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中国钢结构协会标准

CSCS

T/CSCSxxx-2025

钢结构建造质量控制标准
第 4 部分：安装

Steel structures — Execution of structural
steelwork
Part 4: Erection

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前 言

本标准参照 GB/T 1.2—2020 给出的规则起草。

本标准参考了 ISO 17607:2023 Execution of Structural Steelworks 的技术内容。

T/CSCS xxx—2025《钢结构建造质量控制标准》分为如下七个部分：

- 第 1 部分：基本要求和术语；
- 第 2 部分：钢材；
- 第 3 部分：制造；
- 第 4 部分：安装；
- 第 5 部分：焊接；
- 第 6 部分：螺栓连接；
- 第 7 部分：涂装。

本部分为 T/CSCS xxx—2025 的第 4 部分。

在采用 ISO 17607:2023 时，本部分增加了有关“第 7 部分：涂装”的内容。

对应于 ISO 17607:2023，本部分还做了下列编辑性修改：

- “ISO 17607 的本部分”修改为“T/CSCS xxx 的本部分”；
- 用小数点“.”代替作为小数点的逗号“,”；
- 删除国际标准的前言和引言。

本部分的附录 A、B 为规范性附录，附录 C、D、E、F 为资料性附录。

本标准由中国钢结构协会管理。

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1 范围

1 Scope

本标准规定了钢结构工程施工中钢材安装的总体要求，适用于作为结构或部品部件的钢材施工，与 ISO 17607-1 配合使用。

This document defines the general requirements for erection of steels used in the execution of structural steelwork as structures or as manufactured components in conjunction with ISO 17607-1.

钢结构工程施工中，针对结构或部品部件的附加要求，参见 ISO 17607 系列标准的其他章节。

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 引用标准

2 Normative references

本标准引用以下技术文件，其部分或全部内容构成本标准的相关规定及要求。对于有标注日期的引用文件，仅引用的版本适用。对于未标注日期的引用文件，使用所引用的最新版本（包括最新修订版）。

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 4463-1, Measurement methods for building — Setting-out and measurement — Part 1: Planning and organization, measuring procedures, acceptance criteria

ISO 7976-1, Tolerances for building — Methods of measurement of buildings and building products — Part 1: Methods and instruments

ISO 7976-2, Tolerances for building — Methods of measurement of buildings and building products — Part 2: Position of measuring points

ISO 17607-1¹, Steel structures — Execution of structural steelwork — Part 1: General requirements and vocabulary

ISO 17607-3², Steel structures — Execution of structural steelwork — Part 3: Fabrication

ISO 17607-5³, Steel structures — Execution of structural steelwork — Part 5: Welding

ISO 17607-6⁴, Steel structures — Execution of structural steelwork — Part 6:

Bolting

ISO 22966, Concrete structures — Execution of concrete structures

3 术语和定义

3 Terms and definitions

标准 ISO 17607-1 中的术语和定义适用于本标准。

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

国际标准化组织（ISO）和国际电工委员会（IEC）用于维护标准化术语的数据库可通过以下链接访问：

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

—ISO 在线浏览平台：<https://www.iso.org/obp>

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

—IEC 电子百科：<https://www.electropedia.org/https://www.electropedia.org/>

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

4 建造技术规格说明和质量要求

4 Execution specification and quality requirements

4.1 概述

4.1 General

总体要求见标准 ISO 17607-1。

See ISO 17607-1.

本章规定了钢结构工程施工的安装要求。当涉及钢构件制作加工类似操作时，应按 ISO 17607-3 中的规定执行。

This clause specifies the requirements for erection of structural steelwork.

When work performed on site involves operations similar to fabrication, the work shall be performed in accordance with ISO 17607-3.

注 1：类似操作包括切割、钻孔及安装前的构件装配。

注 2：焊接和螺栓连接分别见 ISO 17607-5 和 ISO 17607-6。

NOTE 1 Examples of similar operations include cutting, holing, and assembling of components prior to erection.

NOTE 2 Welding and structural bolting are addressed in ISO 17607-5 and ISO 17607-6.

4.2 建造技术规格说明

4.2 Execution specification

国家标准和技术条件等效的文件可全部或部分替代第 2 章引用的 ISO 标准或本标准的其他要求。在此种情况下，技术等效的国家标准或文件与本标准之间的差异，应在施工技术规格中予以注明。

National standards and documents that provide technically equivalent conditions may be used, in whole or in part, in place of the ISO standards referenced in Clause 2 or requirements of this document. In these cases, the technically equivalent national standards and documents, and deviations from the requirements of this document,

shall be referenced in the execution specification.

钢结构工程各部分施工所需的资料信息和技术要求,应在该部分实施开始前达成一致并予以完善。

The necessary information and technical requirements for execution of each part of the structural steelwork shall be agreed upon and complete before commencement of execution of that part of the structural steelwork.

建造技术规格应包括以下适用内容:

The execution specification shall include the following items as are relevant:

a) 补充信息, 见附录 A.1;

a) additional information, see A.1;

b) 可选技术要求, 见附录 A.2;

b) options that may be specified, see A.2;

c) 施工等级相关要求, 见附录 A.3;

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

d) 标识和可追溯性要求, 见 ISO 17607-1;

d) identification and traceability requirements in accordance with ISO 17607-1;

e) 几何公差, 见第 7 章。

e) geometrical tolerances, see Clause 7.

对已达成一致的建造技术规格进行替换, 应制定相关程序程序。

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

5 组成产品

5 Constituent products

5.1 概述

5.1 General

ISO 17607-1 规定了组成产品的相关信息和要求。

ISO 17607-1 provides information and requirements for constituent products.

5.2 锚固件、地脚螺栓和其他锚固件

5.2 Anchorages, foundation bolts and other anchorages

ISO 17607-6 对锚具、地脚螺栓和其他锚具的性能和要求作出了明确规定。

ISO 17607-6 provides information and requirements for anchorages, foundation bolts and other anchorages.

5.3 灌浆材料

5.3 Grouting materials

5.3.1 概述

5.3.1 General

所用灌浆材料应在建造技术规格中明确规定，包括水泥基灌浆料、特种灌浆料或细石混凝土。

The grouting materials to be used shall be specified in the execution specification.

They shall be cement- based grout, special grout, or fine concrete.

5.3.2 水泥基灌浆料

5.3.2 Cement based grout

用于钢底座或承压板与混凝土基础之间的水泥基灌浆料应符合以下要求：

Cement based grout for use between steel bases or bearing plates and concrete foundations shall be as follows:

a) 公称厚度不超过 25 mm 时：应采用纯硅酸盐水泥砂浆；

a) for nominal thickness not exceeding 25 mm: Neat Portland cement mortar;

b) 公称厚度在 25mm 至 50mm 之间时：应采用流态硅酸盐水泥砂浆，且水泥与细骨料的比例不得低于 1:1；

b) for nominal thickness between 25 mm and 50 mm: Fluid Portland cement mortar that is not leaner than 1:1 cement to fine aggregate;

c) 公称厚度 50mm 及以上时：应采用干硬性硅酸盐水泥砂浆，且水泥与细骨料的比例不得低于 1:2。

c) for nominal thickness of 50 mm and above: Dry as possible Portland cement mortar that is not leaner than 1:2 cement to fine aggregate.

5.3.3 特种灌浆料

5.3.3 Special grout

特种灌浆料包括掺有外加剂的水泥基灌浆料、膨胀灌浆料和树脂基灌浆料。建议使用具有低收缩特性的特种灌浆料。

Special grout includes cement-based grout used with admixtures, expanding grout and resin-based grout. Those with low shrinkage characteristics are recommended.

特种灌浆料应提供符合制造商建议的详细使用说明。

Special grout shall be accompanied by detailed instructions for use that are conform to the manufacturer's recommendations.

5.3.4 细石混凝土

5.3.4 Fine concrete

细石混凝土仅用于钢底座或承压板与混凝土基础之间间隙在公称厚度 50 毫米及以上的情况。

Fine concrete shall only be used between steel bases or bearing plates and concrete foundations that have gaps with nominal thickness of 50 mm and above.

5.4 桥梁伸缩缝

5.4 Expansion joints for bridges

明确规定伸缩装置的类型和性能要求。

Requirements for type and characteristics of expansion joints shall be specified.

6 安装

6 Erection

6.1 概述

6.1 General

本章规定了现场安装及其他相关作业的要求，包括底座灌浆，以及确保现场安全安装和精确处理的支撑结构。

This clause gives requirements for erection and other work undertaken on site including grouting of bases as well as those relevant to the suitability of the site for safe erection and for accurately prepared supports.

现场施工包括加工制作、焊接及结构螺栓连接作业，应分别符合标准 ISO 17607-3、ISO 17607-5 和 ISO 17607-6 的规定。

Work carried out on site that includes fabrication, welding, and structural bolting shall be in accordance with ISO 17607-3, ISO 17607-5, and ISO 17607-6, respectively.

结构检验与验收应按照第 8 章中规定的要求进行。

Inspection and acceptance of the structure shall be performed in accordance with the requirements specified in Clause 8.

6.2 场地条件

6.2 Site conditions

钢结构吊装作业必须在施工现场符合钢结构安全技术要求的前提下方可作业。相关技术要求应包括以下内容：

Erection shall not commence until the site for the construction works conforms with the technical requirements with respect to the safety of the structural steelwork. This shall include the following items where relevant:

- a) 为起重机及进场设备提供硬化地面并进行维护；
- a) provision and maintenance of hard standing for cranes, and access equipment;

- b) 施工现场运输通道的设置应满足材料、构件、设备及人员的运输与通行要求；
b) access routes to the site, and within the site suitable for delivery, and movement of material, components, equipment and personnel;
- c) 满足现场安全作业和施工的地质条件；
c) soil conditions affecting the safe operations, and construction at the site;
- d) 结构安装的支撑体系潜在的沉降；
d) possible settlement of erection supports for the structure;
- e) 地下管线、架空电缆及现场障碍物的详细信息，包括需迁移的架空障碍物等，如在安装区域的架空电缆；
e) details of underground services, overhead cables, or site obstructions, including the necessity to relocate overhead obstructions such as power lines from the area of erection;
- f) 可运送到现场的构件在尺寸或重量方面的限制；
f) limitations on dimensions, or weights of components that can be delivered onto the site;
- g) 施工现场及其周边特殊的环境和气候条件；
g) special environmental, and climatic conditions on, and around the site;
- h) 影响工程或受工程影响的相邻建筑物的详细情况；
h) particulars of adjacent structures affecting, or affected by the works
- i) 有足够且合适的材料及构件堆放空间。
i) adequate and suitable storage space for material, and components.

现场平面图中应标明工地现场内的进出路线。包括储存区域、通道的尺寸和标高，以及现场道路和机械设备作业区的标高。

Access routes to the site and within the site shall be given in a site plan. This shall

show areas available for storage, dimensions and level of access routes, and level of the prepared working area for site traffic and plant.

如果钢结构工程与其他专业交叉,则钢结构工程安全技术要求应与其他专业协调统一。此项检查应视情况考虑以下各项内容:

If the structural steelwork is inter-linked with other trades, the coherence of technical requirements with respect to the safety of the structural steelwork should be coordinated with those for other parts of the construction works. This check shall consider the following items as relevant:

- j) 预先安排与其他施工方合作的工作流程,包括确定吊装设备是否可用;
- j) prearranged procedures for co-operation with other constructors, including availability of hoisting equipment;
- k) 现场服务的有效性;
- k) availability of site services;
- l) 对钢结构上允许的最大施工荷载和堆放荷载分析和确定。;
- l) analysis and definition of maximum construction and storage loads permitted on the steelwork;
- m) 在组合结构施工过程中对混凝土浇筑的控制(见国际标准 ISO 22966)。
- m) control of concrete placement during composite construction (see ISO 22966).

6.3 安装方法

6.3 Erection method

6.3.1 安装方法设计依据

6.3.1 Design basis for the erection method

如果局部安装状态下的结构稳定性无法保证,则应提供基于结构设计的安全安装方法。此安装方法应考虑以下事项:

If the structural stability in the part-erected condition is not evident, a safe method of erection on which the design was based shall be provided. This design basis method of erection shall consider the following items:

- a) 现场连接的位置和类型;
a) positions and types of site connections;;
- b) 最大构件尺寸、重量和位置;
b) maximum piece size, weight and location;
- c) 确定关键起吊作业, 如达到额定起重量一定比例的起吊作业和多台起重机协同起吊作业;
c) identification of critical lifts, such as lifts above a selected proportion of crane capacity and multi- crane lifts;
- d) 安装顺序;
d) sequence of erection;
- e) 保证部分已安装结构稳定性的方案, 包括临时支撑的技术要求;
e) stability concept for the part-erected structure, including any requirements for temporary bracing or propping (shoring);
- f) 组合结构分阶段浇筑混凝土时所采用的支撑或其他措施;
f) propping or other measures for the execution of phased concreting of composite structures;
- g) 拆除临时支撑的条件, 或对结构(包括地脚螺栓和锚杆)进行卸载或加载的任何要求;
g) conditions for removal of temporary bracing or propping, or any requirement for de-stressing or stressing the structure including foundation bolts and anchor rods;

- h) 施工过程中可能造成安全隐患的因素；
- h) features that can create a safety hazard during construction;

- i) 基础连接件或支座的调整以及灌浆的时机和方法；
- i) timing and method for adjustment of foundation connections or bearings and for grouting;

- j) 在加工制作阶段提供起拱和预调值的要求；
- j) camber and presets required in relation of those provided at fabrication stage;

- k) 使用隔板（如压型钢板、预制板）以确保结构稳定性；
- k) use of diaphragms (e.g. profiled steel sheeting, precast panel) to ensure stability;

- l) 使用横隔板来提供侧向约束；
- l) use of diaphragms to provide lateral restraint;

- m) 构件单元的运输，包括用于起吊、翻转或牵引的附属措施；
- m) transportation of units, including attachments for lifting, turning or pulling;

- n) 支撑和顶升的位置和条件；
- n) positions and conditions for supporting and jacking;

- o) 支座稳定性方案；
- o) stability concept for the bearings;

- p) 支撑的沉降预测值；
- p) expected settlements of the supports;

- q) 起重机、堆放构件、配重等在不同施工阶段的特定位置和荷载；
- q) particular positions and loads from, e.g. cranes, stored components, counterweight, for the various construction phases;

- r) 关于拉索的运输、存放、吊装、定位和预张拉的说明；
- r) instructions for the delivery, storage, lifting, positioning, and pretensioning of stay cables;
- s) 对已安装构件的变形控制采取措施，例如采用支撑、千斤顶或者在安装过程中动态调整荷载，以保证构件挠度和位置偏差在允许值范围内；
- s) actions required to account for deformations of the partly erected structure, such as the use of propping, jacks or loads that must be adjusted as erection progresses to set or maintain camber, position within the specified tolerances or prestress;
- t) 所有临时结构和永久结构连接附属构件的分析、设计和详细信息，并附有拆除说明。
- t) analysis, design and details of all temporary works and attachments to permanent works with instructions as to their removal.

6.3.2 施工方案说明

6.3.2 Constructor's erection method statement

施工方应编制安装技术方案，并依据设计规范对方案进行审核，尤其要检查部分已安装结构对施工荷载及其他荷载的承载力。

A method statement describing the constructor's erection method shall be prepared and it shall be checked in accordance with design rules, notably against resistance of the partly erected structure to erection loads and other loading.

当需要对设计阶段确定的施工方案进行调整时，应确保替代方案安全可靠。

The erection method statement may deviate from the design basis method of erection, provided that it is a safe alternative.

对安装方案的修改，包括因现场条件必须进行的修改，应按照上述要求进行审核。

Amendments to the erection method statement, including those necessitated by site conditions, shall be checked and reviewed in accordance with the above requirement.

安装方案应详细阐述钢结构的安全施工流程，并应包括确保结构自身安全的相关

技术要求。

The erection method statement shall describe procedures to be used to safely erect the steelwork and shall consider the technical requirements regarding the safety of the structural steelwork.

施工流程应与具体的作业指导书（书面或口头形式）相结合。

The procedures should link to specific work instructions, written or verbal as appropriate.

