall depth *h*:		

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Table C.5 *(continued)*

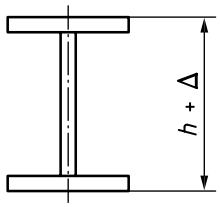
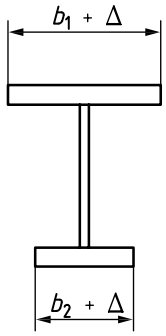
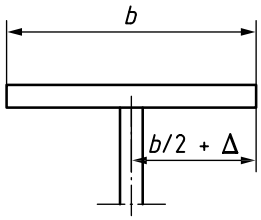
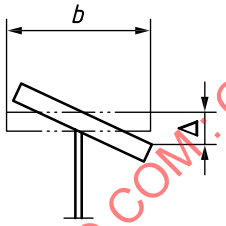
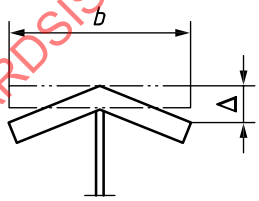
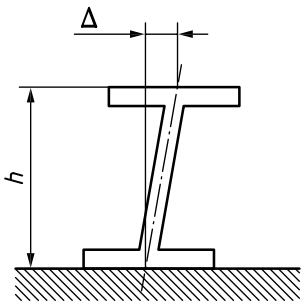
		h < 800 mm h ≥ 800 mm	Δ = ±3 mm Δ = ±4 mm	Δ = ±2 mm Δ = ±3 mm
1.2	Flange width 	Width $b = b_1$ or b_2	Δ = ±3 mm	Δ = ±2 mm
1.3	Web eccentricity 	General case	Δ = ±3 mm	Δ = ±2 mm
1.4	Squareness of flanges 		follow item 1,5	follow item 1.5
1.5	Flatness of flanges 	General case Joint portion	Δ = ±3b/100 but |Δ| ≤ 3 mm Δ = ±3b/200 but |Δ| ≤ 1,5 mm	Δ = ±2b/100 but |Δ| ≤ 2 mm Δ = ±b/100 but |Δ| ≤ 1 mm
1.6	Squareness of bearings 		follow item 1.5	follow item 1.5
1.7	Plate curvature			

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Table C.5 *(continued)*

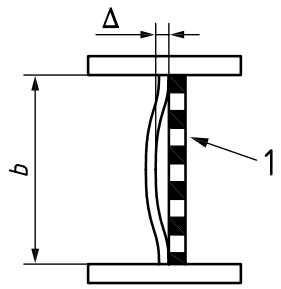
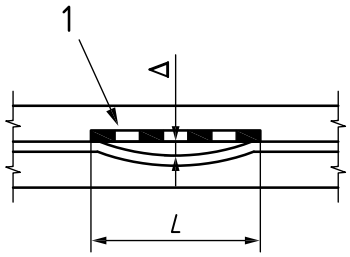
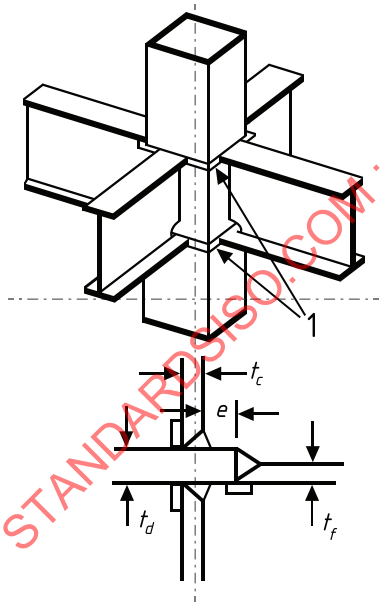
	 1 gauge length	Derivation Δ over plate height b	$\Delta = \pm b/100$ but $\lvert\Delta\rvert \leq 6$ mm	$\Delta = \pm b/150$ but $\lvert\Delta\rvert \leq 4$ mm
1.8	Web distortion  1 gauge length	Deviation Δ on gauge length L equal to web height b (see item 1.7)	$\Delta = \pm L/100$ but $\lvert\Delta\rvert \leq 6$ mm	$\Delta = \pm L/150$ but $\lvert\Delta\rvert \leq 4$ mm
1.9	Web undulation		No requirement	
1.10	Castellated beams and cellular beams (fabricated either from plate or from hot-rolled sections) with openings of inscribed nominal diameter D		No requirement	
1.11	Welding detail of through diaphragm structure  Key 1 Diaphragm plate	Beam flange shall be welded inside the thickness of the diaphragm, including its flatness and squareness. t_d = thickness of diaphragm plate t_f = thickness of beam or girder flange t_c = thickness of column e = extension of diaphragm plate beyond column	No requirement	
1.12	Non-intended eccentricity about either column surface	Non-intended eccentricity e about either column surface		

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Table C.5 *(continued)*

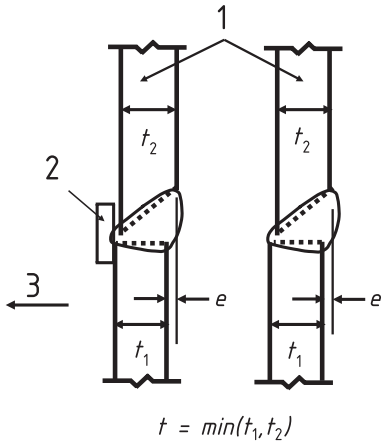
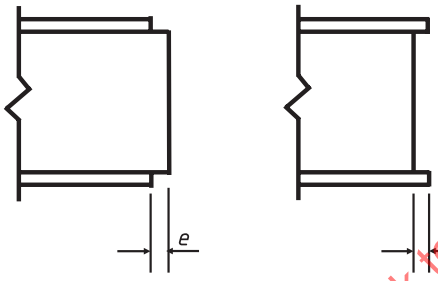
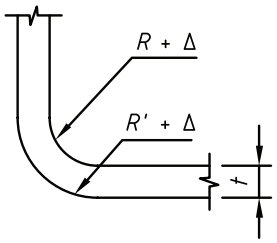
	 Key 1 column flange 2 backing bar 3 toward inside face of column	$t \leq 15$ mm $T > 15$ mm	$e \leq 1{,}5$ mm $e \leq t/10$, and $e \leq 3$ mm	$e \leq 1$ mm $e \leq t/15$, and $e \leq 2$ mm
1.13	Misalignment of edges and welded assemblies 	Misalignment of edges and welded assemblies e	$e \leq 3$ mm	$e \leq 2$ mm
2.	**Press-braked profiles**			
No	**Criterion**	**Parameter**	**JASS6 - additional rules 6**	
			Limit tolerance	**Control tolerance**
2.1	Internal element width		No requirement	
2.2	Outstanding element width		No requirement	
2.3	Straightness for component to be used unrestrained		No requirement	
2.4	Flatness		No requirement	
2.5	Bend radius 	Cold roll formed square pipe Cold press formed square pipe In other case, R' shall be not more than 10 t without confirming property after bending.	$R' = 2{,}5\ t$ $\Delta = 0{,}5\ t$ (6 mm ≤ t ≤ 25 mm) $R' = 3{,}5\ t$ $\Delta = 0{,}5\ t$ (6 mm ≤ t ≤ 19 mm) $\Delta = 0{,}4\ t$ (19 mm < t ≤ 40 mm)	
2.6	Shape		No requirement	
3.	**Flanges of welded profiles**			

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Table C.5 *(continued)*

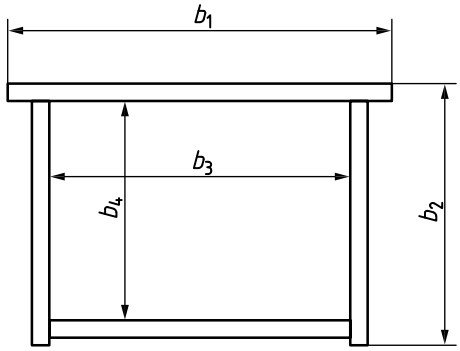
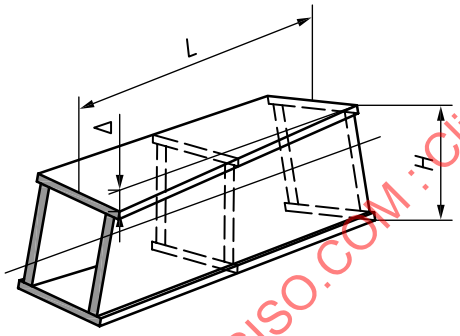
No	Criterion	Parameter	JASS6 - additional rules 6	
			Limit tolerance	Control tolerance
3.1	Flange distortion of I section		No requirement	
3.2	Flange undulation of I section		No requirement	
3.3	Straightness for component to be used unrestrained		No requirement	
4.	**Flanges of welded box sections**			
No	**Criterion**	**Parameter**	**JASS6 - additional rules 6**	
			Limit tolerance	**Control tolerance**
4.1	Section dimension 	b < 800 mm b ≥ 800 mm $b = b_1, b_2, b_3$ or b_4	Δ = ±3 mm Δ = ±4 mm	Δ = ±2 mm Δ = ±3 mm
4.2	Twist 	Overall deviation Δ in a piece of length L and height H	Δ = ±9H / 1 000 but |Δ| ≤ 8 mm	Δ = ±6H / 1 000 but |Δ| ≤ 5 mm
4.3	Out-of-plane imperfection of plate panel between web or stiffener, general case		No requirement	
4.4	Out-of-plane imperfections of plate panel between webs or stiffeners (special case with compression in the transverse direction – the general case applies unless this special case is specified)		No requirement	
4.5	Squareness		No requirement	
5.	**Web stiffeners and cruciform joints of profiles or box sections**			
No	**Criterion**	**Parameter**	**JASS6 - additional rules 6**	
			Limit tolerance	**Control tolerance**
5.1	In-plane straightness		No requirement	
5.2	Out-of-plane straightness		No requirement	
5.3	Location of web stiffeners		No requirement	
5.4	Location of web stiffeners at support		No requirement	
5.5	Eccentricity of web stiffeners		No requirement	

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Table C.5 *(continued)*

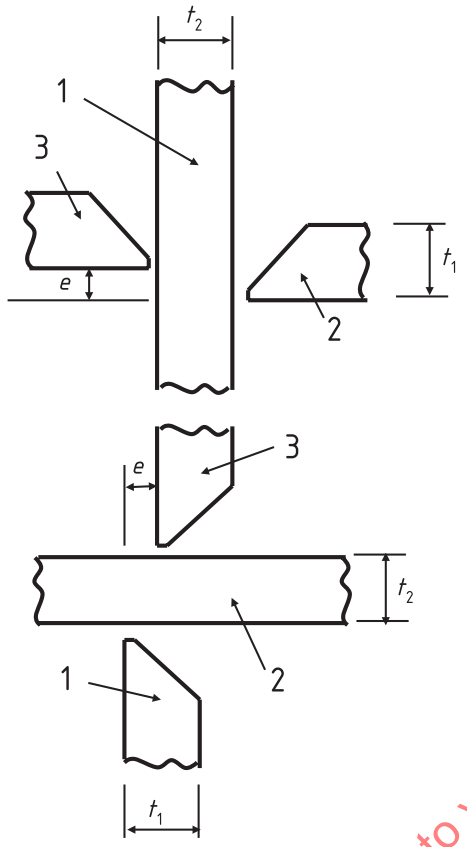
5.6	Eccentricity of web stiffeners at supports		No requirement	
5.7	Misalignment of diaphragm and flange  Key 1 Column flange 2 Beam flange 3 Diaphragm plate	Misalignment e of diaphragm and flange: $t_1 \geq t_2$ $t_1 < t_2$	$e \leq t_1/5$, and $e \leq 4$ mm $e \leq t_1/4$, and $e \leq 5$ mm	$e \leq t_2/15$, and $e \leq 3$ mm $e \leq t_1/5$, and $e \leq 4$ mm
6.	**Components**			
No	**Criterion**	**Parameter**	**JASS6 - additional rules 6**	
			Limit tolerance	**Control tolerance**
6.1	Length			

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Table C.5 *(continued)*

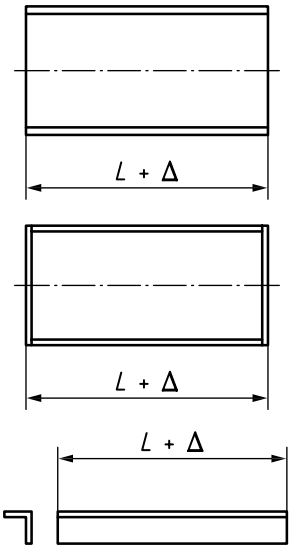
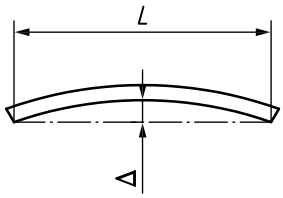
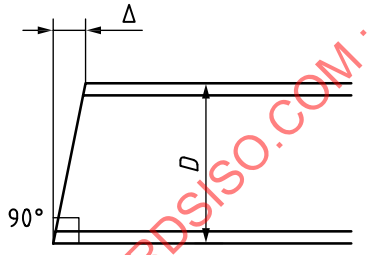
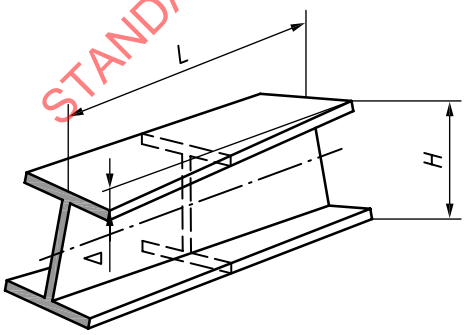
		Beam: Column: L < 10 m L ≥ 10 m	Δ = ±5 mm Δ = ±5 mm Δ = ±6 mm	Δ = ±3 mm Δ = ±3 mm Δ = ±4 mm
6.2	Length, where sufficient compensation with adjacent component is possible		No requirement	
6.3	Straightness of column 	NOTE: Does not include rolled or hot finished	Δ = ±L/1 000, but |Δ| ≤ 8 mm	Δ = ±L/1 500, but |Δ| ≤ 5 mm
6.4	Camber or intended curvature on plan		No requirement	
6.5	Surfaces finished for full contact bearing		No requirement	
6.6	Squareness of ends 	Steel in contact	Δ = ±2,5D / 1 000	Δ = ±1,5D / 1 000
6.7	Twist 	Overall deviation Δ in a piece of length L and height H	No requirement	
6.8	Torsion of column			