安装方案应包含第 6.3.1 节的所有相关项目，并且应根据实际情况考虑以下相关事项：

The erection method statement shall address all relevant items in 6.3.1, and shall also consider the following items as relevant:

a) 根据第 6.6.4 条规定进行的任何预拼装的经验；

a) experience from any trial assembly undertaken in accordance with 6.6.4;

b) 焊接前应采用有效约束措施确保结构稳定性，并控制接头的局部位移；

b) restraints necessary to ensure stability prior to welding and to control local movement of the joint;

c) 必要的起吊装置；

c) lifting devices necessary;

d) 在较大重量或不规则形状的构件上标记重量或重心位置，必要时应同时标记；

d) necessity to mark either weights or centres of gravity, or both, on large or irregularly shaped pieces;

e) 起重机的起吊重量与作业半径的关系；

e) relationship between the weights to be lifted and the radius of operation where cranes are to be used;

f) 识别摇摆或倾覆力，特别是在安装期间现场风荷载，以及保持构件稳定和抗

倾覆力的措施方案；

f) identification of sway or overturning forces, particularly those due to the predicted wind conditions on site during erection, and the exact methods of maintaining adequate sway and overturning resistance;

g) 降低已识别安全隐患风险的方法；

g) methods of minimizing risk from identified safety hazards;

h) 提供安全施工场地和安全通道。

h) provision of safe working positions and safe means of access to them。

对于钢混组合结构，还应满足以下要求：

In addition, the following apply for composite steel and concrete structures:

i) 排布组合楼板的压型钢板铺设方向，以确保钢梁能充分支撑钢板，并在后续工序前固定；

i) sequence of fixing of profiled steel sheeting for composite slabs shall be planned to ensure that sheets are adequately supported by supporting beams before fixing, and are securely fixed before they are used to gain access to subsequent working positions;

j) 除非压型钢板已按照 I) 的要求通过紧固件将其固定，否则压型钢板不得作为焊接抗剪连接件的作业通道；

j) profiled steel sheeting should not be used to gain access for welding of shear connectors unless the sheeting is secured already by fasteners in accordance with i);

k) 确定永久模板的铺设顺序、固定和封闭的方法，以确保在利用模板进行后续施工作业以及支撑楼板钢筋和板面混凝土之前，模板是牢固的。

k) sequence of placing and method of securing and sealing permanent formwork to ensure that formwork is secure before being used to gain access for subsequent construction operations and supporting slab reinforcement and deck concrete.

与混凝土工程施工相关的因素都应予以考虑，例如混凝土的浇筑顺序、施加预应

力的情况、钢材与新浇筑混凝土之间的温差、顶升操作以及支撑情况等。

Factors associated with the execution of the concrete works should be considered as relevant, such as sequence of placing concrete, pre-stressing, and temperature difference between steel and freshly placed concrete, jacking and supports.

6.4 测量

6.4 Survey

6.4.1 基准系统

6.4.1 Reference system

除非另有规定，钢结构的现场测量应按标准 ISO 4463-1 建立的施工放线测量系统为基准。

Unless otherwise specified, site measurements for the structural steelwork shall be related to the system established for the setting out and measurement of the construction works in accordance with ISO 4463-1.

应提供一份关于二级控制网（为控制建筑物而建立的测量控制网）的书面测量报告，并将其用作钢结构放样以及确定支座偏差的参考系统。如果此测量报告中给出的二级控制网坐标符合标准 ISO 4463-1 中规定的验收要求，则应认定这些坐标是准确的。

A documented survey of a secondary net (a survey grid established to control the building) shall be provided and used as the reference system for setting out the steelwork and establishing the deviations of supports. The coordinates of the secondary net given in this survey shall be accepted as true if they conform with the acceptance criteria given in ISO 4463-1.

当施工规范有要求时，应明确规定钢结构放线与测量的参考温度。

When required by the execution specification, the reference temperature for setting out and measuring the steelwork shall be specified.

6.4.2 标记点

6.4.2 Position points

标记各个构件安装预定位置的标记点应符合标准 ISO 4463-1 的规定。

The position points which mark the intended position for the erection of individual components shall be in accordance with ISO 4463-1

6.5 支座

6.5 Supports

6.5.1 概述

6.5.1 General

支座包括地脚螺栓、锚杆、锚固件、预埋板和支座装置。

Supports may include foundation bolts, anchor rods, anchors, embedded plates and bearings.

6.5.2 支座适用性的测量与记录

6.5.2 Measuring and documenting suitability of supports

应使用适当的目测和测量手段对支座的状况和位置进行检查，并且应在开始安装之前确认其适用性。在开始安装之前，应对不合适的支座进行校正。对于不符合要求的情况应进行记录，并且应向进行钢结构安装的施工人员提供相关记录。

The condition and location of the supports shall be checked using appropriate visual and measurement means and shall be confirmed as suitable before the commencement of erection. Unsuitable supports shall be corrected prior to the commencement of erection. Nonconformities shall be documented and records shall be available to the constructor performing steel erection.

所有用于支撑钢结构的支座都应准确安装就位，以便安装钢结构。结构支座的安装应符合相关标准、文件或产品制造商的说明或以上要求的组合。

All supports for the steelwork shall be suitably prepared to receive the steel structure. Installation of structural bearings shall conform with either the relevant standards or documents or product manufacturer's instructions, or combination thereof.

在支座位置与标高符合第 7 章验收标准，或已发布对指定要求的适当修订之前，不得开始安装作业。

Erection shall not commence until the location and levels of the supports are in accordance with the acceptance criteria in Clause 7, or an appropriate amendment to the specified requirements has been issued.

用于检查支座位置的测量工作应形成书面记录。

The survey used to check the positions of the supports shall be documented.

如果地脚螺栓需要施加预应力，应在施工方案中明确规定施工方法。

If foundation bolts are to be pre-stressed, methods and procedure requirements shall be specified in the execution specification.

6.5.3 支座适用性保证

6.5.3 Maintaining suitability of supports

在安装过程中，钢结构的支座应保持良好状态，以发挥其预期功能。

During erection, the supports for the steelwork shall be maintained in a condition to serve their intended function.

支座需防腐处理的部位应标识，并采取适当的防护措施。

Areas of supports that require protection against rust staining shall be identified and appropriate protection provided.

除非规范另有规定。允许对支座的沉降进行补偿。可通过在钢结构和支座之间进行注浆或增加垫片来补偿。

Compensation for settlement of supports is permitted, unless otherwise specified in the execution specification. This shall be done by grouting or packing between steelwork and support.

6.5.4 临时支撑

6.5.4 Temporary supports

底板下用作临时支撑的垫片、填块及其他支撑装置应与钢结构接触面保持平整，

支撑应具有足够的尺寸、强度和刚度，以避免下部混凝土结构或砌体的局部破坏。

Shims, packings and other supporting devices used as temporary supports under base plates shall present a flat surface to the steel and be of adequate size, strength and rigidity to avoid local crushing of the substructure concrete or masonry.

若垫片、填块等支撑装置后续需灌浆固定，其布置应确保灌浆层至少提供 25mm 侧向覆盖。施工规范另有规定的按其要求执行。

If shims, packings or other supporting devices are subsequently to be grouted, they shall be placed so that the grout will provide the packings with a minimum lateral cover of 25 mm, unless otherwise specified in the execution specification.

灌浆后永久保留的支撑装置，其材料耐久性应与结构本体相同。

If shims, packings or other supporting devices are left in position after grouting they shall be made from materials with the same durability as the structure.

如果通过底板下基础螺栓上的调平螺母来调整基座的位置，除非施工规范另有规定，这些调平螺母可以留在原位。所选的螺母应能维持部分已安装结构的稳定性，且不会影响基础螺栓在使用过程中的性能。

If adjustment to the position of the base is achieved using levelling nuts on the foundation bolts under the base plate, these may be left in position unless specified in the execution specification. The nuts shall be selected to ensure that they are suitable to maintain the stability of the part-erected structure without adversely affecting the performance of the foundation bolt in service.

可使用垫片、垫块、半螺母或塑料螺母来进行找平。

Shims, blocks, half-nuts or plastic nuts may be used for levelling.

6.5.5 灌浆

6.5.5 Grouting

灌浆作业应按照附录 B 的规定执行。

Grouting shall be carried out in accordance with Annex B.

6.5.6 锚固

6.5.6 Anchoring

本标准不涉及结构混凝土部件或相邻结构中的锚固装置, 这些锚固装置应按照其相关规范进行设置。

Anchoring devices in concrete parts of the structure or adjacent structures are not addressed by this document and shall be set in accordance with their specification.

6.6 现场安装和作业

6.6 Erection and work at site

6.6.1 安装图纸

6.6.1 Erection drawings

应提供安装图或相关说明, 将其作为施工方案的一部分(参见第 6.3.1 节和第 6.3.2 节)。

Erection drawings or equivalent instructions shall be provided and form a part of the erection method statement (see 6.3.1 and 6.3.2).

图纸应包含平面图和立面图, 并采用适当比例尺, 所有构件的安装编号均在图中清晰标注。

Drawings shall be prepared showing plans and elevations and at such a scale that the erection marks for all components can be shown on them.

图纸应包含轴网位置、支座位置和构件组装情况, 以及特殊公差要求和其他与本文件不同的参数要求。

Drawings shall show grid locations, bearing positions and assembly of components together with requirements for special tolerances and those that differ from the requirements of this document.

基础平面图应标明钢结构的基础位置和朝向, 与基础直接接触的任何构件和这些构件的基础位置和标高, 以及设计的支承标高和基准标高。基础平面图应包括柱脚支座和其他结构支座。

Foundation plans shall show the base location and orientation of the steelwork, any

other components in direct contact with the foundations, their base location and level, the intended bearing level and the datum level. Foundation plans shall include column base support and other structural supports.

立面图包括楼层、结构的标高。

Elevations shall show required levels for floors, structure, or both.

图纸应显示将钢材或螺栓固定至基础的必要细节、通过垫片和楔块进行调整的方法、灌浆要求，以及将钢结构和支座固定至支撑件上的相关细节。

Drawings shall show necessary details for fixing of steel or bolts to the foundations, the method of adjustment by packing and wedging, and grout requirements as well as fixing of steelwork and bearings to their supports.

图纸应详细标注施工所需的钢结构工程或其他临时工程的结构细部与布置方案，以确保施工过程的结构稳定性及人员安全性。

Drawings shall show details and arrangements of any steelwork or other temporary works necessary for erection purposes to ensure the stability of the construction or the safety of personnel.

图纸应说明所有超过 5 吨的构件重量，以及大型不规则构件的重心位置。

Drawings shall state the weight of all components or assemblies over five tonnes and the centre of gravity of all large irregular pieces.

6.6.2 标记

6.6.2 Marking

现场单独组装或安装的构件应作安装编号。若构件形状的方向不清晰，须标注其就位朝向。

Components that are individually assembled or erected at the site shall be allocated an erection mark. A component shall be marked with its erected orientation if this is not clear from its shape.

标记方法应符合标准 ISO 17607-3 中的规定。

Marking methods shall be in accordance with ISO 17607-3.

6.6.3 现场运输和储存

6.6.3 Handling and storage on site

钢构件、焊丝和螺栓的现场搬运和储存应分别符合标准 ISO 17607-3、ISO 17607-5 和 ISO 17607-6，同时也需符合以下规定。

Handling and storage of fabricated steel, filler metals and bolting products on site shall be in accordance with ISO 17607-3, ISO 17607-5, and ISO 17607-6 respectively, and those given below.

构件的搬运和堆放方式应尽量避免损坏。应特别注意吊装方法，以避免对钢结构及防护涂层造成破坏。

Components shall be handled and stacked in such a way that the likelihood of damage is minimized. Particular attention shall be paid to slinging methods to avoid damage to the steelwork and protective treatment.

在卸货、运输、储存或安装过程中损坏的钢结构应修复至符合要求的状态。

Steelwork damaged during off-loading, transportation, storage or erection shall be restored to conformity.

修复前应有明确修复方案。对于执行 EXL2、EXL3 和 EXL4 等级构件修复的情况，修复程序应形成记录文件。

The procedure for restoration shall be defined before undertaking the repair. For execution levels EXL2, EXL3 and EXL4, the procedure shall also be documented.

所有节点板和其他配件应妥善包装并做好标识。

All small plates and other fittings shall be suitably packed and identified.

6.6.4 预拼装

6.6.4 Trial assembly

现场预拼装应按照标准 ISO 17607-3 进行。预拼装应考虑以下方面：

Any site trial assembly shall be performed in accordance with ISO 17607-3. Trial assembly should be considered:

- a) 确认构件相互之间安装匹配;
a) to confirm fit between components;
- b) 当安装工序需要提前评估时, 论证施工方案, 保持安装过程中结构稳定;
b) to prove methodology to maintain stability during erection if the erection sequence needs evaluating in advance;
- c) 当现场存在作业时间限制时, 通过预拼装测算各工序耗时。
c) to prove duration of operations if site conditions are restricted by limited possession time.

6.6.5 安装方法

6.6.5 Erection methods

6.6.5.1 概述

6.6.5.1 General

钢结构安装作业应严格遵循安装方案的要求执行, 且须确保施工全过程的结构稳定性。

The erection of the steelwork shall be carried out in conformity with the erection method statement and in such a way as to ensure stability at all times.

未设缆风绳的立柱不得用基础锚栓固定防止其倾覆, 除非已通过受力验算。

Foundation bolts shall not be used to secure un-guyed columns against overturning unless they have been checked for this mode of use.

在结构安装过程中, 钢结构应具备安全性, 应能承受施工临时荷载, 包括安装设备自重或其操作荷载, 同时应能承受未完工结构所受风荷载。

Throughout the erection of the structure, the steelwork shall be made safe against temporary erection loads, including those due to erection equipment or its operation and against the effects of wind loads on the unfinished structure.

对于建筑物结构, 每个连接处至少安装三分之一的永久螺栓后, 方可认定该节点

可保证已安装结构的稳定性。在结构安装过程的稳定性分析中,应考虑并明确要求连接节点安装程度。

For buildings, at least one third of the permanent bolts in each connection should be installed before that connection can be considered to contribute to the stability of the partly completed structure. Further requirements for the degree of completion of connections shall be considered and defined in the stability analysis of the structure during erection.

6.6.5.2 临时工程

6.6.5.2 Temporary works

所有临时支撑及约束应安装就位,直到安装工程允许其安全拆除。

All temporary bracing and temporary restraints shall be left in position until erection is sufficiently advanced to allow their safe removal.

如果高层建筑中的支撑在安装过程中需要卸载,以消除竖向荷载在支撑中产生的应力,应逐个卸载。在卸载过程中,须设置足够的替代支撑以确保结构稳定性。如有必要,可临时增设附加支撑。

If bracings in tall buildings are required to be de-stressed as erection progresses, to release the forces induced in them by vertical loads, this shall be carried out progressively one panel at a time. During such de-stressing, sufficient alternative bracing shall be in place to ensure stability. If necessary, additional bracing shall be added temporarily for this purpose.

用于安装作业的临时构件连接方式应符合本标准规定,且不得削弱结构强度或影响使用功能。

All connections for temporary components provided for erection purposes shall be made in accordance with this document and in such a way that they do not weaken the permanent structure or impair its serviceability.

如果在焊接过程中使用临时支撑来固定结构,则应确保其满足承载力要求,并且其焊缝承载力能满足安装工况的荷载条件。

If temporary erection aids are used to support the structure during welding, it shall be

ensured that they are sufficiently strong and that their retaining welds are appropriate for the erection load conditions.

如果选用滚动或以其他方式移动就位的安装工序在组装后，应做好制动装置。

If the erection procedure involves rolling or otherwise moving the structure, or part of the structure, into its final position after assembly, provision shall be made for controlled braking of the moving mass.

所有临时锚固装置应确保牢固，防止意外松动。

All temporary anchoring devices shall be made secure against unintentional release.

液压千斤顶应具备负载状态位置锁定功能。否则须配置其他安全保护装置。

Jacks shall be capable of being locked in any position under load unless other safety provisions are made.

6.6.5.3 安装和校准

6.6.5.3 Fit-up and alignment

施工过程中须确保钢结构在构件堆放或安装荷载作用下不产生永久性变形或附加应力。

Care shall be taken that no part of the structure is permanently distorted or over-stressed by stacking of steelwork components or by erection loads during the erection process.

结构部件应在安装完成后尽快校准调整，并尽快完成最终组装。

Each part of the structure shall be aligned as soon as practicable after it has been erected and final assembly completed as soon as possible thereafter.

在结构已经找正、调平、校直并进行临时连接后，以确保构件在后续结构的安装过程中不会发生移位之前，才能在构件之间进行永久性连接。

Permanent connections shall not be made between components until a sufficient portion of the structure has been aligned, levelled, plumbed, and temporarily connected to ensure that components will not be displaced during subsequent erection

or alignment of the remainder of the structure.