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Table C.5 *(continued)*

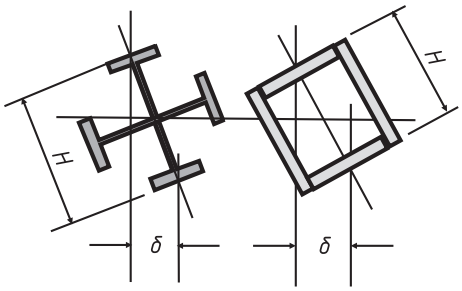
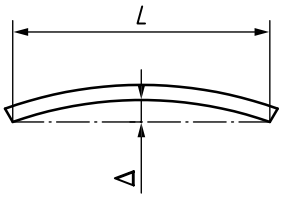
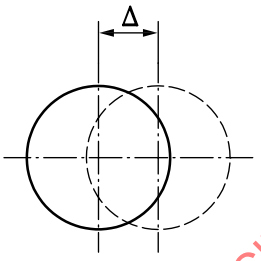
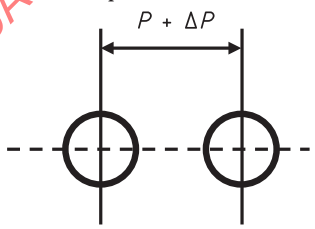
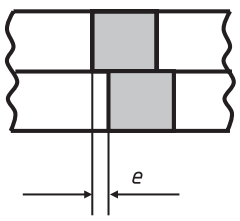
		—	$\delta \leq 9D$ / 1 000, and $\delta \leq 8$ mm	$\delta \leq 6D$ / 1 000, and $\delta \leq 5$ mm
6.9	Straightness of Beam 	—	$\Delta = \pm 1{,}5L$ / 1 000 but $\lvert\Delta\rvert \leq 15$ mm	$\Delta = \pm L$ / 1 000 but $\lvert\Delta\rvert \leq 10$ mm
7.	**Fastener holes, notches and cut edges**			
No	**Criterion**	**Parameter**	**JASS6 – additional rules 6**	
			Limit tolerance	**Control tolerance**
7.1	Position of holes for fasteners 	Misalignment of hole centre Δ	Δ ≤ 1,5 mm	Δ ≤ 1 mm
7.2	Position of holes for fasteners		No requirement	
7.3	Position of hole group		No requirement	
7.4	Spacing of hole groups		No requirement	
7.5	Twist of hole group		No requirement	
7.6	Ovalisation of holes		No requirement	
7.7	Notches		No requirement	
7.8	Difference of hole pitch 		No requirement	-1 mm ≤ ΔP ≤ 1 mm
7.9	Misalignment of holes 		$e \leq 1{,}5$ mm	$e \leq 1$ mm

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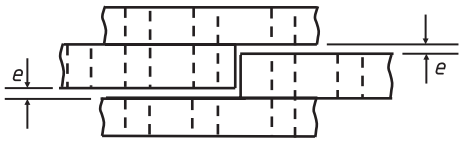
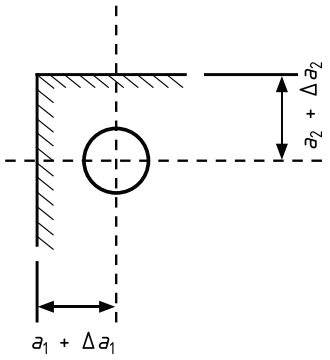
Table C.5 *(continued)*

7.10	Gap in friction surface of high strength bolted joint 		$e \leq 1$ mm	$e \leq 1$ mm
7.11	Edge distance along axis of force and in direction perpendicular to axis of force 	Edge distance to satisfy the minimum requirements of "Design Standard for Steel Structures" and "Guidebook on Design and Fabrication of High Strength Bolted Connections"	$\Delta a_1 \geq -3$ mm $\Delta a_2 \geq -3$ mm	$\Delta a_1 \geq -2$ mm $\Delta a_2 \geq -2$ mm
8.	**Column splices and baseplates**			
No	**Criterion**	**Parameter**	**JASS6 - additional rules 6**	
			Limit tolerance	**Control tolerance**
8.1	Column splice		No requirement	
8.2	Baseplate		No requirement	
9.	**Lattice components**			
No	**Criterion**	**Parameter**	**JASS6 - additional rules 6**	
			Limit tolerance	**Control tolerance**
9.1	Straightness and camber		No requirement	
9.2	Panel dimensions		No requirement	
9.3	Straightness of bracing components		No requirement	
9.4	Cross-section dimensions		No requirement	
9.5	Intersecting joints		No requirement	
9.6	Gap joints		No requirement	

C.7 Tolerances for Russian Federation

The reference standard for Table C.6 is the interstate standard GOST 23118.

Table C.6 — Russian Federation

1.	**Welded profiles**		
No	**Criterion**	**Parameter**	**Tolerance**
1.1	Depth	Deviation in height H	±3 mm