结构对中及连接偏差可通过垫片进行调节。存在松动风险的垫片须采取固定措施。

Alignment of the structure and lack of fit in connections may be adjusted using shims.

Shims shall be secured where they are in danger of coming loose.

除非另有规定，垫片应由扁钢制成。垫片耐久性应同结构主体。

Shims shall be made of flat steel, unless otherwise specified. Shims shall have similar durability to that of the structure.

如果垫片用于表面覆盖涂层的结构校正，则垫片也应覆盖涂层保证其耐久性，除非垫片需要满足规定的摩擦面抗滑移系数。

If shims are used to align structures composed of coated material, the shims shall be protected in a similar manner to provide the specified durability unless the shims are required to meet a specified friction surface slip factor.

如果垫片不能纠正构件偏差，则应根据本文件对构件进行局部改造。改造不得影响结构在临时或永久状态下的性能。改造工作可以在现场进行。焊接格构构件和空间框架结构改造时应特别注意，以确保它们不会受到过大的力，改变其原有刚度。

If lack-of-fit between erected components cannot be corrected by the use of shims, components of the structure shall be locally modified in accordance with this document. The modifications shall not compromise the performance of the structure in the temporary or permanent state. This work may be executed on site. Care shall be taken with structures built of welded latticed components and space- frame structures to ensure that they are not subjected to excessive forces in an attempt to force a fit against their inherent rigidity.

孔的对准和螺栓连接工艺应符合标准 ISO 17607-3 和 ISO 17607-6。

Processes for aligning of holes and bolting shall be in accordance with ISO 17607-3 and ISO 17607-6.

6.6.5.4 承压型高强螺栓连接

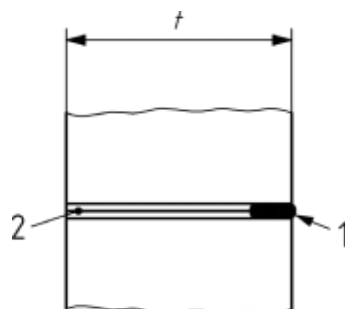
6.6.5.4 Bolted splices with full contact bearing

对于全接触承压的螺栓拼接，若已安装构件表面之间的装配间隙超过规定值时，在螺栓初拧后，若间隙仍超过规定限值，可使用垫片将间隙减小至允许偏差范围内。

Where full contact bearing is specified for bolted splices, and where the fit-up between surfaces of erected components exceeds the specified tolerance, shims may be used where the gap exceeds the specified limits after initial bolting-up, to reduce the gaps to within the permitted deviation.

除非另有规定，垫片可以用最厚为 3 毫米的低碳扁钢制成。任何一处不得使用超过三个垫片。如有必要，且在现行规范未禁止的情况下，如图 1 所示，垫片可通过角焊缝或部分熔透对接焊来固定。

Unless otherwise specified, the shims may be made of flat mild steel with a maximum thickness of 3mm. No more than three shims shall be used at any point. If necessary, and if not prohibited by the execution specification, the shims may be held in place by means of either fillet welds or a partial penetration butt weld extending over the shims, as shown in Figure 1.



关键

Key

t 构件厚度

t component thickness

1 部分透焊对接焊或角焊

1 partial penetration butt weld or fillet weld

2 垫片

2 shims

图 1 -全接触高强螺栓接头的垫片示意图

Figure 1 - Option for securing shims used for bolted splice in full contact bearing

7 几何公差

7 Geometrical tolerances

几何公差应在施工规范中予以规定。

Geometrical tolerances shall be specified in the execution specification.

附录 C、D、E 和 F 中列出的信息可用于施工规范中对几何公差的规定。

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

附录 C、D、E 和 F 列出了各国几何偏差的类型和要求，以及不同类型的允许偏差的数值：

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, E and F, for:

—建筑；

—Buildings;

—桥梁；

—Bridges;

—起重机轨道；

—Crane runways;

—混凝土基础和支架。

—Concrete foundations and supports.

所给出的允许偏差不包括构件自重引起的弹性变形。

The permitted deviations given do not include elastic deformations induced by the

self-weight of the components.

此外,特殊公差可以根据数值定义的几何偏差和用其他类型的几何偏差进行规定。

如果需要特殊公差,应提供下列资料:

In addition, 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, the following information shall be given as appropriate:

—已定义公差的修正值;

—amended values for tolerances already defined;

—要控制的几何偏差的参数和允许值;

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

—特殊公差是适用于所有相关构件,还是仅适用于指定的构件。

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

任何情况下都需要满足最终验收要求。如果在现场使用预制构件来搭建结构,除了预制构件本身的公差要求外,还必须明确已搭建好的结构最终检查时的公差要求。

In each case, the requirements are for final acceptance testing. If fabricated components are used on site to form/build a structure, the tolerances for the final check of the erected structure have to be defined in addition to the tolerances for the fabricated parts.

注:规范编制者可直接引用附录(C、D、E、F)。

NOTE The specifier can make direct reference to the Annexes (C, D, E, F).

8 检验、试验和校正

8 Inspection, testing and correction

8.1 概述

8.1 General

标准 ISO 17607-1 规定了检验、试验和校正的信息和要求。

ISO 17607-1 provides information and requirements for inspection, testing and correction.

8.2 安装

8.2 Erection

8.2.1 预拼装检验

8.2.1 Inspection of trial assembly

对于任何符合第 6.6.4 节规定的预拼装的检查要求均应予以明确说明。

Requirements for inspection of any trial assembly to 6.6.4 shall be specified.

8.2.2 已安装结构检验

8.2.2 Inspection of the erected structure

应对结构进行检查，确认所有构件均按正确位置和方向安装就位，同时节点连接符合施工规范要求。

The structure shall be inspected to confirm that all components are erected in the correct location and orientation, and that the connections are completed in conformance with the execution specification.

应对已安装完毕结构进行检查，查看是否有构件发生变形，并确保临时措施件已安全拆除。

The condition of the erected structure shall be inspected for any indication that components have been distorted, and to ensure that any temporary attachments have either been removed satisfactorily or are in accordance with the specified requirements.

8.2.3 连接节点几何位置测量

8.2.3 Survey of geometrical position of connection nodes

8.2.3.1 测量方法及精度

8.2.3.1 Survey methods and accuracy

应对结构进行测量。该测量应与二级测量(建筑测量控制网)相关。对于 EXL3 和 EXL4 级, 测量时应做好记录; 若有要求在结构验收时记录尺寸检查情况, 则应予以规定。

A survey of the structure shall be made. This survey shall be related to the secondary net (survey grid established to control the building). For EXL3 and EXL4 this survey shall be recorded; if there is a requirement to record dimensional checks at acceptance of the structure, this shall be specified.

应选择标准 ISO 7976-1 和标准 ISO 7976-2 中列出的测量方法和仪器。选择时需考虑测量精度与验收标准是否匹配。如适用, 应根据温度影响对测量结果进行修正, 并依据 ISO 17123 系列标准中相应分册的要求, 对第 6.4.1 节所述的测量精度进行评估。

Methods and instruments used shall be selected from those listed in ISO 7976-1 and ISO 7976-2. The selection shall take into account the capability of the survey process in terms of accuracy relative to the acceptance criteria. If appropriate, the survey shall be corrected for the effects of temperature and the accuracy of the measurements relative to that in 6.4.1 shall be estimated in accordance with the relevant parts of ISO 17123.

8.2.3.2 测量系统

8.2.3.2 System of measurement

允许偏差系统是由基准面(已确定的柱线)的位置点、柱垂直度的包络线和一系列中间和屋顶标高(称为竣工楼面标高)组成。

The system of permitted deviations is built up from position points at base level (established column line), an envelope for column verticality and a series of intermediate and roof levels referred to as-built floor levels.

注 1：定位点标明了各个构件的位置，例如柱子的位置（见 ISO 4463-1）。

NOTE 1 Position points mark the location of individual components, for example columns (see ISO 4463-1).

每个单独的值应与图和表中的值相一致。离散值的代数和不得大于总体结构的允许偏差。

Each individual value shall be in accordance with the values from the figures and tables. The algebraic sum of the discrete values shall not be greater than the permitted deviations for the total structure.

系统应规定对连接位置的要求，并规定公差。在这些位置之间，制造公差决定了允许的偏差。

The system shall set out requirements for positions of connections with defined tolerances. Between these positions the fabrication tolerances define permitted deviations.

注 2：该体系并未对诸如边柱和檩条等次要结构构件提出明确的要求。

NOTE 2 The system does not set out explicit requirements for secondary structural components such as side posts and purlins.

注 3：在与既有建筑结构进行连接时，需要特别注意确定（构件的）定位线和标高。

NOTE 3 Special attention will need to be given to establishing lines and levels when fitting to existing construction.

8.2.3.3 参考点和水平面

8.2.3.3 Reference points and levels

一般来说，安装公差应相对于每个构件上的以下参考点来进行规定：

Erection tolerances shall generally be specified relative to the following reference points on each component:

- a) 对于垂直 10° 以内的构件:构件两端的中心;
- a) for components within 10° of the vertical: the centre of the component at each end;
- b) 水平方向 45° 以内的组件(包括桁架顶部):每端上顶面中心;
- b) for components within 45° of the horizontal (including the tops of lattice trusses): the centre of the top surface at each end;;
- c) 对于组合格构式构件和桁架中的内部构件:每端构件的中心;
- c) for internal components in built-up lattice girders and trusses: the centre of the component at each end;;
- d) 其他构件:安装图中应注明参照点,参照点一般为主要受弯曲的构件的顶面或外表面,以及主要受直接压缩或拉伸的部件的中心线。
- d) for other components: the erection drawings shall indicate the reference points which shall generally be the top or outside surfaces of components mainly subject to bending and centre lines of components mainly subject to direct compression or tension.

为方便参考,如果其他参考点与上述规定的参考点具有类似作用,可用上述参考点来替换。

Alternative reference points may be substituted for ease of reference if they have similar effect to those specified above.

8.2.3.4 位置和频率

8.2.3.4 Location and frequency

仅对主要结构部件的节点进行测量。测量的位置和频率根据规范中的要求执行。

Measurements shall be taken only of the position site connection nodes for major structural components. The location and frequency of measurements shall be specified in the execution specification.

对于竣工结构，应确定与特殊公差相关的关键尺寸检查项目，并且这些检查项目应纳入检查计划中。

Critical dimensional checks of the as-built structure necessary in relation to special tolerances should be identified and these should be incorporated into the inspection plan.

项目施工过程中，应在钢结构自重以及该施工阶段的恒载作用下，对已安装钢结构的位置精度进行测量。测量结果应根据测量时的荷载和条件进行分析和调整。如果除钢结构自重之外的其他施加荷载会影响尺寸检查，那么还应明确说明测量时的其他条件，以及所导致的偏差和位移情况。

The positional accuracy of the erected steelwork shall be measured during construction of the project under self-weight of steelwork and dead loads expected during that stage of construction. Survey results shall be interpreted and adjusted in consideration of loads and conditions at the time of the survey. Other conditions under which the measurements take place shall be specified as well as the deviations and movements due to imposed loads, other than those due to self-weight of steelwork, if these can affect dimensional checks.

8.2.3.5 验收标准

8.2.3.5 Acceptance criteria

验收标准应在施工规范中予以明确规定。

The acceptance criteria shall be specified in the execution specification.

8.2.3.6 不合格项的定义

8.2.3.6 Definition of nonconformity

在评估是否存在不符合项时，应考虑 ISO 17607-1 规定的测量方法中不可避免的可变性。

Assessment of whether a nonconformity exists shall consider the inevitable variability

in methods of measurement calculated in accordance with ISO 17607-1.

ISO 3443-1、ISO 3443-2 和 ISO 3443-3 给出了建筑物公差和构件之间适配性差异的指南。

ISO 3443-1, ISO 3443-2 and ISO 3443-3 give guidance on tolerances for buildings and the implications of variabilities on the fit between components.

注:可变性包括制造、放样和安装偏差。

NOTE Variabilities include manufacturing, setting-out, and erection deviations.

施工精度的准确性应结合构件预期的挠度、起拱度、预调值、弹性变形以及热膨胀情况来考虑。

Accuracy of construction shall be interpreted in relation to the expected deflections, cambers, pre-sets, elastic movements, and thermal expansion of components.

若预计结构会发生显著位移并影响尺寸检查（如张拉结构），则需规定允许位置的包络范围。

If significant movement of a structure is anticipated that can affect dimensional checking (e.g. for tension structures) an envelope of permissible positions shall be specified.

8.2.3.7 不符合项处理

8.2.3.7 Action on nonconformity

应根据标准 ISO 17607-1 处理不合格项。同时使用本标准规定的方法进行校正。

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.

若钢结构交付时有未校正的不符合项，则应列出这些不符合项。

If a steel structure is handed over with uncorrected nonconformities awaiting action, these shall be listed.

8.2.4 其他验收测试

8.2.4 Other acceptance tests

若结构部件需在特定的负载条件下安装，而不是在特定的位置上，则应规定具体要求，如荷载的变化范围等。

If components of a structure are to be erected to a specific load, rather than position, detailed requirements, including tolerance range on the load, shall be specified.

9 符合本标准要求的证明文件

9 Documents required to claim conformity to these requirements

9.1 概述

9.1 General

承包商可通过以下方式声明符合本标准的规定：

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

—本标准中引用的 ISO 标准(视情况而定)。

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

—采用其他-其提供与引用的 ISO 标准文件同等技术条件。

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

除施工规范中另有说明，建造商有责任证明其所用标准或技术说明与相应的 ISO 标准具有同等效力。

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.

在施工之前，采用其他标准或文件应由规范编制者验证并批准，且应纳入施工规范中。

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 符合性声明

9.2 Declaration of conformity

声明符合这些要求的建造商应列出适用的配套标准或文件。

A constructor claiming conformity with these requirements shall list the applicable

supporting standards or documents.

附录 A

Annex A

(规范性附录)

(normative)

与施工等级相关的附加信息清单、选项清单和要求

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

A.1 附加信息一览表

A.1 List of required additional information

表 A.1 列出了本标准中根据具体情况需要提供的附加信息，以充分界定符合本标准的钢结构工程施工规范的要求（即“应予以规定”等用语出现的条款）。

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).

表 A.1 -附加信息

Table A.1 - Additional information

条款 Clause	所要求的附加信息 Additional information required
4	施工规范和质量要求 Execution specification and quality requirements
4.2	技术等效的国家标准和文件 Technically equivalent national standards and documents
4.2	与本标准要求差异 Deviations from the requirements of this document
4.2 d)	标识和可追溯性要求 Identification and traceability requirements

4.2 e)	几何公差 Geometrical tolerances
5	组成产品 Constituent products
5.1	伸缩缝的类型及特点 Type and characteristics of expansion joints
5.3.1	灌浆材料 Grouting materials to be used
5.4	伸缩装置的类型和性能要求 Requirements for type and characteristics of expansion joints
6	安装 Erection
6.3.1	与制造阶段提供的相关的起拱度和预调值要求 Camber and presets required in relation to those provided at manufacturing stage
6.4.1	钢结构放样和测量的参考温度 Reference temperature for setting out and measuring the steelwork
6.5.3	对需要保护的支撑区域的标识和适当保护措施 Identification and appropriate protection for areas of supports requiring protection
6.6.1	特殊公差要求 Requirements for special tolerances
6.6.5.4	初次紧固后，当间隙超过规定限值时，可使用垫片 Shims may be used where the gap exceeds the specified limits after initial bolting-up
7	几何公差 Geometrical tolerances
7	几何公差 Geometrical tolerances
8	检验、测试和校正 Inspection, testing and correction

8.2.1	预拼装检验要求 Requirements for inspection of trial assembly
8.2.3.3	相对于参考点的安装公差 Erection tolerances relative to reference points
8.2.3.4	测量的位置和频率 Location and frequency of measurements
8.2.3.5	验收标准 Acceptance criteria
9	符合本标准要求的证明文件 Documents required to claim conformity to these requirements
9.1	采用其他标准或文件的核实、批准及纳入 Verification and approval, incorporation of other standards or documents
9.2	列出适用的配套标准或者文件 List of the applicable and supporting documents

A.2 选项清单

A.2 List of options

表 A.2 列出了施工规范中应规定的选项，用于明确工程施工作业要求。

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.