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Table C.6 *(continued)*

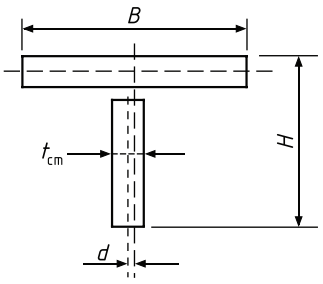
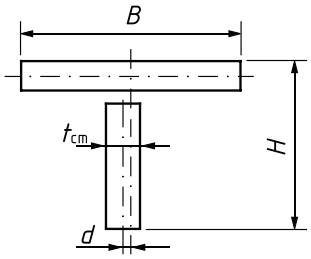
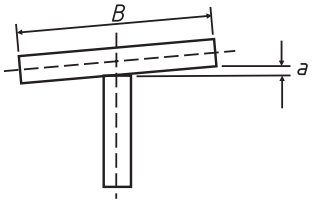
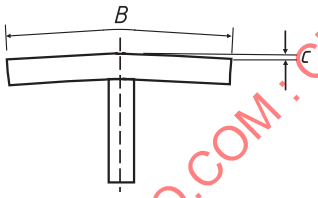
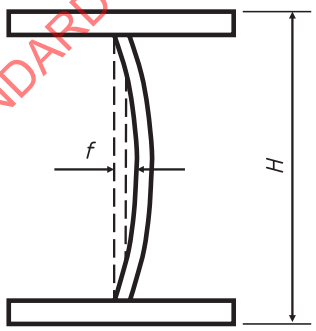
		Displacement of the web *d* relative to the axis of the flange	≤ 0,5 t_{cm}
1.2	Flange width 	Deviation in width of the flange *B* Displacement of the web relative to the axis of the flange *d*	±3 mm ≤ 0,5 t_{cm}
1.3	Web eccentricity 	Misalignment of the web relative to the flange in T and I-sections *a*: at the joints and points of abutment in other places	 ≤ 0,005 *B* ≤ 0,01 *B*
1.4	Squareness of flanges 	Bent shape of the flange of the welded I-beam *c*: at the joints and junction points in other places Misalignment or bending of the flange of the upper chords of crane beams	 ≤ 0,005 *B* ≤ 0,01 *B* ≤ 0,005 *B*
1.5	Flatness of flanges		No requirement
1.6	Squareness of bearings 	curvature of the unreinforced ribs of the beam web *f* curvature of a web reinforced with stiffeners Curvature of the web of crane beams	≤ 0,003 *H* ≤ 0,006 *H* ≤ 0,003 *H*
1.7	Plate curvature		No requirement
1.8	Web distortion Twisting (helicalness of the beam)		

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Table C.6 *(continued)*

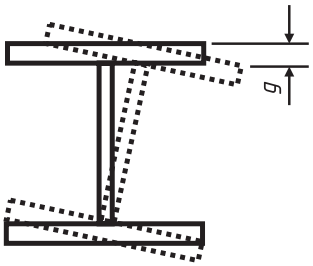
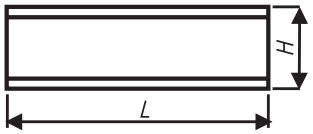
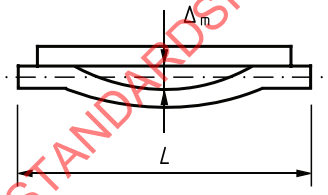
		Twisting (helicalness of the beam) g	≤ 0,001 L, but ≤ 10 mm
1.9	Web undulation		No requirement
1.10	Castellated beams and cellular beams		No requirement
1.11	Maximum permissible deviation of a beam in and out of plane 	along the length L in height H Maximum deviation of the beam length at L up to 16 000 mm inclusive Deviation from perpendicular of the ends of the beam	≤ 0,001 L ≤ 0,001 H + 20 mm ≤ 0,000 7 H
2.	**Press-braked profiles**		
No	**Criterion**	**Parameter**	**Tolerance**
2.1	Internal element width	For cold-formed profiles, see GOST R 58384 (section 4)	
2.2	Outstanding element width		
2.3	Straightness for component to be used unrestrained		
2.4	Flatness		
2.5	Bend radius		
2.6	Shape		
3.	**Flanges of welded profiles**		
No	**Criterion**	**Parameter**	**Tolerance**
3.1	Flange distortion of I section		No requirement
3.2	Flange undulation of I section		No requirement
3.3	Straightness for component to be used unrestrained 	Warped parts - the gap Δ_m between the sheet and a steel ruler	≤ 1,5 mm
4.	**Flanges of welded box sections**		
No	**Criterion**	**Parameter**	**Tolerance**
4.1	Section dimension	Deviation in the height H of the webs and the width B of the flanges	±3 mm

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Table C.6 *(continued)*

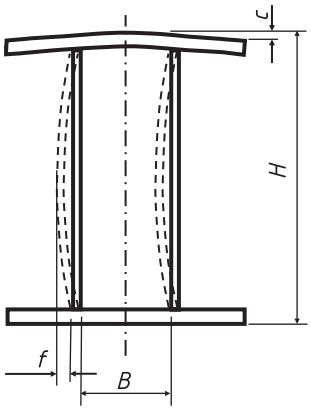
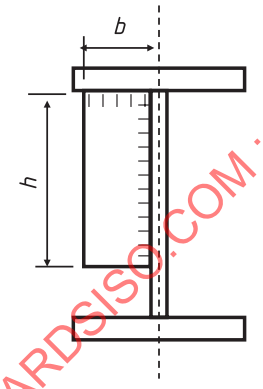
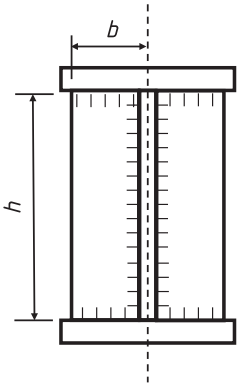
		t_{st} = thickness of stiffener Curvature of flanges Curvature of beam web f	 ±0,015 $B \leq t_{st}$ ±0,015 $H \leq t_{st}$
4.2	Twist		No requirement
4.3	Out-of-plane imperfection of plate panel between web or stiffener, general case		No requirement
4.4	Out-of-plane imperfections of plate panel between webs or stiffeners		No requirement
4.5	Squareness		No requirement
5.	**Web stiffeners and cruciform joints of profiles or box sections**		
No	**Criterion**	**Parameter**	**Tolerance**
5.1	In-plane straightness		No requirement
5.2	Out-of-plane straightness		No requirement
5.3a	Location of web stiffeners (adjoining on both sides) 	width b and height h tangent of the angle of deviation of adjoining sides	±5 mm ≤ 0,002
5.3b	Location of web stiffeners (stiffeners and gussets adjoining on three sides) 	Width b Height h tangent of the angle of deviation of adjoining sides	±5 mm from -2 mm to -4 mm ≤ 0,001

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Table C.6 *(continued)*

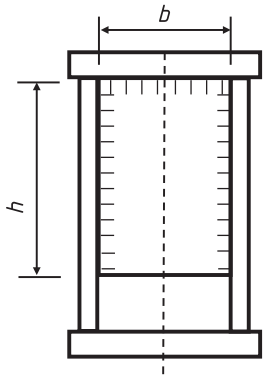
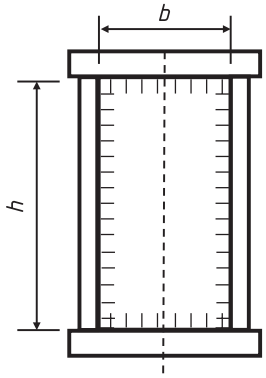
5.3c	Location of web stiffeners (diaphragms adjacent on three sides) 	Width *b* Height *h* tangent of the angle of deviation of adjoining sides	from -2 mm to -4 mm ±5 mm ≤ 0,001
5.3d	Location of web stiffeners (diaphragms adjacent on four sides) 	width *b* and height *h* tangent of the angle of deviation of adjoining sides	from -2 mm to -4 mm ≤ 0,001
5.4	Location of web stiffeners at support		No requirement
5.5	Eccentricity of web stiffeners		No requirement
5.6	Eccentricity of web stiffeners at supports		No requirement
5.7a	Gussets with overlapping elements	width and height tangent of the angle of deflection of any two sides	±10 mm ≤ 0,004
5.7b	Sheet parts of composite sections, in width	flanges webs	±5 mm ±2 mm
5.7c	Sheet metal parts of weld maps and pipe shells	width length inequality of the diagonals (*D*)	±3 mm ±3 mm ≤ 0,001
5.7d	Parts from shaped profiles and composite sections, overlapped	length tangent of the angle of deviation of the end from the axis of the profile	±10 mm ≤ 0,004
5.7e	Parts from shaped profiles and composite sections, docked with two ends	length tangent of the angle of deviation of the abutting ends from the axis of the profile	±3 mm ≤ 0,000 7
5.7f	Details from shaped profiles and composite sections when transferring force through the end face	length tangent of the angle of deflection of the support from the profile axis	±3 mm ≤ 0,000 7
6.	**Components**		
No	**Criterion**	**Parameter**	**Tolerance**

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Table C.6 *(continued)*

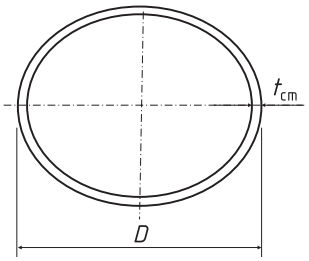
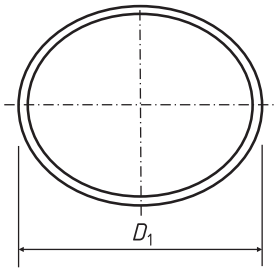
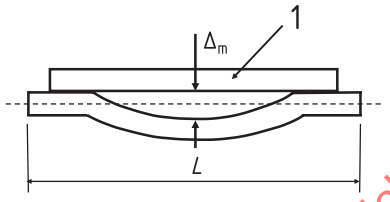
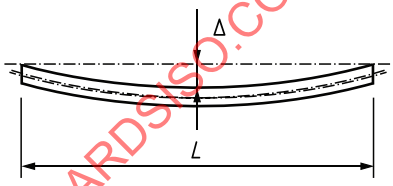
6.1a	Deviation of the outer perimeter of the pipe P 	Deviation of the outer perimeter of the pipe $P = \pi D$ from the theoretical size	±0,75 t_{cm}
6.1b	Ovality of the pipe section 	in places of stiffeners in places not reinforced with stiffeners	±0,01 D_1 ±0,02 D_1
6.2	Length, where sufficient compensation with adjacent component is possible		No requirement
6.3a	Curvature of parts  Key 1 Steel Ruler	Gap between the sheet and the steel ruler Δ_m	≤ 1,5 mm
6.3b	Straightness 	Gap Δ between the stretched string and the edge of the corner, the shelf or the wall of the channel, I-beam, rectangular and round pipes of length L	≤ 0,001 L, but ≤ 10 mm
6.3c	Deviations of lines of edges of sheet metal parts	of elements with field joints in butt welding the same when joint overlap, in T-section, in the corner and on the linings	0 mm to 5 mm ≤ 10 mm
6.3d	Deviations in bending	Gap between the template and the surface of rolled sheet, shelf, obushkom profile folded in a: — cold condition — hot state	 ≤ 2 mm ≤ 1,5 mm
6.3e	Ellipticity (difference in diameters) of a circle in overall sheet structures (with a structure diameter D)	outside the joints at the assembly joints	≤ 0,005 D ≤ 0,003 D
6.4	Camber or intended curvature on plan		No requirement
6.5	Surfaces finished for full contact bearing		No requirement
6.6	Squareness of ends		No requirement
6.7	Twist		

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Table C.6 *(continued)*

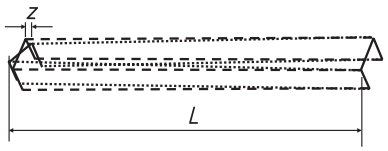
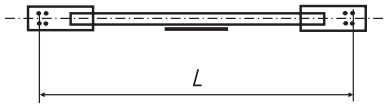
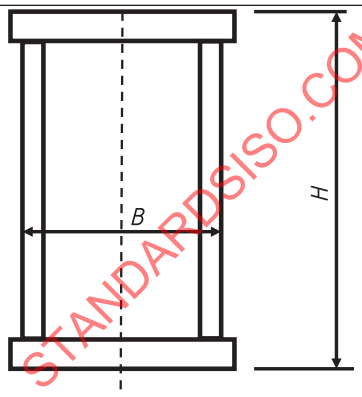
		Twisting z (helical) of the element length L	≤ 0,001 L, but ≤ 10 mm
7.	**Fastener holes, notches and cut edges**		
No	**Criterion**	**Parameter**	**Tolerance**
7.1	Dimensional tolerance for bolted elements 	Shear, friction, and friction-shear connections with: L ≤ 6 000 mm L > 6 000 mm	 ±3 mm ±5 mm
7.2	Position of holes for fasteners		No requirement
7.3	Position of hole group		No requirement
7.4	Spacing of hole groups		No requirement
7.5	Twist of hole group		No requirement
7.6	Ovalisation of holes		No requirement
7.7	Notches		No requirement
8.	**Column splices and baseplates**		
No	**Criterion**	**Parameter**	**Tolerance**
8.1	Column splice		No requirement
8.2	Baseplate	 Width and length The gap between the ruler and the surface of the slab for a length of not more than 1 m	 ±5 mm ≤ 0,3 mm
8.3	Deviation in height H of racks and columns	Mounted in one and two tiers	±5 mm
		The same in three and more tiers Non-perpendicularity of the ends relative to the width of the rack Non-flatness of the closing of the end surfaces of the flanges	±3 mm ≤ 0,000 7 B ≤0,3 mm
8.4	Height tolerance		