表 A.2 — 选项清单

Table A.2 — List of options

条款	指定的选项 Option(s) to be specified
6	安装 Erection
6.5.1	钢结构放样与测量时的参考温度

	Reference temperature for setting out and measuring the steelwork
6.5.2	是否对螺栓进行预应力处理 If bolts are to be pre-stressed
6.5.3	是否允许对支撑的沉降进行补偿 If compensation for settlement of supports is permitted
6.5.4	如果后续要对垫片进行灌浆，是否可以放置垫片，使得灌浆材料不会完全包裹住它们 If packings subsequently to be grouted, may be placed so that the grout does not totally enclose them
6.5.4	桥梁垫片是否可以保留在原位 If packings for bridges may be left in position
6.5.4	底板下的锚栓的调平螺母是否会被移走 If levelling nuts on the foundation bolts under the base plate are to be removed
6.6.5.3	垫片材料是否与扁钢不一样 If material of shims is to be different from flat steel
7	几何公差 Geometrical tolerances
7	是否规定特殊公差 If special tolerances are specified
8	检验、测试和校正 Inspection, testing and correction
8.2.3.1	验收时是否需要进行详细尺寸的检查 If detailed specific dimensional checks at acceptance are required
8.2.3.4	当连接节点非现场连接节点时，应明确对该节点几何位置的测量范围 Extent of measurements for the survey of geometrical position of connection nodes if other than site interconnection nodes
8.2.3.4	钢结构自重以外的测量条件 Conditions of measurements other than under the self-weight of steelwork

8.2.3.6	<p>如果预计结构会发生可能影响尺寸检查的显著位移，规定允许的位置范围</p> <p>An envelope of permissible positions if significant movement of a structure is anticipated that could affect dimensional checking</p>
8.2.4	<p>如果构件要在特定的负载条件下安装，载荷的公差范围</p> <p>Tolerance range on the load, if components of a structure are to be erected to a specific load</p>
9	<p>符合本标准要求的证明文件</p> <p>Documents required to claim conformity to these requirements</p>
9.1	<p>证明所选的其他标准或文件与相应的 ISO 标准提供了同等的技术条件</p> <p>Demonstration that other standards or documents selected provide technically equivalent conditions to those in the corresponding ISO standards</p>
附录 B Annex B	<p>灌浆</p> <p>Grouting</p>
	<p>是否在稳定固定的支撑上进行捣实和夯实操作</p> <p>If tamping and ramming against properly fixed supports shall be used</p>
	<p>灌浆前是否需要对钢结构、支座和混凝土表面进行处理</p> <p>If treatment of steelwork, bearings and concrete surfaces is required before grouting</p>
附录 C Annex C	<p>几何公差——建筑物</p> <p>Geometrical tolerances – Buildings</p>
	<p>特殊公差</p> <p>Special tolerances</p>
附录 E Annex E	<p>几何公差-起重机轨道</p> <p>Geometrical tolerances - Crane runways</p>
	<p>特殊公差</p> <p>Special tolerances</p>

A.3 施工等级要求

A.3 Requirements related to the execution levels

本附录条款列出了本标准引用的施工等级要求。

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

表 A.3 中以粗体标明的条款与施工控制通用体系相关, 此类条款适用于整体钢结构工程(或某一阶段的钢结构工程)采用统一的施工等级。其余条款通常需要根据单个构件或连接细部逐一确定适用的执行等级。

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.

表 A.3 — 各施工等级的要求

Table A.3 — Requirements to each execution level

条款 Clauses	EXL1 ^a	EXL2 ^a	EXL3	EXL4
6 – 安装 6 – Erection				
6.6.3 现场运输和储存 6.6.3 Handling and storage on site	—	钢结构在卸载、运输、储存或安装过程中损坏时的修复流程 Procedure for restoration if steelwork damaged during off- loading, transportation, storage or erection		
8 - 检查、试验和修理 8 - Inspection, testing and repair				
8.2.3.1 连接节点几何位置的	—	测量记录		

测量 8.2.3.1 Survey of the geometrical position of connection nodes		Record of the survey
符号 “--” 表示文中无具体要求。 a dash "—" means no specific requirement in the text.		

附录 B

Annex B

(规范性附录)

(normative)

灌浆

Grouting

若对底板下方的空隙进行灌浆，应使用符合第 5.3 节以及制造商说明的材料。

If spaces under base plates are to be grouted, material shall be used in accordance with 5.3 and manufacturer's instructions. Grouting material shall be used as follows:

a) 应按照灌浆材料制造商的建议来混合和使用该材料，尤其要注意使用时材料的稠度。除非制造商的建议允许，否则在 0 摄氏度以下不得混合或使用该材料；

a) the material shall be mixed and used in accordance with grouting material manufacturer's recommendations, notably regarding its consistency when used. Material shall not be mixed or used below 0°C unless the manufacturer's recommendations permit this;

b) 应在合适的压力下灌注该材料，以便将空隙完全填满；

b) the material shall be poured under a suitable head so that the space is completely filled;

c) 如果灌浆制造商指定或推荐，则应对固定的支架进行夯实

c) tamping and ramming against properly fixed supports shall be used if either specified or recommended, or both, by the grout manufacturer;

d) 必要时应设置排气孔。

d) vent holes shall be provided, as necessary.

在灌浆前，钢底板下应无液体、冰、杂物和污染物。

Immediately before grouting, the space under the steel base plate shall be free from liquids, ice, debris and contaminants.

柱底板间隙应填充密实混凝土，其抗压强度特征值不低于周围混凝土。

Pocket bases containing columns shall be filled with dense concrete having a characteristic compressive strength not less than that of the surrounding concrete.

如果在灌浆前需要对钢结构、轴承和混凝土表面进行处理，应加以说明。

If treatment of steelwork, bearings and concrete surfaces is required before grouting, it shall be specified.

特别关注外部轮廓的灌浆允许水从钢结构构件中排出。

Care shall be taken that the external profile of grouting allows water to be drained away from structural steel components.

如果在使用过程中存在积水或腐蚀性液体残留的风险，柱底板周围的灌浆料不应过量填充，使其高于底板的最低表面，并且混凝土灌浆料形成的形状应，与底板形成符合图 B.1 要求的角度。

If there is a danger of water or corrosive liquid becoming entrapped during service, the grout around base plates shall not be surcharged such that it rises above the lowest surface of the base plate and the geometry of the concrete grout shall form an angle from the base plate in accordance with Figure B.1.

混凝土施工和灌浆作业应按照第 5.3 节以及国际标准 ISO 22966 的要求进行。

The concrete and the grouting shall be carried out in accordance with 5.3 and ISO 22966.

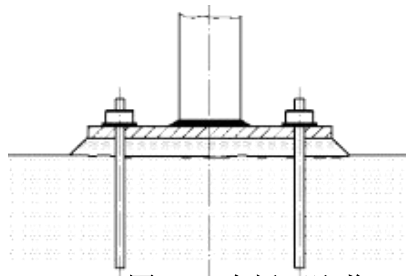


图 B.1 - 底板下注浆

Figure B.1 – Grouting under base plate

附录 C

Annex C

(资料性附录)

(informative)

几何公差-建筑物

Geometrical tolerances – Buildings

C.1 概述

C.1 General

建筑物中允许的几何公差分为六类:

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

— 概述

— General

— 建筑物中的梁

— Beams in buildings

— 单层建筑立柱

— Columns of single-storey buildings

— 多层建筑

— Multi-storey buildings

— 全接触端承面

— Full contact end-bearing

— 柱位

— Positions of columns

允许公差在以下标准中给出：

Permitted deviations are given in:

— 表 C.1:欧洲；

— Table C.1: Europe;

— 表 C.2:澳大利亚和新西兰；

— Table C.2: Australia and New Zealand;

— 表 C.3:加拿大；

— Table C.3: Canada;

— 表 C.4:中国；

— Table C.4: China;

— 表 C.5:日本；

— Table C.5: Japan;

— 表 C.6:俄罗斯；

— Table C.6: Russian Federation;

— 表 C.7:英国；

— Table C.7: United Kingdom;

— 表 C.8:美国

— Table C.8: United States

C.2 欧洲公差

C.2 Tolerances for Europe

除非另有说明，表 C.1 的参考标准是 EN 1090-2:2018。表 C.1 中的具体定义如下：

Unless otherwise noted, the reference standard for Table C.1 is EN 1090-2:2018.

Definitions specific to Table C.1 are:

a) 基本公差:

a) Essential tolerances:

基本公差对于结构的承载力和稳定性至关重要，因此必须满足。

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

b) 功能公差:

b) Functional tolerances:

功能公差是指满足装配和外观等其他标准所需的公差。

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

c) 一级公差:

c) Class 1:

除非执行规范中另有规定，否则应采用一级公差。

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

d) 二级公差:

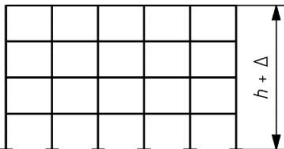
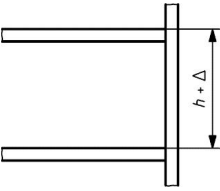
d) Class 2:

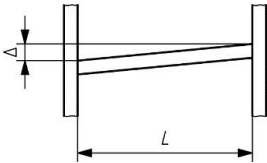
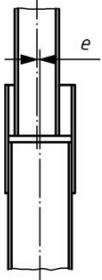
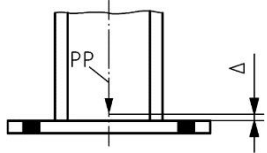
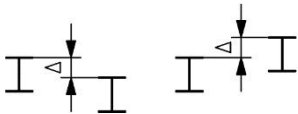
在更小的公差要求中可以采用二级公差代替一级公差，如安装玻璃幕墙。

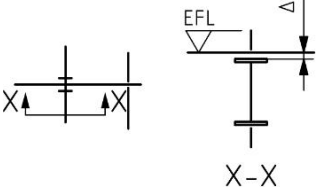
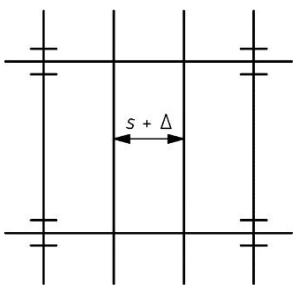
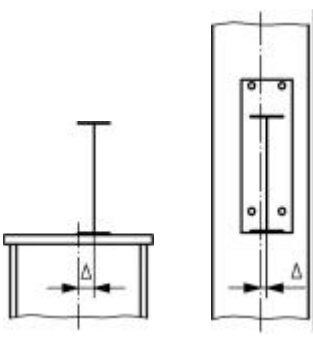
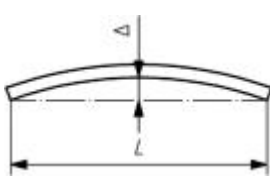
Tolerance Class 2 can substitute Class 1 if smaller tolerance deviations are required, for example if glazed facades are to be fitted.

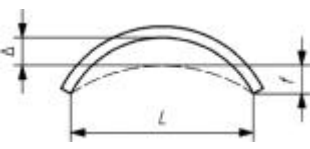
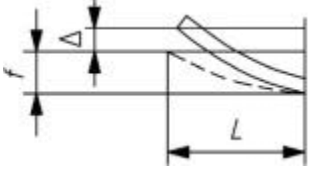
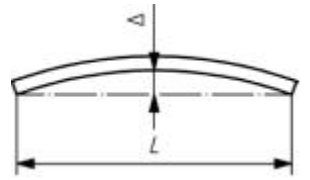
表 C.1 - 欧洲


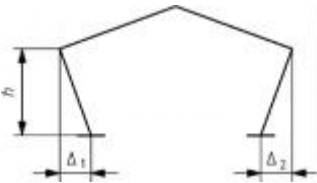
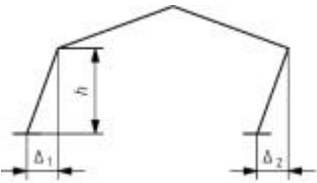
Table C.1 - Europe


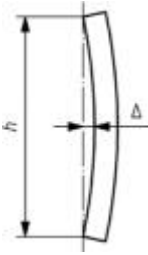
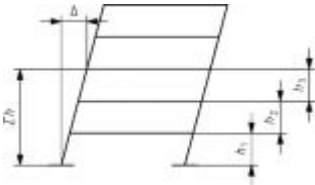
编号 No	标准 Criterion	参数 Parameter	基本公差 Essential tolerances	功能公差 Functional Tolerances	
			一级和二级 Class 1 and 2	一级 Class 1	二级 Class 2
1.	概述 General				
1.1	建筑总高度 Height 	相对于基准面的总高度 (h, 单位为 m): Overall height, relative to the base level(h in metres): (h, 单位为 m): $h \leq 20 \text{ m}$ $20 \text{ m} < h < 100 \text{ m}$ $h \geq 100 \text{ m}$		$\Delta = \pm 20 \text{ mm}$ $\Delta = \pm 0.5 (h+20)\text{mm}$ $\Delta = \pm 0.2 (h+200)\text{mm}$	$\Delta = \pm 20 \text{ mm}$ $\Delta = \pm 0.25 (h+20)\text{mm}$ $\Delta = \pm 0.2 (h+200)\text{mm}$
1.2	楼层高度 Storey height 	相对于相邻楼层的高度 Height relative to the adjacent levels		$\Delta = \pm 10 \text{ mm}$	$\Delta = \pm 5 \text{ mm}$

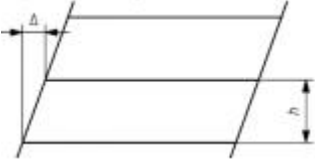
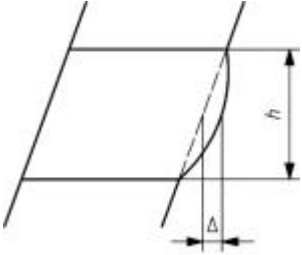
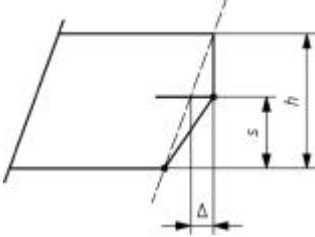
1.3	梁倾斜度 Slope 	相对于梁另一端的高度 偏差 Height relative to the other end of a beam		$\Delta = \pm L/500$, 且 $ \Delta \leq 10\text{mm}$ $\Delta = \pm L/500$, and $ \Delta \leq 10\text{mm}$	$\Delta = \pm L/1000$, 且 $ \Delta \leq 5\text{mm}$ $\Delta = \pm L/1000$, and $ \Delta \leq 5\text{mm}$
1.4	立柱拼接 Column splice 	任意轴的偏心率 e Non-intended eccentricity e about either axis		$e \leq 5\text{mm}$	$e \leq 3\text{mm}$
1.5	柱脚定位 Column base 	柱底部相对于其定位点 (PP) 设计标高的偏差 Level of bottom of column shaft, relative to specified level of its position point (PP)		$\Delta = \pm 5\text{mm}$	$\Delta = \pm 5\text{mm}$
1.6	相对标高 Relative levels 	相邻梁在对应端部测量 的标高 Levels of adjacent beams, measured at corresponding ends		$\Delta = \pm 10\text{mm}$	$\Delta = \pm 5\text{mm}$
1.7	连接标高 Connection levels 	相对于设计的楼板标高 (EFL) 测量，梁柱连接 处梁的标高 Level of the beam at a		$\Delta = \pm 10\text{mm}$	$\Delta = \pm 5\text{mm}$

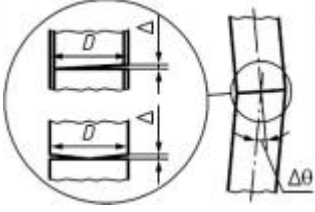
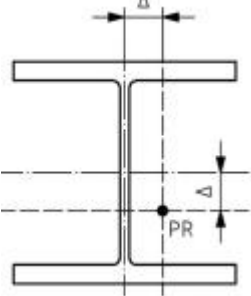
		beam-to-column connection, measured relative to the established floor level (EFL)			
2.	建筑物横梁 Beams in buildings				
2.1	梁中心线间距 Spacing between beam centrelines 	测量在相邻梁之间距离与设计距离 s 的偏差 Δ Deviation Δ from intended distance s between adjacent erected beams, measured at each end		$\Delta = \pm 10\text{mm}$	$\Delta = \pm 5\text{mm}$
2.2	立柱位置 Location at columns 	梁柱连接节点位置相对于柱轴线的偏差 Δ Deviation Δ from intended location of a beam-to column connection, measured relative to the column		$\Delta = \pm 5\text{mm}$	$\Delta = \pm 3\text{mm}$
2.3	梁平直度 Straightness in plan 	长度为 L 的梁或悬臂梁直线度偏差 Δ Deviation Δ from straightness of an erected beam or cantilever of length L		$\Delta = \pm L/500$	$\Delta = \pm L/1000$