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Table C.6 *(continued)*

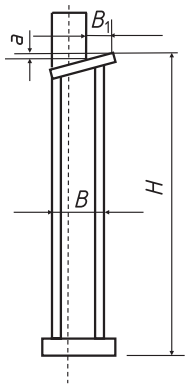
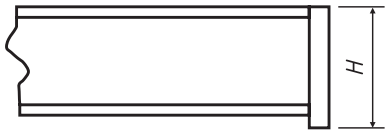
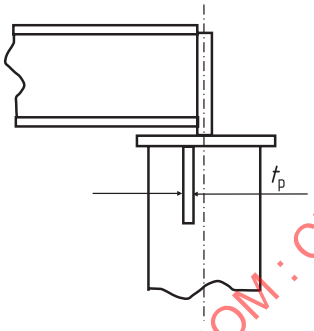
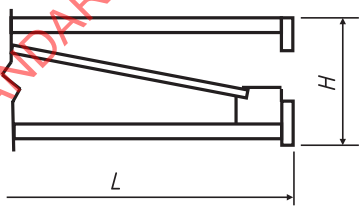
		Distance H from the base plate of the column, column to the supporting surface of tables, consoles, traverses, etc. Non-perpendicularity in the supporting surface of consoles, tables, traverses (along the width of the supporting surface)	±3 mm ≤ 0,001 B_1
8.5	Beam height deviation during force transfer 	Through supporting ribs Through base plates	±2 mm ±5 mm
8.6	Offset of supporting ribs and stiffening diaphragms 	Displacement of supporting ribs and stiffness diaphragms during the transfer of concentrated loads in the traverses of columns, support nodes of beams, frame nodes (with rib thickness t_p) Displacement and deviation from the design axis of the stiffeners and diaphragms that ensure the stability of the wall	≤ 0,25 t_p ±10 mm
9	**Lattice components**		
No	**Criterion**	**Parameter**	**Tolerance**
9.1	Straightness and camber	—	No requirement
9.2a	Panel dimensions 	Deviation of the linear dimensions of lattice structures: deviation of the length L of assembly units in the presence of gaskets in the field connections or when welded with lining deviation of the height H on the supports the same at the joints the same in other places	 ±5 mm ±3 mm ±3 mm ±10 mm
9.2b	Panel dimensions (at support ends)		

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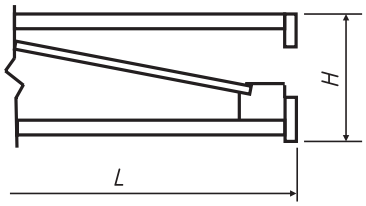
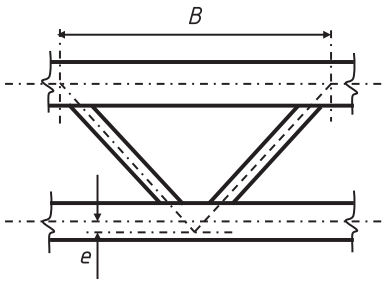
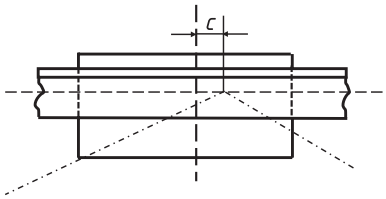
Table C.6 *(continued)*

		Trusses with the transfer of the support force through the end support ribs: Deviation from the supporting surface of the rib to the outer surface of the upper chord *H*	±5 mm
9.3	Straightness of components		No requirement
9.4	Cross-section dimensions		No requirement
9.5	Intersecting joints 	Misalignment *e* of lattice elements relative to the belt axis for structures made of rectangular pipes, I-beams and channels, posts and columns, misalignment relative to the vertical axis The same for corner structures	≤ 0,04 *B* ≤ 0,03 *B*
9.6	Gap joints 	Deviations *c* of nodal gussets of lattice structures and gussets for joining ties, beams, etc.	±5 mm

C.8 Tolerances for United Kingdom

The reference standard for Table C.7 is BCSA National Structural Steelwork Specification.

Table C.7 — United Kingdom

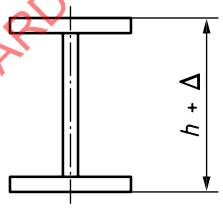
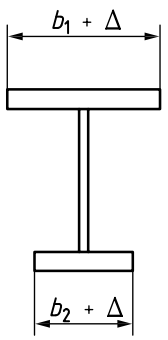
1.	**General**		
No	**Criterion**	**Parameter**	**Tolerance**
1.1	Depth 	Overall depth *h* on centreline: *h* ≤ 900 mm 900 < *h* ≤ 1 800 mm *h* > 1 800 mm	 Δ = ±3 mm Δ = ±*h*/300 Δ = ±6 mm
1.2	Flange width 	Width b_1 or b_2	-Δ = *b*/100 +Δ = *b*/100, or 3 mm, whichever is greater

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Table C.7 *(continued)*

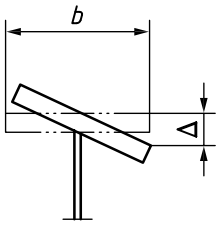
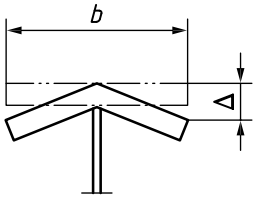
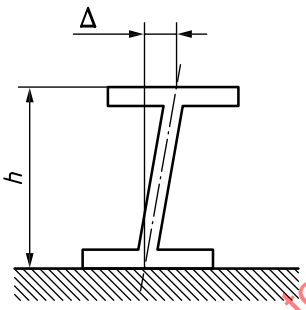
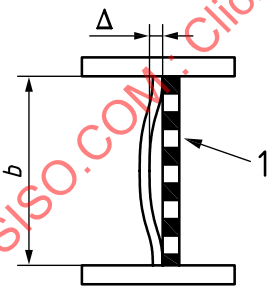
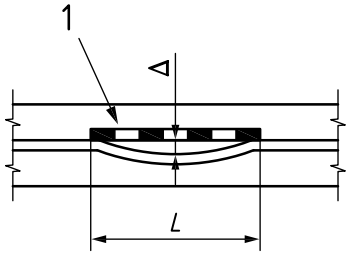
1.3	Web eccentricity		No requirement
1.4	Squareness of flanges  	Position of web: general case flange parts in contact with structural bearings in locations identified in the execution specification	 Δ = ±*b*/100 Δ = ±*b*/400
1.5	Flatness of flanges  	Out of flatness: general case flange parts in contact with structural bearings in locations identified in the execution specification	 Δ = ±*b*/100, or 5 mm, whichever is greater Δ = ±*b*/400
1.6	Squareness of bearings  	Squareness of flanges to web	Δ = ±*h*/300, or 3 mm, whichever is greater
1.7	Plate curvature  1 gauge length	Derivation Δ over plate height *b* where *t* = plate thickness *b*/*t* ≤ 80 80 < *b*/*t* ≤ 200 *b*/*t* > 200	 Δ = ±*b*/200 Δ = ±*b*^{2} / (16 000 *t*) Δ = ±*b*/80, or *t*, whichever is greater
1.8	Web distortion  1 gauge length	Deviation Δ on gauge length *L* equal to web height *b* where *t* = plate thickness	 Δ = ±*b*/100, or *t*, whichever is greater
1.9	Web undulation		