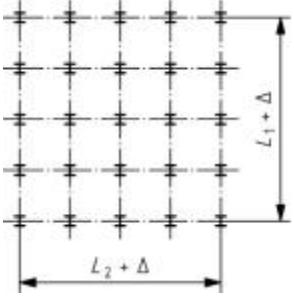

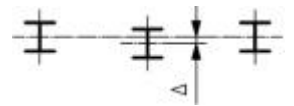
2.4	<p>起拱度 Camber</p> 	<p>长度为 L 的梁或格构构件在跨中处与设计起拱度 f 的偏差 Δ</p> <p>Deviation Δ at mid span from intended camber f of an erected beam or lattice component of length L</p>		$\Delta = \pm L/300$	$\Delta = \pm L/500$
2.5	<p>悬臂梁预起拱 Pre-set of cantilever</p> 	<p>长度为 L 的悬臂梁端部与拟定预调位置的偏差 Δ</p> <p>Deviation Δ from intended pre-set at end of an erected cantilever of length L</p>		$\Delta = \pm L/200$	$\Delta = \pm L/300$
2.6	<p>受弯梁和无约束受压构件的平直度 Straightness of beams subject to bending and components subject to compression if unrestrained</p> 	<p>相对于长度 L 的平直度偏差 Δ</p> <p>Deviation Δ from straightness relative to length L</p>	$\Delta = \pm L/1000$		
3.	<p>单层建筑立柱 Columns of Single Storey Buildings</p>				

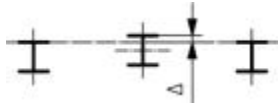
3.1	<p>单层建筑物柱倾斜度</p> <p>Inclination of columns of single storey buildings</p> 	<p>楼层高度 h 范围内的总倾斜度</p> <p>Overall inclination in storey height h</p>	$\Delta = \pm h/300$	$\Delta = \pm h/300$	$\Delta = \pm h/500$
3.2	<p>单层门式刚架中单柱的倾斜度</p> <p>Inclination of individual columns in single storey portal frame buildings</p> 	<p>各柱倾斜度 Δ</p> <p>Inclination Δ of each Column</p> <p>$\Delta = \Delta_1$ 或 Δ_2</p> <p>$\Delta = \Delta_1$ or Δ_2</p>	<p>无要求</p> <p>No requirement</p>	$\Delta = \pm h/150$	$\Delta = \pm h/300$
3.3	<p>单层门式刚架的倾斜度</p> <p>Inclination of single storey portal frame buildings</p> 	<p>同一框架中所有柱的平均倾斜度</p> <p>Average inclination of all the columns in the same frame</p> <p>(对于两根柱子平均值为 $\Delta = (\Delta_1 + \Delta_2)/2$)</p> <p>(For two columns the average is $\Delta = (\Delta_1 + \Delta_2)/2$)</p>	$\Delta = \pm h/500$	$\Delta = \pm h/500$	$\Delta = \pm h/500$

3.4	<p>支撑起重机龙门架的立柱的倾斜度</p> <p>Inclination of any column that supports a crane gantry</p> 	<p>从楼层平面到吊车梁支承的倾斜度</p> <p>Inclination from floor level to bearing of crane beam</p>	$\Delta = \pm h/1000$	$\Delta = \pm 25\text{mm}$	$\Delta = \pm 15\text{mm}$
3.5	<p>单层柱的直线度</p> <p>Straightness of a single storey column</p> 	<p>柱子在平面上相对于轴线偏差</p> <p>Location of the column in plan, relative to a straight line between position points at top and bottom</p>	$\Delta = \pm h/1000$	无要求 No requirement	无要求 No requirement
4.	<p>多层建筑</p> <p>Multi-storey buildings</p>				
4.1	<p>相对于基础以上 n 层的楼层平面位置</p> <p>Location at the storey level n levels above the base, relative to that at the base</p> 	<p>柱平面位置相对于基底中心垂直线</p> <p>Location of the column in plan, relative to a vertical line through its centre at base level</p>	$\Delta = \pm \sum h / (300\sqrt{n})$	$\Delta = \pm \sum h / (300\sqrt{n})$	$\Delta = \pm \sum h / (500\sqrt{n})$

4.2	<p>相邻楼层之间的柱倾斜度</p> <p>Inclination of a column, between adjacent storey levels</p> 	<p>在平面上，柱子相对于垂直直线偏差</p> <p>Location of the column in plan, relative to a vertical line through its centre at the next lower level:</p>	$\Delta = \pm h/300$	$\Delta = \pm h/300$	$\Delta = \pm h/500$
4.3	<p>相邻楼层之间连续柱的直线度</p> <p>Straightness of a continuous column between adjacent storey levels</p> 	<p>在平面上，柱子相对于相邻楼层位置点之间直线的偏差</p> <p>Location of the column in plan, relative to a straight line between position points at adjacent storey levels</p>	$\Delta = \pm h/1000$	$\Delta = \pm h/1000$	$\Delta = \pm h/1000$
4.4	<p>相邻楼层之间拼接柱的直线度</p> <p>Straightness of a spliced column, between adjacent storey levels</p> 	<p>在平面上，柱子拼接处位置相对于相邻楼层位置点之间直线的偏差</p> <p>Location of the column in plan at the splice, relative to a straight line between position points at adjacent storey levels</p>	$\Delta = s/1000,$ $s \leq h/2$	$\Delta = s/1000,$ $s \leq h/2$	$\Delta = \pm s/1000,$ $s \leq h/2$
5.	<p>全接触端承面</p> <p>Full contact end-bearing</p>				

5.1	<p>立柱拼接对齐和支承面之间的间隙</p> <p>Column splice alignment and gap between bearing surfaces</p> 	<p>在“X”点处出现间隙 Δ 的同时发生的局部角度偏差 $\Delta \theta$</p> <p>Local angular misalignment $\Delta \theta$ occurring at the same time as gap Δ at point "X"</p>	<p>$\Delta \theta = \pm 1/500$, 且至少在 2/3 的面积上最大间隙 $\Delta = 0.5\text{mm}$,</p> <p>$\Delta \theta = \pm 1/500$, and $\Delta = 0,5\text{ mm}$ maximum over at least 2/3 of the area,</p> <p>局部最大间隙 $\Delta = 1.0\text{mm}$ and $\Delta = 1,0\text{ mm}$ maximum locally</p>	无要求 No requirement	无要求 No requirement
6.	<p>柱位</p> <p>Positions of columns</p>				
6.1	<p>位置</p> <p>Location</p> 	<p>柱子底部中心在平面上相对于参考定位点（PR）的位置</p> <p>Location in plan of the centre of the column at the level of its base, relative to the position point of reference (PR)</p>		$\Delta = \pm 10\text{mm}$	$\Delta = \pm 5\text{mm}$

6.2	<p>建筑物总长度 Overall length of a building</p> 	<p>底层每行端柱之间的距离 (L, 单位为 m)</p> <p>$L \leq 30\text{m}$ $30\text{m} < L < 250\text{m}$ $L \geq 250\text{m}$</p> <p>Distance between end columns in each line, at base level (L in metres)</p> <p>$L \leq 30\text{ m}$ $30\text{ m} < L < 250\text{ m}$ $L \geq 250\text{ m}$</p>		<p>$\Delta = \pm 20\text{mm}$</p> <p>$\Delta = \pm 0.25$ (L+50) mm</p> <p>$\Delta = \pm 0.1$ (L+500) mm</p>	<p>$\Delta = \pm 16\text{mm}$</p> <p>$\Delta = \pm 0.2$ (L+50) mm</p> <p>$\Delta = \pm 0.1$ (L+350) mm</p>
6.3	<p>柱间距 Column spacing</p> 	<p>底层相邻立柱中心之间的距离: (L, 单位为 m)</p> <p>$L \leq 5\text{m}$ $L > 5\text{m}$</p> <p>Distance between centres of adjacent columns at base level: (L in metres)</p> <p>$L \leq 5\text{ m}$ $L > 5\text{ m}$</p>		<p>$\Delta = \pm 10\text{mm}$</p> <p>$\Delta = \pm 0.2$ (L+45) mm</p>	<p>$\Delta = \pm 7\text{mm}$</p> <p>$\Delta = \pm 0.2$ (L+30) mm</p>
6.4	<p>柱中心对齐 Column alignment generally</p> 	<p>柱底中心相对于定位轴线 (ECL) 的偏差位置 Location of the centre of the column at base level, relative to the established column line (ECL)</p>		<p>$\Delta = \pm 10\text{mm}$</p>	<p>$\Delta = \pm 7\text{mm}$</p>

6.5	边柱对齐 Perimeter column alignment 	底层边柱外表面相对于 相邻立柱外表面的距离 Location of the outer face of a perimeter column at base level, relative to the line joining the faces of the adjacent columns		$\Delta = \pm 10\text{mm}$	$\Delta = \pm 7\text{mm}$
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C.3 澳大利亚和新西兰公差

C.3 Tolerances for Australia and New Zealand

除非另有说明，表 C.2 的参考标准为 AS/NZS 5131:2020。表 C.2 特有的定义是：

Unless otherwise noted, the reference standard for Table C.2 is AS/NZS 5131:2020.

Definitions specific to Table C.2 are:

a) 基本公差:

a) Essential tolerances:

为满足结构在设计承载能力和稳定性方面的设计假定所需的几何公差的基本限值 (见 AS 4100, AS 51006 和 NZS 3404)。

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 5100.6 and NZS 3404).

b) 功能公差:

b) Functional tolerances:

指除基本公差所涉及的功能之外，为满足其他功能（如外观或装配方面的功能）所需的公差。。

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

c) 一级公差:

c) Class 1:

除非执行规范中另有规定，否则应采用一级公差。

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

d) 二级公差:

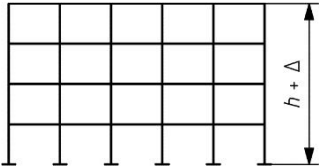
d) Class 2

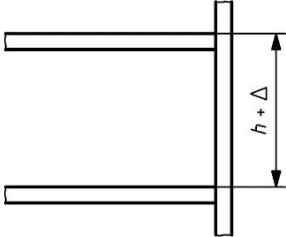
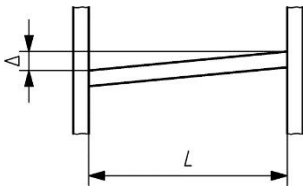
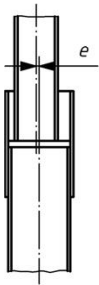
在更小的公差要求中可以采用二级公差代替一级公差，如安装玻璃幕墙。

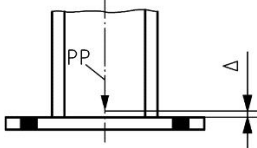
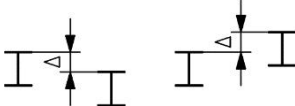
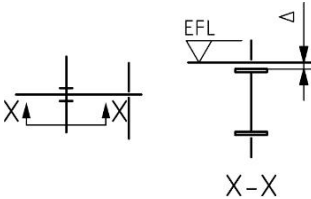
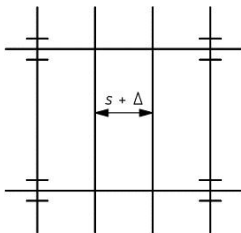
Tolerance Class 2 can substitute for Class 1 if smaller tolerance deviations are required, for example if glazed facades are to be fitted.

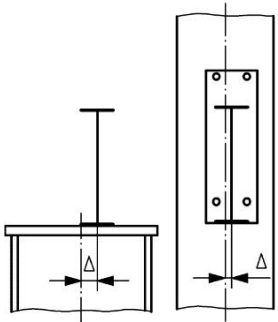
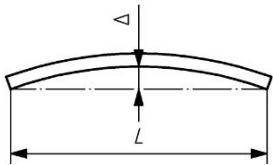
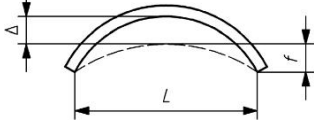
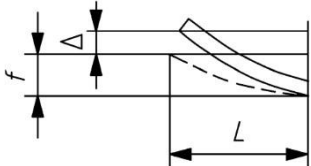
表 C.2 -澳大利亚和新西兰

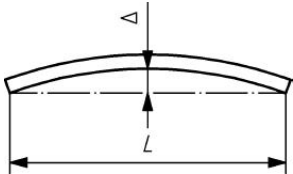
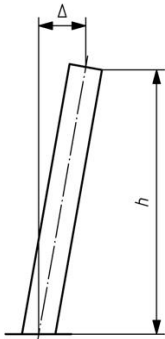
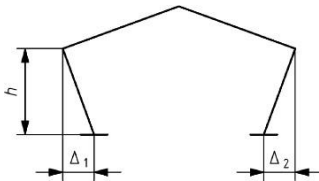
Table C.2 - Australia and New Zealand

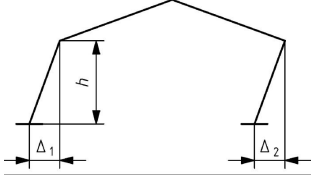
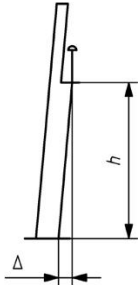
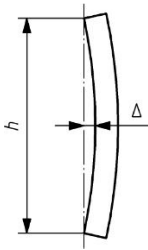
编号 No	标准 Criterion	参数 Parameter	基本公差 Essential tolerances	功能公差 Functional Tolerances	
			一级和二级 Class 1 and 2	一级 Class 1	二级 Class 2
1.	概述 General				
1.1	建筑总高度 Height 	相对于基准面的总高度: (h, 单位为 m) Overall height, relative to the base level: (h in metres) $h \leq 30 \text{ m}$ $h \geq 30 \text{ m}$ $h \leq 20 \text{ m}$	$\Delta = \pm 20 \text{ mm}$ $\Delta = \pm [20 + 0.25 (h - 30)] \text{ mm}$	$\Delta = \pm 20 \text{ mm}$	$\Delta = \pm 10 \text{ mm}$

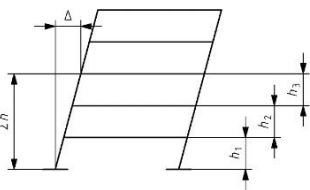
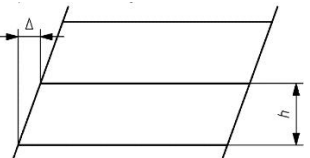
		$20\text{ m} < h < 100\text{ m}$ $h \geq 100\text{ m}$		$\Delta = \pm 0.5$ $(h+20)\text{ mm}$ $\Delta = \pm 0.2$ $(h+200)$ mm	$\Delta = \pm 0.25$ $(h+20)\text{ mm}$ $\Delta = \pm 0.1$ $(h+200)\text{ mm}$
1.2	楼层高度 Storey height 	相对于相邻楼层的高度 Height relative to the adjacent levels	$\Delta = \pm 20\text{ mm}$	$\Delta = \pm 10\text{ mm}$	$\Delta = \pm 5\text{ mm}$
1.3	梁倾斜度 Slope 	相对于梁另一端的高度偏差 Height relative to the other end of a beam	$\Delta = \pm L/500$, 和 $ \Delta \leq 10\text{ mm}$	$\Delta = \pm$ $L/500$, 和 $ \Delta \leq 10\text{ mm}$	$\Delta = \pm L/1000$, 和 $ \Delta \leq 5\text{ mm}$
1.4	立柱拼接 Column splice 	沿任意轴的偏心率 e Non-intended eccentricity e about either axis	2mm	5mm	3mm
1.5	柱脚定位 Column base	柱底部相对于其定位点 (PP) 设计标高的偏差 Level of bottom of column	$\Delta = \pm 10\text{ mm}$	$\Delta = \pm 5\text{ mm}$	$\Delta = \pm 5\text{ mm}$

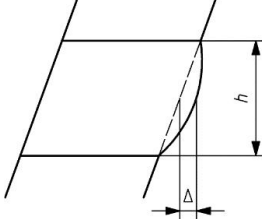
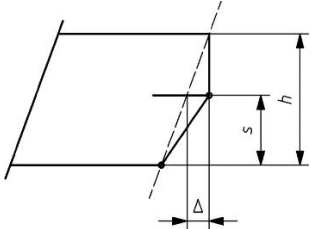
		shaft, relative to specified level of its position point (PP)			
1.6	<p>相对标高 Relative levels</p> 	<p>相邻梁在对应端部测量的标高 Levels of adjacent beams, measured at corresponding ends</p>	$\Delta = \pm 10\text{mm}$	$\Delta = \pm 10\text{mm}$	$\Delta = \pm 5\text{mm}$
1.7	<p>连接标高 Connection levels</p> 	<p>相对于设计的楼板标高（EFL）测量，梁柱连接处梁的标高 Level of the beam at a beam-to-column connection, measured relative to the established floor level (EFL)</p>	$\Delta = \pm 10\text{mm}$	$\Delta = \pm 10\text{mm}$	$\Delta = \pm 5\text{mm}$
2.	<p>建筑物横梁 Beams in buildings</p>				
2.1	<p>梁中心线间距 Spacing between beam centrelines</p> 	<p>在每端测量的相邻梁之间距离与设计距离 s 的偏差 Δ Deviation Δ from intended distance (s) between adjacent erected beams, measured at each end</p>		$\Delta = \pm 10\text{mm}$	$\Delta = \pm 5\text{mm}$

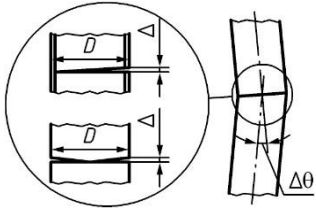
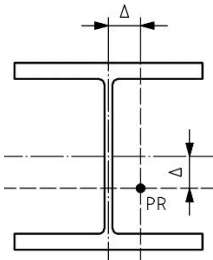
2.2	<p>立柱位置</p> <p>Location at columns</p> 	<p>梁柱连接节点位置相对于柱轴线的偏差 Δ</p> <p>Deviation Δ from intended location of a beam-to column connection, measured relative to the column</p>	$\Delta = \pm 3\text{mm}$	$\Delta = \pm 5\text{mm}$	$\Delta = \pm 3\text{mm}$
2.3	<p>梁平直度</p> <p>Straightness in plan</p> 	<p>长度为 L 的梁或悬臂梁直线度偏差 Δ</p> <p>Deviation Δ from straightness of an erected beam or cantilever of length L</p>	$\Delta = \pm L/500$	$\Delta = \pm L/500$	$\Delta = \pm L/1000$
2.4	<p>起拱度</p> <p>Camber</p> 	<p>长度为 L 的梁或格构构件在跨中处与预期起拱度 f 的偏差 Δ</p> <p>Deviation Δ at mid span from intended camber f of an erected beam or lattice component of length L</p>	无要求 No requirement	无要求 No requirement	无要求 No requirement
2.5	<p>悬臂梁预起拱</p> <p>Pre-set of cantilever</p> 	<p>长度为 L 的悬臂梁端部与设计预调位置的偏差 Δ</p> <p>Deviation Δ from intended pre-set at end of an erected cantilever of length L</p>	无要求 No requirement	无要求 No requirement	无要求 No requirement

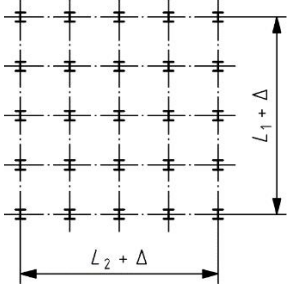
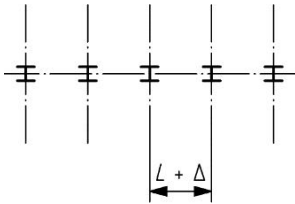
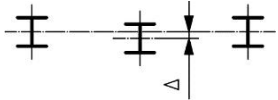
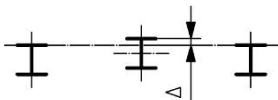
2.6	<p>受弯梁和无约束受压构件的平直度</p> <p>Straightness of beams subject to bending and components subject to compression if unrestrained</p> 	<p>平直度偏差 Δ</p> <p>Deviation Δ from straightness</p>	无要求 No requirement	无要求 No requirement	无要求 No requirement
3.	<p>单层建筑立柱</p> <p>Columns of Single Storey Buildings</p>				
3.1	<p>单层建筑物柱倾斜度</p> <p>Inclination of columns of single storey buildings</p> 	<p>楼层高度 h 范围内的总倾斜度</p> <p>Overall inclination in storey height h</p>	$\Delta = \pm h/500$	$\Delta = \pm h/300$	$\Delta = \pm h/500$
3.2	<p>单层门式刚架中单柱的倾斜度</p> <p>Inclination of individual columns in single storey portal frame buildings</p> 	<p>各柱倾斜度 Δ</p> <p>$\Delta = \Delta_1$ 或 Δ_2</p> <p>Inclination Δ of each column</p> <p>$\Delta = \Delta_1$ or Δ_2</p>	无要求 No requirement	无要求 No requirement	无要求 No requirement

3.3	<p>单层门式刚架的倾斜度</p> <p>Inclination of single storey portal frame buildings</p> 	<p>同一框架中所有柱的平均倾斜度</p> <p>Average inclination of all the columns in the same frame</p> <p>(对于两根柱子平均值为</p> $\Delta = (\Delta_1 + \Delta_2)/2)$ <p>(For two columns, the average is</p> $\Delta = (\Delta_1 + \Delta_2)/2)$	无要求 No requirement	无要求 No requirement	无要求 No requirement
3.4	<p>支撑起重机龙门架的立柱倾斜度</p> <p>Inclination of any column that supports a crane gantry</p> 	<p>从楼层平面到吊车梁支座的倾斜度</p> <p>Inclination from floor level to bearing of crane beam</p>	无要求 No requirement	无要求 No requirement	无要求 No requirement
3.5	<p>单层柱的直线度</p> <p>Straightness of a single storey column</p> 	<p>柱子在平面上相对于轴线偏差</p> <p>Location of the column in plan, relative to a straight line between position points at top and bottom:</p>	$\Delta = \pm h/1000$	无要求 No requirement	无要求 No requirement

4.	多层建筑 Multi-storey buildings				
4.1	<p>相对于基础以上 n 层的楼层平面位置</p> <p>Location at the storey level n levels above the base, relative to that at the base</p> 	<p>柱平面位置相对于基底中心垂直线:</p> <p>Location of the column in plan, relative to a vertical line through its centre at base level:</p> <p>距基础 < 60m 的点</p> <p>距基础 > 60m 的点</p> <p>距基础任意高度的点</p> <p>Point < 60m above base</p> <p>Point > 60m above base</p> <p>Point at any height above base</p>	<p>$\Delta = \pm \sum h/500, \leq 25\text{mm}$</p> <p>$\Delta = \pm \sum h/500, \leq 25 + (\sum h - 60) / 3\text{mm}$</p>	<p>$\Delta = \pm \sum h / (300\sqrt{n})$</p>	<p>$\Delta = \pm \sum h / (500\sqrt{n})$</p>
4.2	<p>相邻楼层之间的柱倾斜度</p> <p>Inclination of a column, between adjacent storey levels</p> 	<p>在平面上，柱子相对于垂直线偏差</p> <p>Location of the column in plan, relative to a vertical line through its centre at the next lower level</p>	<p>$\Delta = \pm h/500$</p>	<p>$\Delta = \pm h/500$</p>	<p>$\Delta = \pm h/1000$</p>

4.3	<p>相邻楼层之间连续柱的直线度</p> <p>Straightness of a continuous column between adjacent storey levels</p> 	<p>在平面上，柱子相对于相邻楼层位置点之间直线的偏差</p> <p>Location of the column in plan, relative to a straight line between position points at adjacent storey levels</p>	$\Delta = \pm h/500$	$\Delta = \pm h/750$	$\Delta = \pm h/1000$
4.4	<p>相邻楼层之间拼接柱的直线度</p> <p>Straightness of a spliced column, between adjacent storey levels</p> 	<p>在平面上，柱子拼接处相对于相邻楼层位置点之间直线的偏差</p> <p>Location of the column in plan at the splice, relative to a straight line between position points at adjacent storey levels</p>	$\Delta = \pm s/1000,$ $s \leq h/2$	$\Delta = \pm s/750,$ $s \leq h/2$	$\Delta = \pm s/1000,$ $s \leq h/2$
5.	<p>全接触端承面</p> <p>Full contact end-bearing</p>				

5.1	<p>立柱拼接对齐和支承面之间的间隙</p> <p>Column splice alignment and gap between bearing surfaces</p> 	<p>在“X”点处出现间隙 Δ 的同时发生的局部角度偏差 $\Delta \theta$</p> <p>Local angular misalignment $\Delta \theta$ occurring at the same time as gap Δ at point "X"</p>	<p>$\Delta \theta = \pm 1/500$, 且至少在 2/3 的面积上最大间隙 $\Delta = 0.5\text{mm}$, $\Delta \theta = \pm 1/500$ radians, and $\Delta = 0,5 \text{ mm}$ over at least 67% of the area,</p> <p>局部最大间隙 $\Delta = 1.0\text{mm}$ $\Delta = 1,0 \text{ mm}$ and $\Delta = 1,0 \text{ mm}$ maximum locally</p>	无要求 No requirement	无要求 No requirement
6.	<p>柱位</p> <p>Positions of columns</p>				
6.1	<p>位置</p> <p>Location</p> 	<p>柱子底部中心在平面上相对于参考定位点（PR）的位置</p> <p>Location in plan of the centre of the column at the level of its base, relative to the position point of reference (PR)</p>	$\Delta = \pm 6\text{mm}$	$\Delta = \pm 10\text{mm}$	$\Delta = \pm 5\text{mm}$

6.2	<p>建筑物总长度 Overall length of a building</p> 	<p>底层每行端柱之间的距离 (L, 单位为 m) Distance between end columns in each line, at base level (L in metres) $L \leq 30 \text{ m}$ $30 \text{ m} < L < 250 \text{ m}$ $L \geq 250 \text{ m}$</p>	$\Delta = \pm 20 \text{ mm}$ $\Delta = \pm [20 + 0.25 (L - 30)] \text{ mm}$ $\Delta = \pm [20 + 0.25 (L - 30)] \text{ mm}$	$\Delta = \pm 20 \text{ mm}$ $\Delta = \pm 0.25 (L + 50) \text{ mm}$ $\Delta = \pm 0.1 (L + 500) \text{ mm}$	$\Delta = \pm 16 \text{ mm}$ $\Delta = \pm 0.2 (L + 50) \text{ mm}$ $\Delta = \pm 0.1 (L + 350) \text{ mm}$
6.3	<p>柱间距 Column spacing</p> 	<p>底层相邻立柱中心之间的距离: (L, 单位为 m) Distance between centres of adjacent columns at base level: (L in metres) $L \leq 5 \text{ m}$ $L > 5 \text{ m}$</p>		$\Delta = \pm 10 \text{ mm}$ $\Delta = \pm 0.2 (L + 45) \text{ mm}$	$\Delta = \pm 7 \text{ mm}$ $\Delta = \pm 0.2 (L + 30) \text{ mm}$
6.4	<p>柱中心对齐 Column alignment generally</p> 	<p>底层柱子中心相对于设计柱列线 (ECL) 的位置 Location of the centre of the column at base level, relative to the established column line (ECL)</p>	$\Delta = \pm 15 \text{ mm}$	$\Delta = \pm 10 \text{ mm}$	$\Delta = \pm 7 \text{ mm}$
6.5	<p>边柱对齐 Perimeter column alignment</p> 	<p>底层边柱外表面相对于相邻立柱外表面的距离 Location of the outer face of a perimeter column at base level, relative to the line joining the faces of the</p>	<p>无要求 No requirement</p>	<p>无要求 No requirement</p>	<p>无要求 No requirement</p>

		adjacent columns			
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C.4 加拿大公差

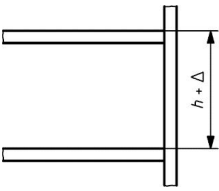
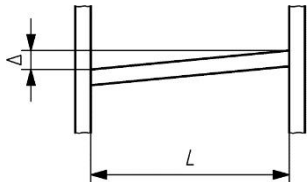
C.4 Tolerances for Canada

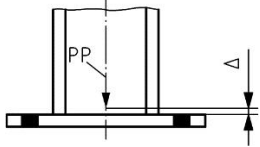
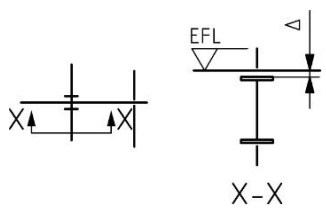
除非另有说明，表 C.3 的参考标准为 CSA S16:2019。

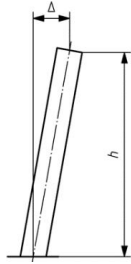
Unless otherwise noted, the reference standard for Table C.3 is CSA S16:2019.

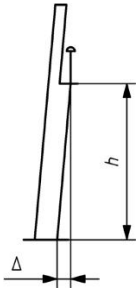
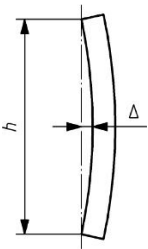
表 C.3 -加拿大

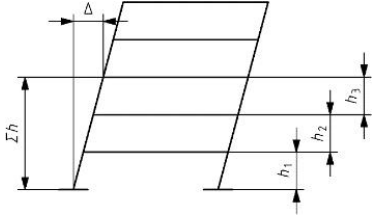
Table C.3 - Canada

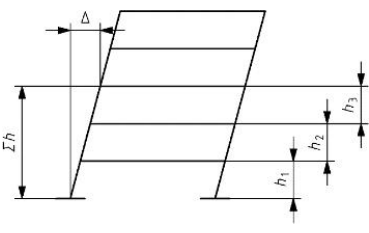
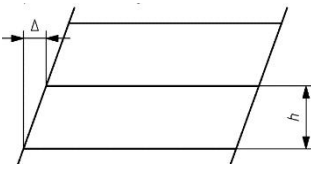
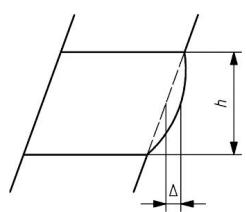
编号 No.	标准 Criterion	参数 Parameter	公差 Tolerances
1.	概述 General		
1.1	高度 Height	—	无要求 No requirement
1.2	楼层高度 Storey height 	相对于相邻楼层的高度 Height relative to the adjacent levels	$\Delta = \pm 10\text{mm}$
1.3	梁倾斜度 Slope 	相对于梁另一端的高度偏差 Height relative to the other end of a beam	$\Delta = \pm L/500$, 和 $ \Delta \leq 6\text{mm}$ $\Delta = \pm L/500$, and $ \Delta \leq 6\text{mm}$

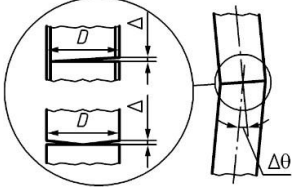
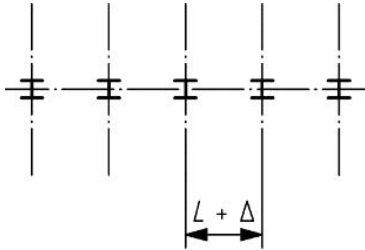
1.4	立柱拼接 Column splice	对齐后的最大允许间距 Maximum allowable separation after alignment	6mm	
1.5	柱脚定位 Column base 	柱底部相对于其定位点（PP）设计标高的偏差 Level of bottom of column shaft, relative to specified level of its position point (PP)	简易结构 Simple construction	$\Delta = \pm 5\text{mm}$
			连续结构 Continuous construction	$\Delta = \pm 3\text{mm}$
1.6	相对标高 Relative levels	—	无要求 No requirement	
1.7	连接标高 Connection levels 	相对于设计的楼板标高（EFL）测量，梁柱连接处梁的标高 Level of the beam at a beam-to-column connection, measured relative to the established floor level (EFL)	$\Delta = \pm 6\text{mm}$	
2.	建筑物横梁 Beams in buildings			
2.1	梁中心线间距 Spacing between beam centrelines	—	无要求 No requirement	
2.2	立柱位置 Location at columns	—	无要求 No requirement	
2.3	梁平直度 Straightness in plan	—	无要求 No requirement	
2.4	起拱度 Camber	—	无要求 No requirement	