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Table C.7 *(continued)*

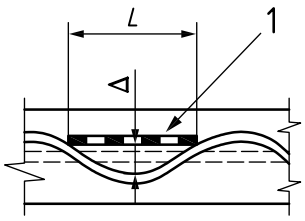
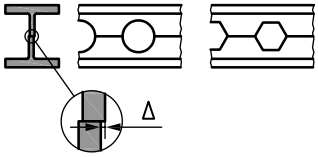
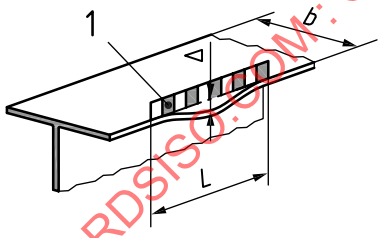
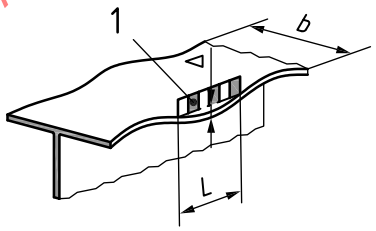
	 1 gauge length	Deviation Δ on gauge length L equal to web height b where t = plate thickness (see tolerance 1,7)	$\Delta = \pm b/100$, or t, whichever is greater
1.10	Castellated beams and cellular beams (fabricated either from plate or from hot-rolled sections) with openings of inscribed nominal diameter D 	Misalignment of web post across thickness: Misalignment of overlap for opening of nominal radius r: $r = D/2 < 200$ mm $r = D/2 \geq 200$ mm	$\Delta = 2$ mm $\Delta = 2$ mm $\Delta = r/100$, and $\Delta \leq 5$ mm
NOTE	Notations such as $\Delta = \pm d/100$ but $\lvert\Delta\rvert \geq t$, mean that $\lvert\Delta\rvert$ is the larger of $d/100$ and t.		
2.	**Press-braked profiles**		
No	**Criterion**	**Parameter**	**Tolerance**
2.1	Internal element width	For press braked cold-formed profiles, refer to EN 1090-2:2018 Table 8.2	
2.2	Outstanding element width		
2.3	Straightness for component to be used unrestrained		
2.4	Flatness		
2.5	Bend radius		
2.6	Shape		
3.	**Flanges of welded profiles**		
No	**Criterion**	**Parameter**	**Tolerance**
3.1	Flange distortion  1 gauge length	Deviation Δ on gauge length L, where L = length b = flange width t = flange thickness $b/t \leq 20$ $b/t > 20$	 $\Delta = \pm b/150$ $\Delta = \pm b^2 / (3\,000\ t)$
3.2	Flange undulation  1 gauge length	Deviation Δ on gauge length L, where L = length b = flange width t = flange thickness $b/t \leq 20$ $b/t > 20$	 $\Delta = \pm b/150$ $\Delta = \pm b^2 / (3\,000\ t)$
3.3	Straightness for component to be used unrestrained		No requirement
4.	**Flanges of welded box sections**		
No	**Criterion**	**Parameter**	**Tolerance**

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Table C.7 *(continued)*

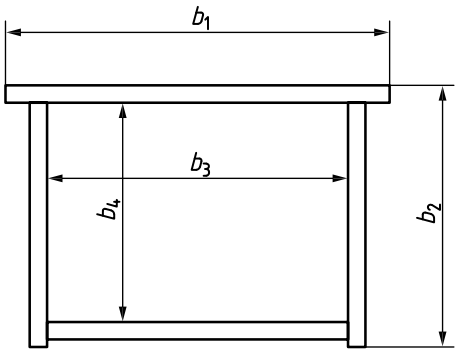
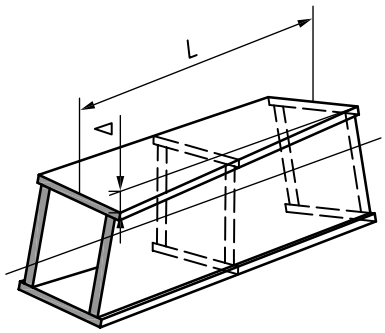
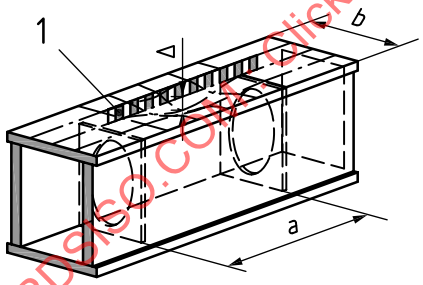
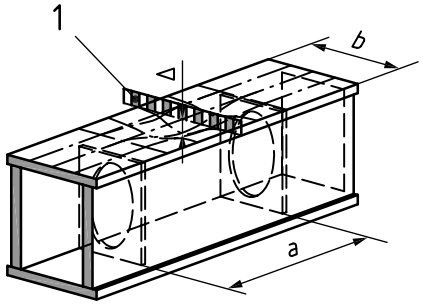
4.1	Section dimension  	Deviation in internal or external dimension $b = b_1, b_2, b_3$ or b_4 $b \leq 300$ mm 300 mm < $b \leq$ 900 mm 900 < b < 1 800 mm $b \geq$ 1 800 mm	 Δ =, + 3 mm, - (b/100) Δ = ±3 mm Δ = ±b/300 Δ = ±6 mm
4.2	Twist  	Overall deviation Δ in a piece of length L	Δ = ±L/700, or 4 mm, whichever is greater, up to a maximum of 10 mm
4.3	Out-of-plane imperfection of plate panel between web or stiffener, general case  1 straight edge gauge of length L	For a panel of width b with distance a between stiffener diaphragms. Distortion perpendicular to the plane of the plate transversely over whole width relative to straight edge < D or longitudinally with respect to a gauge < D of length b. if $a \leq 2b$, $L = a$	Δ = ±a/250
4.4	Out-of-plane imperfections of plate panel between webs or stiffeners (special case with compression in the transverse direction)  1 straight edge gauge of length L	Deviation Δ perpendicular to the plane of the plate: if $a > 2b$, $L = 2a$ NOTE: The special case only applies for compression of the box section in the transverse direction if specified in the execution specification.	Δ = ±a/125
4.5	Squareness		

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Table C.7 *(continued)*

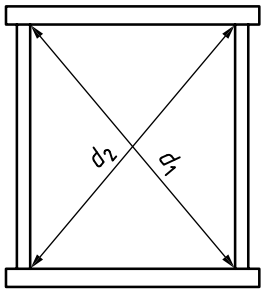
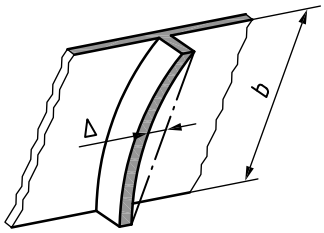
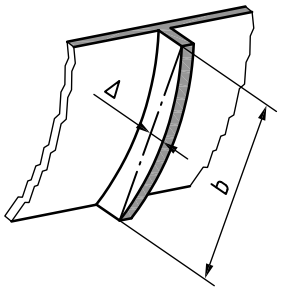
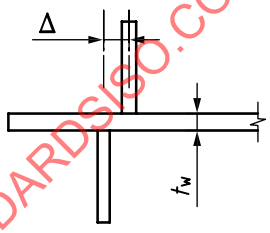
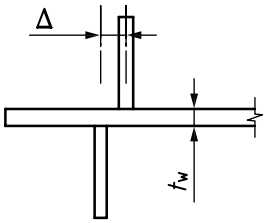
		Difference Δ between diagonal dimensions at diaphragm positions: (nom = nominal, and act= actual) at diaphragm positions. $\Delta = \lvert (d_1 - d_2)_{act} - (d_1 - d_2)_{nom} \rvert$	$\Delta = (d_1 + d_2)_{nom}/400$, or 6 mm, whichever is greater
5.	**Web stiffeners and cruciform joints of profiles or box sections**		
No	**Criterion**	**Parameter**	**Tolerance**
5.1	In-plane straightness 	Deviation Δ from straightness in the plane of the plate after welding	$\Delta = \pm b/250$, or 4 mm, whichever is greater
5.2	Out-of-plane straightness 	Deviation Δ from straightness normal to the plane of the web after welding	$\Delta = \pm b/500$, or 4 mm, whichever is greater
5.3	Location of web stiffeners		No requirement
5.4	Location of web stiffeners at support		No requirement
5.5	Eccentricity of web stiffeners 	Eccentricity between a pair of non-bearing stiffeners	Δ = ±5 mm
5.6	Eccentricity of web stiffeners at supports 	Eccentricity between a pair of stiffeners	Misalignment Δ between a pair of bearing stiffeners fixed to a web of thickness t_w $\Delta = \pm t_w/2$ generally, but restricted to $\pm t_w/3$ at support positions
5.7	Position of fittings		

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Table C.7 *(continued)*

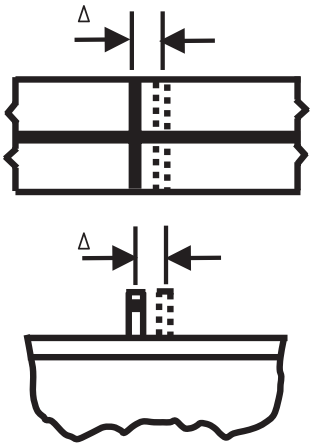
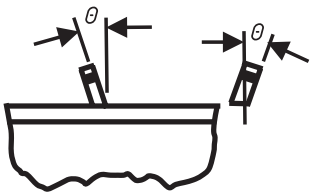
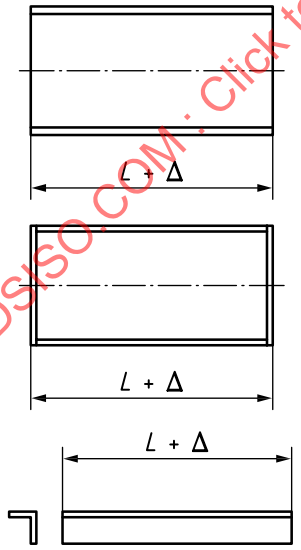
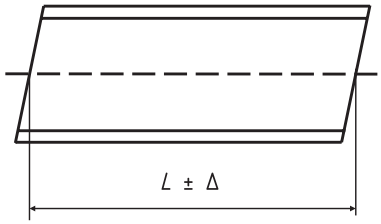
		Deviation Δ from the intended position, generally, relative to the setting-out point on the primary component. Fittings and attachments whose location is not critical to the force	Δ = ±3 mm Δ = ±5 mm
5.8	Alignment of fittings 	Angular deviation θ relative to intended local orientation (assumed square in figure)	θ = 1 in 60
[a] For cruciform joints, the misalignment eccentricity is limited to $\pm t/2$ where t is the larger of the thicknesses of the two plates attached either side of the web, see ISO 17607-4 (Erection).			
6.	**Components**		
No	**Criterion**	**Parameter**	**Tolerance**
6.1	Length 	Cut length measured on the centreline (or on the corner for an angle): NOTE: Length L measured including welded end plates as applicable. general case ends ready for full contact bearing	 Δ = ±(L/5 000 + 2 mm) Δ = ±1 mm
6.2	Length, where sufficient compensation with adjacent component is possible 	Cut length measured on centre-line	Δ = ±(L/5 000 + 2 mm) This may be increased up to a maximum of 50 mm if sufficient clearance compensation with next adjacent component is possible.
6.3	Straightness		

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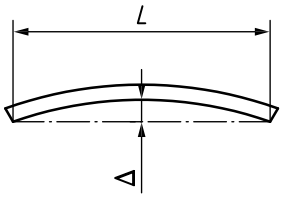
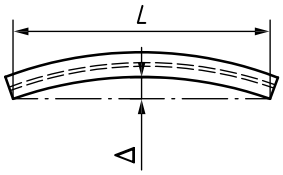
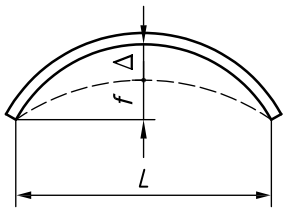
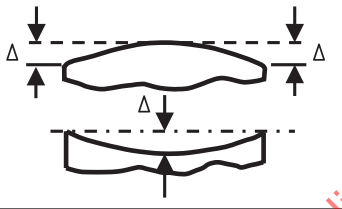
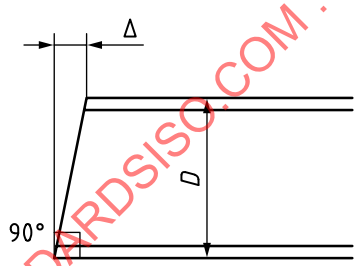
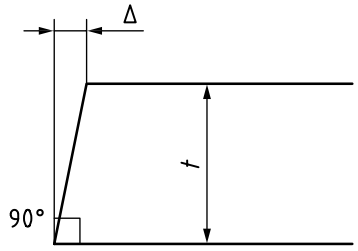
Table C.7 *(continued)*

		Distance Δ from rectangular axes of a fabricated or press-braked section	$\Delta = \pm L/1\,000$
6.3a	Flange straightness 	Straightness of individual flanges	$\Delta = \pm L/1\,000$ At least 3 mm allowable on beams shorter than 3 000 mm if specified as restrained in the execution specification.
6.4	Camber or intended curvature on plan 	Offset f at mid-length Vertical camber should be measured with the member on its side.	$-\Delta = 0$ $+\Delta = L/500$, or 6 mm, whichever is greater
6.5	Surfaces finished for full contact bearing	See Flatness in 6.5a	
6.5a	Flatness 	Maximum gap Δ between the surface and a straight edge laid in any direction for surfaces specified for full contact bearing in the execution specification	Generally, Δ = 0,5 mm with local high spots not projecting more than 0,5 mm above the surface
6.6	Squareness of ends 	Squareness to longitudinal axis: ends intended for full contact bearing ends not intended for full contact bearing	 $\Delta = \pm D/1\,000$ $\Delta = \pm D/100$
6.6a	Sheared or cropped edges of plates or angles 	Deviation from a 90° edge	$\Delta = \pm t/10$, up to a maximum of 3 mm
6.7	Twist		

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