2.5	悬臂梁预起拱 Pre-set of cantilever	—	无要求 No requirement
2.6	受弯梁和无约束受压构件的平直度 Straightness of beams subject to bending and components subject to compression if unrestrained	—	无要求 No requirement
2.7	梁偏移 Offset of beam	梁在端部偏移量（边梁除外） Offset of one beam end relative to another (except spandrel beams)	$\Delta = \pm L/500$, 和 $ \Delta \leq 12\text{mm}$ $\Delta = \pm L/500$, and $ \Delta \leq 12\text{mm}$
2.8	边梁的偏移 Offset of spandrel beam	边梁在端部偏移量 Offset of spandrel beam end relative to another	$\Delta = \pm L/1000$, 和 $ \Delta \leq 6\text{mm}$ $\Delta = \pm L/1000$, and $ \Delta \leq 6\text{mm}$
3.	单层建筑立柱 Columns of Single Storey Buildings		
3.1	单层建筑物柱倾斜度 Inclination of columns of single storey buildings 	楼层高度 h 范围内的总倾斜度 Overall inclination in storey height h	$\Delta = \pm h/500$

3.2	<p>单层门式刚架中单柱的倾斜度</p> <p>Inclination of individual columns in single storey portal frame buildings</p>	—	<p>无要求</p> <p>No requirement</p>
3.3	<p>单层门式刚架倾斜度</p> <p>Inclination of single storey portal frame buildings</p>	—	<p>无要求</p> <p>No requirement</p>
3.4	<p>支撑起重机龙门架的立柱的倾斜度</p> <p>Inclination of any column that supports a crane gantry</p> 	<p>从楼层平面到吊车梁支座的倾斜度</p> <p>Inclination from floor level to bearing of crane beam</p>	<p>$\Delta = \pm h/1000$, 且 $\Delta \leq 6\text{mm}$, 但不必是小于 3mm</p> <p>$\Delta = \pm h/1000$, and $\Delta \leq 6\text{mm}$, but need not be less than 3 mm</p>
3.5	<p>单层柱的直线度</p> <p>Straightness of a single storey column</p> 	<p>柱子在平面上相对于轴线偏差</p> <p>Location of the column in plan, relative to a straight line between position points at top and bottom</p>	<p>$\Delta = \pm h/1000$</p>
4.	<p>多层建筑</p> <p>Multi-storey buildings</p>		

<p>4.1</p>	<p>相对于基础以上 n 层的楼层平面位置</p> <p>Location at the storey level n levels above the base, relative to that at the base</p> 	<p>柱平面位置相对于基底中心垂直线</p> <p>Location of the exterior column in plan, relative to a vertical line through its centre at base level</p> <p>对于 n ≤ 20 层 for n ≤ 20 storeys</p> <p>对于 n > 20 层 for n > 20 storeys</p>	<p>-朝向建筑边线（外部） +背离建筑边线（外部）</p> <p>-indicates toward building line (exterior) +indicates away from building line (exterior)</p> <p>$\Delta = \pm \Sigma h/1000$, 且 $-25\text{mm} \leq \Delta \leq +50\text{mm}$</p> <p>$\Delta = \pm \Sigma h/1000$, and $-25\text{mm} \leq \Delta \leq +50\text{mm}$</p> <p>$\Delta = \pm \Sigma h/1000$, 且 $\pm \Sigma h/1000 \pm (n-20) 2\text{mm}$, 且 $-50\text{mm} \leq \Delta \leq +75\text{mm}$</p> <p>$\Delta = \pm \Sigma h/1000$, and $\pm \Sigma h/1000 \pm (n-20) 2\text{mm}$, and $-50\text{mm} \leq \Delta \leq +75\text{mm}$</p>
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4.1a	<p>相对于基础以上 n 层的楼层平面位置</p> <p>Location at the storey level n levels above the base, relative to that at the base</p> 	<p>在平面图中，相对于通过电梯井底部中心的垂直线，与电梯井相邻的柱子的位置</p> <p>Location of the columns adjacent to elevator shafts in plan, relative to a vertical line through its centre at base level</p> <p>对于 n ≤ 20 层 for n ≤ 20 storeys</p> <p>对于 n > 20 层 for n > 20 storeys</p>	<p>$\Delta = \pm \sum h/1000$, 且 $\Delta \leq 25\text{mm}$</p> <p>$\Delta = \pm \sum h/1000$, and $\Delta \leq 25\text{mm}$</p> <p>$\Delta = \pm \sum h/1000$, 且</p> <p>$\Delta \leq (n-20) \text{ mm}$, 且 $-50\text{mm} \leq \Delta \leq +50\text{mm}$</p> <p>$\Delta = \pm \sum h/1000$, and</p> <p>$\Delta \leq (n-20) \text{ mm}$, and $-50\text{mm} \leq \Delta \leq +50\text{mm}$</p>
4.2	<p>相邻楼层之间的柱倾斜度</p> <p>Inclination of a column, between adjacent storey levels:</p> 	<p>在平面上，柱子相对于垂直线偏差</p> <p>Location of the column in plan, relative to a vertical line through its centre at the next lower level</p>	<p>$\Delta = \pm h/500$</p>
4.3	<p>相邻楼层之间连续柱的直线度:</p> <p>Straightness of a continuous column between adjacent storey levels:</p> 	<p>在平面上，柱子相对于相邻楼层位置点之间直线的偏差</p> <p>Location of the column in plan, relative to a straight line between position points at adjacent storey levels</p>	<p>$\Delta = \pm h/1000$</p>

4.4	<p>相邻楼层之间拼接柱的直线度</p> <p>Straightness of a spliced column, between adjacent storey levels</p>	—	<p>无要求</p> <p>No requirement</p>
5.	<p>全接触端承面</p> <p>Full contact end-bearing</p>		
5.1	<p>立柱拼接对齐和支承面之间的间隙</p> <p>Column splice alignment and gap between bearing surfaces</p> 	<p>在“X”点处出现间隙Δ的同时发生的局部角度偏差Δθ</p> <p>Local angular misalignment Δθ occurring at the same time as gap Δ at point "X"</p>	<p>$\Delta \theta = \pm 2/500$, 且 $\Delta = 6\text{mm}$[1/4 英寸] (如果有垫片) 或 $\Delta = 2\text{mm}$[1/16 英寸] (如未设置垫片)</p> <p>$\Delta \theta = \pm 2/500$, and $\Delta = 6\text{mm}$[1/4in] (if shimmed) or $\Delta = 2\text{mm}$[1/16in] (if unshimmed)</p>
6.	<p>柱位</p> <p>Positions of columns</p>		
6.1	<p>位置</p> <p>Location</p>	—	<p>无要求</p> <p>No requirement</p>
6.2	<p>建筑物总长度</p> <p>Overall length of a building</p>	—	<p>无要求</p> <p>No requirement</p>
6.3	<p>柱间距</p> <p>Column spacing</p> 	<p>底层相邻立柱中心之间的距离:</p> <p>Distance between centres of adjacent columns at base level:</p> <p>(L, 单位为 m)</p> <p>(L in metres)</p> <p>$L \leq 5\text{m}$</p> <p>$L > 5\text{m}$</p>	<p>$\Delta = \pm 10\text{mm}$</p> <p>$\Delta = \pm 0.2 (L+45) \text{ mm}$</p>

6.4	柱中心对齐 Column alignment, generally	—	无要求 No requirement
6.5	边柱对齐 Perimeter column, alignment	—	无要求 No requirement

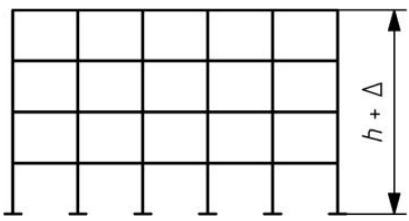
C.5 中国公差

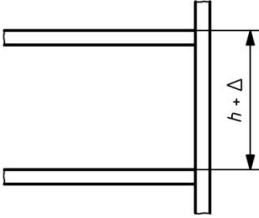
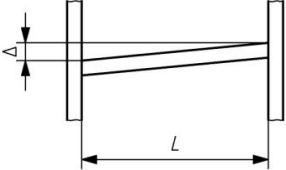

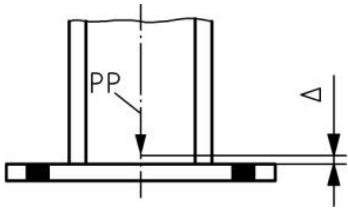
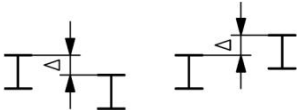
C.5 Tolerances for China

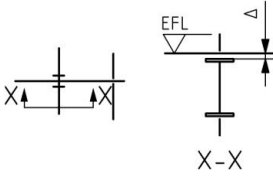
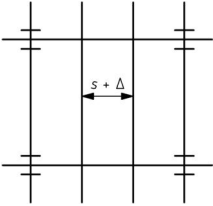
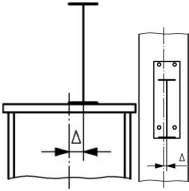
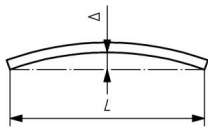
除非另有说明，表 C.4 的参考标准为 GB 50205:2020。

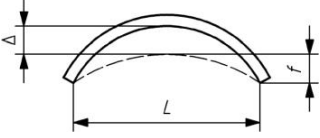
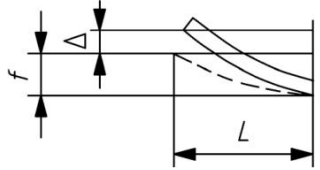
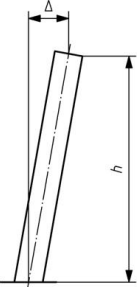
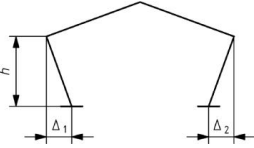
Unless otherwise noted, the reference standard for Table C.4 is GB 50205:2020.

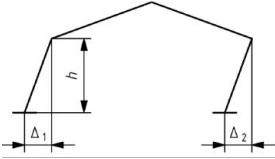
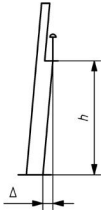
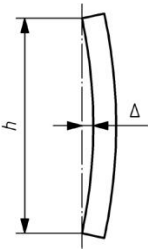
表 C.4 -中国
Table C.4 - China

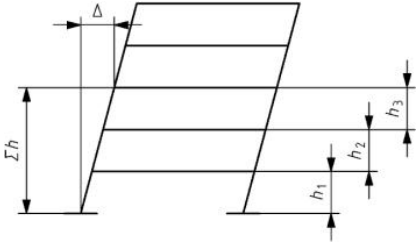
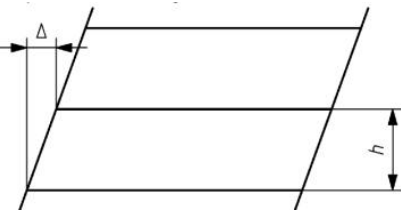
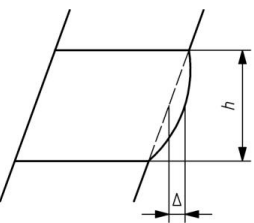
编号 No.	标准 Criterion	参数 Parameter	公差 Tolerances
1.	概述 General		
1.1	高度 Height 	相对于基准面的总高度： Overall height, relative to the base level: $h \leq 20\text{m}$ $20\text{m} < h < 60\text{m}$ $60\text{m} < h < 100\text{m}$ $h \geq 100\text{m}$	$\Delta = \pm h/1000, \Delta_{\max} = 20\text{mm}$ $\Delta = \pm h/1000, \Delta_{\max} = 30\text{mm}$ $\Delta = \pm h/1000, \Delta_{\max} = 50\text{mm}$ $\Delta = \pm h/1000, \Delta_{\max} = 100\text{mm}$

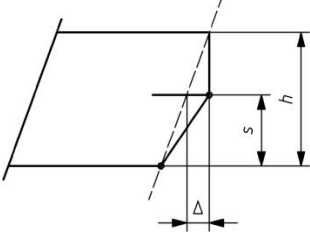
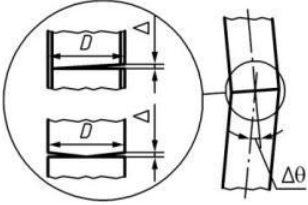
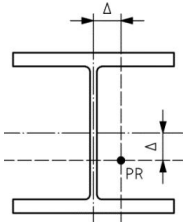
1.2	<p>楼层高度 Storey height</p> 	<p>相对于相邻楼层的高度 Height relative to the adjacent levels</p>	$\Delta = \pm 3\text{mm}$
1.3	<p>梁倾斜度 Slope</p> 	<p>相对于梁另一端的高度偏差 Height relative to the other end of a beam</p>	$\Delta = \pm L/1000,$ 且 $ \Delta \leq 10\text{mm}$ $\Delta = \pm L/1000,$ and $ \Delta \leq 10\text{mm}$
1.4	<p>立柱拼接 Column splice</p> 	<p>任意轴的偏心率 e Non-intended eccentricity e about either axis</p>	$e \leq 3\text{mm}$
1.5	<p>柱脚定位 Column base</p> 	<p>柱底部相对于其定位点 (PP) 设计标高的偏差 Level of bottom of column shaft, relative to specified level of its position point (PP)</p>	$\Delta = \pm 3\text{mm}$
1.6	<p>相对标高 Relative levels</p> 	<p>相邻梁在对应端部测量的标高 Levels of adjacent beams, measured at corresponding ends</p>	$\Delta = \pm 10\text{mm}$

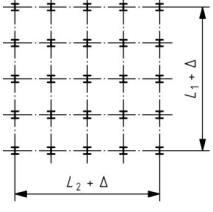
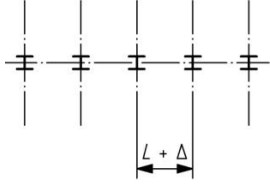
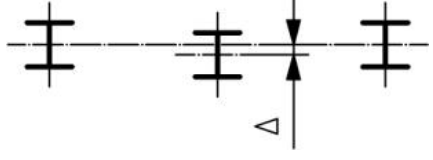
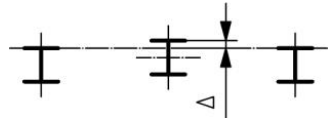
1.7	<p>连接标高 Connection levels</p> 	<p>相对于设计的楼板标高 (EFL) 测量, 梁柱连接处梁的标高 Level of the beam at a beam-to-column connection, measured relative to the established floor level (EFL)</p>	<p>$\Delta = \pm 3\text{mm}$</p>
2.	<p>建筑物横梁 Beams in buildings</p>		
2.1	<p>梁中心线间距 Spacing between beam centrelines</p> 	<p>在每端测量的相邻梁之间距 离与设计距离 s 的偏差 Δ Deviation Δ from intended distance (s) between adjacent erected beams, measured at each end</p>	<p>$\Delta = \pm 3\text{mm}$</p>
2.2	<p>立柱位置 Location at columns</p> 	<p>梁柱连接节点位置相对于柱 轴线的偏差 Δ Deviation Δ from intended location of a beam-to column connection, measured relative to the column</p>	<p>$\Delta = \pm 5\text{mm}$</p>
2.3	<p>梁平直度 Straightness in plan</p> 	<p>长度为 L 的梁或悬臂梁直线度 偏差 Δ Deviation Δ from straightness of an erected beam or cantilever of length L</p>	<p>$\Delta = \pm L/2000$, 且 $\Delta_{\max} = 10\text{mm}$ $\Delta = \pm L/2000$, and $\Delta_{\max} = 10\text{mm}$</p>

2.4	<p>起拱度 Camber</p> 	<p>长度为L的梁或格构构件在跨中处与设计起拱度f的偏差Δ Deviation Δ at mid span from intended camber f of an erected beam or lattice component of length L</p>	<p>$\Delta = \pm L/1000$, 且 $\Delta_{\max}=10\text{mm}$, 以及 $\Delta_{\min}=-5\text{mm}$</p> <p>$\Delta = \pm L/1000$, and $\Delta_{\max}=10\text{mm}$, and $\Delta_{\min}=-5\text{mm}$</p>
2.5	<p>悬臂梁预起拱 Pre-set of cantilever</p> 	<p>长度为L的悬臂梁端部与设计预起拱位置的偏差Δ Deviation Δ from intended pre-set at end of an erected cantilever of length L</p>	<p>$\Delta = \pm L/300$, 且 $\Delta_{\max}=4\text{mm}$</p> <p>$\Delta = \pm L/300$, and $\Delta_{\max}=4\text{mm}$</p>
3.	<p>单层建筑立柱 Columns of Single Storey Buildings</p>		
3.1	<p>单层建筑物柱倾斜度 Inclination of columns of single storey buildings</p> 	<p>楼层高度h内的总倾斜度 Overall inclination in storey height h</p>	<p>$\Delta = \pm h/1000$, 且 $\Delta_{\max}=25\text{mm}$</p> <p>$\Delta = \pm h/1000$, and $\Delta_{\max}=25\text{mm}$</p>
3.2	<p>单层门式刚架中单柱的倾斜度 Inclination of individual columns in single storey portal frame buildings</p> 	<p>各柱倾斜度Δ Inclination Δ of each Column</p> <p>$\Delta = \Delta_1$ 或 Δ_2 $\Delta = \Delta_1$ or Δ_2</p>	<p>$\Delta = \pm h/500$, 且 $\Delta_{\max}=25\text{mm}$</p> <p>$\Delta = \pm h/500$, and $\Delta_{\max}=25\text{mm}$</p>

3.3	<p>单层门式刚架结构倾斜度 Inclination of single storey portal frame buildings</p> 	<p>同一框架中所有柱的平均倾斜度 Average inclination of all the columns in the same frame</p> <p>(对于两根柱子, 平均值 $\Delta = (\Delta_1 + \Delta_2)/2$) (For two columns the average is $\Delta = (\Delta_1 + \Delta_2)/2$)</p>	<p>$\Delta = \pm h/500$, 且 $\Delta_{\max} = 25\text{mm}$</p> <p>$\Delta = \pm h/500$, and $\Delta_{\max} = 25\text{mm}$</p>
3.4	<p>支撑起重机龙门架立柱的倾斜度 Inclination of any column that supports a crane gantry</p> 	<p>从楼层平面到吊车梁支座的倾斜度 Inclination from floor level to bearing of crane beam</p>	<p>$\Delta = \pm h/1000$, 且 $\Delta_{\max} = 10\text{mm}$</p> <p>$\Delta = \pm h/1000$, and $\Delta_{\max} = 10\text{mm}$</p>
3.5	<p>单层柱的直线度 Straightness of a single storey column</p> 	<p>柱子在平面上相对于轴线偏差 Location of the column in plan, relative to a straight line between position points at top and bottom</p>	<p>$\Delta = \pm h/1000$, 且 $\Delta_{\max} = 12\text{mm}$</p> <p>$\Delta = \pm h/1000$, and $\Delta_{\max} = 12\text{mm}$</p>
4.	<p>多层建筑 Multi-storey buildings</p>		

4.1	<p>相对于基础以上 n 层的楼层平面位置</p> <p>Location at the storey level n levels above the base, relative to that at the base</p> 	<p>柱平面位置相对于基底中心垂直线: (h, 单位为 m)</p> <p>Location of the column in plan, relative to a vertical line through its centre at base level: (h in metres)</p> <p>$h \leq 20\text{m}$ $20\text{m} < h < 60\text{m}$ $60\text{m} < h < 100\text{m}$ $h \geq 100\text{m}$</p>	<p>$\Delta = \sum h/1000,$ $\Delta_{\max} = 25\text{mm}$</p> <p>$\Delta = \sum h/2500 + 10,$ $\Delta_{\max} = 30\text{mm}$</p> <p>$\Delta = \sum h/2500 + 10,$ $\Delta_{\max} = 50\text{mm}$</p> <p>$\Delta = \sum h/1000,$ $\Delta_{\max} = 80\text{mm}$</p>
4.2	<p>相邻楼层之间的柱倾斜度</p> <p>Inclination of a column, between adjacent storey levels</p> 	<p>在平面上, 柱子相对于垂直线偏差</p> <p>Location of the column in plan, relative to a vertical line through its centre at the next lower level</p>	<p>$\Delta = \pm h/1000,$ 且 $\Delta_{\max} = 10\text{mm}$</p> <p>$\Delta = \pm h/1000,$ and $\Delta_{\max} = 10\text{mm}$</p>
4.3	<p>相邻楼层之间连续柱的直线度</p> <p>Straightness of a continuous column between adjacent storey levels</p> 	<p>在平面上, 柱子相对于相邻楼层位置点之间直线的偏差</p> <p>Location of the column in plan, relative to a straight line between position points at adjacent storey levels</p>	<p>$\Delta = \pm h/1000,$ 且 $\Delta_{\max} = 10\text{mm}$</p> <p>$\Delta = \pm h/1000,$ and $\Delta_{\max} = 10\text{mm}$</p>

4.4	<p>相邻楼层之间拼接柱的直线度 Straightness of a spliced column, between adjacent storey levels</p> 	<p>在平面上，柱子拼接处相对于 相邻楼层位置点之间直线的 偏差 Location of the column in plan at the splice, relative to a straight line between position points at adjacent storey levels</p>	<p>$\Delta = \pm h/1000$, 且 $\Delta_{\max}=10\text{mm}$ $\Delta = \pm h/1000$, and $\Delta_{\max}=10\text{mm}$</p>
5.	<p>全接触端承面 Full contact end-bearing</p>		
5.1	<p>柱拼接对齐和支承面之间的间隙 Column splice alignment and gap between bearing surfaces</p> 	<p>在“X”点处出现间隙 Δ 的 同时发生的局部角度偏差 $\Delta \theta$ Local angular misalignment $\Delta \theta$ occurring at the same time as gap Δ at point "X"</p>	<p>$\Delta \theta = \pm 1/500$, 且至少在 2/3 的面积上最大间隙 Δ $=0.8\text{mm}$, $\Delta \theta = \pm 1/500$, and $\Delta = 0,8 \text{ mm}$ over at least 2/3 of the area 局部最大间隙 $\Delta = 0.8\text{mm}$ $\Delta = 0.8 \text{ mm}$ maximum locally</p>
6.	<p>柱位 Positions of columns</p>		
6.1	<p>位置 Location</p> 	<p>柱子底部中心在平面上相对 于参考定位点（PR）的位置偏 差 Location in plan of the centre of the column at the level of its base, relative to the position point of reference (PR)</p>	<p>$\Delta = \pm 3\text{mm}$</p>

6.2	<p>建筑物总长度 Overall length of a building</p> 	<p>底层每行端柱之间的距离 Distance between end columns in each line, at base level</p>	<p>$\Delta = L/20000$, 且 $\Delta_{\max} = 3\text{mm}$</p> <p>$\Delta = L/20000$, and $\Delta_{\max} = 3\text{mm}$</p>
6.3	<p>柱间距 Column spacing</p> 	<p>底层相邻立柱中心之间的距离: Distance between centres of adjacent columns at base level: $L \leq 5\text{m}$ $L > 5\text{m}$</p>	<p>$\Delta = \pm 4\text{mm}$ $\Delta = \pm 4\text{mm}$</p>
6.4	<p>柱中心对齐 Column alignment generally</p> 	<p>底层柱子中心相对于设计柱列线（ECL）的位置 Location of the centre of the column at base level, relative to the established column line (ECL)</p>	<p>$\Delta = \pm 3\text{mm}$</p>
6.5	<p>边柱对齐 Perimeter column alignment</p> 	<p>底层边柱外表面相对于相邻立柱外表面的距离 Location of the outer face of a perimeter column at base level, relative to the line joining the faces of the adjacent columns</p>	<p>$\Delta = \pm 5\text{mm}$</p>

C.6 日本公差

C.6 Tolerances for Japan

表 C.5 的参考标准为 JASS6:2018。

The reference standard for Table C.5 is JASS6:2018.

本附录所示公差分为极限公差和控制公差。

The tolerances shown in this annex are classified into limit tolerances and control

tolerances.

极限公差是验收标准的最大值或最小值，通常不得超过。

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

控制公差是被定义为制造或安装标准的目标值，以便 95%或以上的产品可以被验收通过，并且在尺寸精度的验收检验中，用于判断每个产品是否合格，从而判断该检验批是否合格。

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.

在验收检验中，当尺寸精度超过极限公差时，该产品通常应被拒收并重新制造。但是，当无法重新制造时，应进行与重新制造等效的补救工作，并对产品进行重新检验。

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.

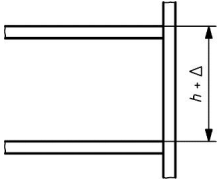
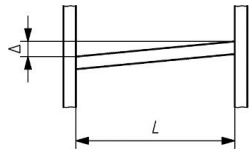
超过控制公差但在极限公差范围内时，不需要对产品进行修理或报废。在以控制公差为验收标准的抽样检验中，当被检验批次不合格时，应对同一批次的所有剩余产品进行检验。

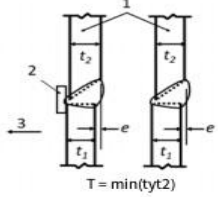
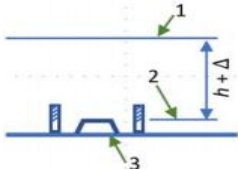
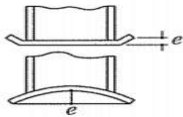
When the control tolerances are exceeded but are within the limit tolerances, repair or scrapping of product shall not be required. In sampling inspection using the control tolerance as the acceptance criteria, when the inspected lot is rejected, all the remaining products of the same lot shall be inspected.

无论检验批次如何，对于超出极限公差的产品，须经工程师评估确认后，采取补救措施、重新制作或其他必要处理措施。

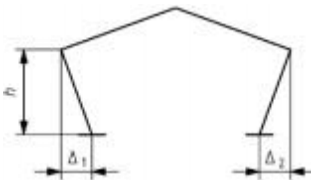
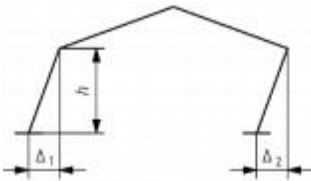
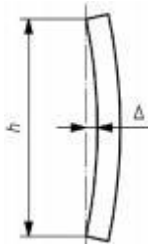
In spite of the inspection lot, with regard to the products that exceed the limit tolerance, the discussion with the engineer, and remedial work, re-fabrication or other necessary measures shall be taken.

表 C.5 -日本
Table C.5 - Japan

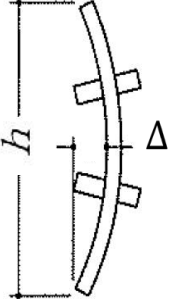
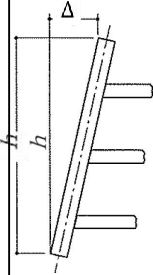
编号 No	标准 Criterion	参数 Parameter	极限公差 Limit Tolerances	控制公差 Control Tolerances
1.	概述 General			
1.1	高度 Height	—	无要求 No requirement	无要求 No requirement
1.2	楼层高度 Storey height 	相对于相邻楼层的高度 Height relative to the adjacent levels	$\Delta = \pm 8\text{mm}$	$\Delta = \pm 5\text{mm}$
1.3	梁倾斜度 Slope 	相对于梁另一端的高度偏差 Height relative to the other end of a beam	$\Delta \leq L/700 + 5\text{mm}$ $\Delta \leq 15\text{mm}$	$\Delta \leq L/1000 + 3\text{mm}$ $\Delta \leq 10\text{mm}$
1.4	立柱拼接 Column splice	—	无要求 No requirement	无要求 No requirement

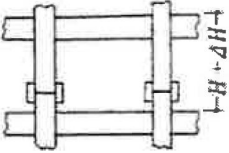
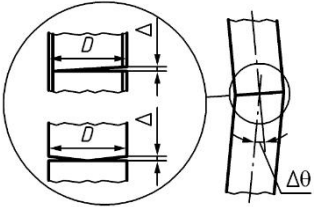
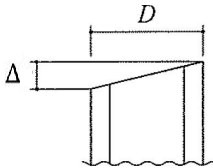
1.4a	立柱拼接 Column splice 	任一柱面的偏心距 e Non-intended eccentricity e about either column surface $t \leq 15 \text{ mm}$ $t > 15 \text{ mm}$	$e \leq 1.5 \text{ mm}$ $e \leq t/10$ 和 $e \leq 3 \text{ mm}$	$e \leq 1 \text{ mm}$ $e \leq t/15$ 和 $e \leq 2 \text{ mm}$
1.5	柱脚定位 Column base		无要求 No requirement	无要求 No requirement
1.5a	柱脚定位 Column base  1 设计标高 1 Reference height 2 安装标高 2 Installation level 3 基础砂浆 3 Base mortar	设计标高与立柱安装标高之间的 距离 Distance between the reference height and the column installation level	$\Delta = \pm 5 \text{ mm}$	$\Delta = \pm 3 \text{ mm}$
1.5 b	柱脚定位 Column base 	底板弯曲量 e Amount of bend e from a base plate 底板平直度偏差 e Deviation e from straightness of a base plate	$e \leq 3 \text{ mm}$	$e \leq 2 \text{ mm}$
1.6	相对标高 Relative levels		无要求 No requirement	无要求 No requirement

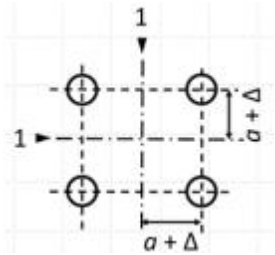
1.7	连接标高 Connection levels		无要求 No requirement	无要求 No requirement
2.	建筑物横梁 Beams in buildings			
2.1	梁中心线间距 Spacing between beam centrelines		无要求 No requirement	无要求 No requirement
2.2	立柱位置 Location at column		无要求 No requirement	无要求 No requirement
2.3	梁平直度 Straightness in plan	长度为 L 的梁或悬臂梁直线度偏差 Δ Deviation Δ from straightness of an erected beam or cantilever of length L	$\Delta \leq 1.5L/1000$ 且 $\Delta \leq 15 \text{ mm}$ $\Delta \leq 1.5L/1000$ and $\Delta \leq 15 \text{ mm}$	$\Delta \leq L/1000$ 且 $\Delta \leq 10 \text{ mm}$ $\Delta \leq L/1000$ and $\Delta \leq 10 \text{ mm}$
2.4	起拱度 Camber		无要求 No requirement	无要求 No requirement
2.5	悬臂梁预起拱 Pre-set of cantilever		无要求 No requirement	无要求 No requirement
3.	单层建筑立柱 Columns of Single Storey Buildings			
3.1	单层建筑物柱倾斜度 Inclination of columns of single storey buildings 	楼层高度 h 范围内的总倾斜度 Overall inclination in storey height h	$\Delta \leq h/700$ 且 $\Delta \leq 15 \text{ mm}$ $\Delta \leq h/700$ and $\Delta \leq 15 \text{ mm}$	$\Delta \leq h/1000$ 且 $\Delta \leq 10 \text{ mm}$ $\Delta \leq h/1000$ and $\Delta \leq 10 \text{ mm}$

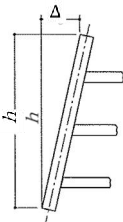
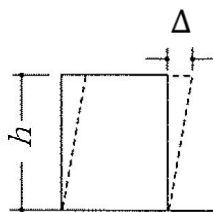
3.2	<p>单层门式刚架中单柱的倾斜度</p> <p>Inclination of individual columns in single storey portal frame buildings</p> 	<p>各柱倾斜度 Δ</p> <p>$\Delta = \Delta_1$ 或 Δ_2</p> <p>Inclination Δ of each column $\Delta = \Delta_1$ or Δ_2</p>	<p>$\Delta \leq h/700$ 且 $\Delta \leq 15 \text{ mm}$</p> <p>$\Delta \leq h/700$ and $\Delta \leq 15 \text{ mm}$</p>	<p>$\Delta \leq h/1000$ 且 $\Delta \leq 10 \text{ mm}$</p> <p>$\Delta \leq h/1000$ and $\Delta \leq 10 \text{ mm}$</p>
3.3	<p>单层门式刚架的倾斜度</p> <p>Inclination of single storey portal frame buildings</p> 	<p>同一框架中所有柱的平均倾斜度</p> <p>(对于两根柱子, 平均值为: $\Delta = (\Delta_1 + \Delta_2)/2$)</p> <p>Average inclination of all the columns in the same frame</p> <p>(For two columns the average is: $\Delta = (\Delta_1 + \Delta_2)/2$)</p>	<p>$\Delta \leq h/700$ 且 $\Delta \leq 15 \text{ mm}$</p> <p>$\Delta \leq h/700$ and $\Delta \leq 15 \text{ mm}$</p>	<p>$\Delta \leq h/1000$ 且 $\Delta \leq 10 \text{ mm}$</p> <p>$\Delta \leq h/1000$ and $\Delta \leq 10 \text{ mm}$</p>
3.4	<p>支撑起重机龙门架的立柱的倾斜度</p> <p>Inclination of any column that supports a crane gantry</p>		<p>无要求</p> <p>No requirement</p>	<p>无要求</p> <p>No requirement</p>
3.5	<p>单层柱的直线度</p> <p>Straightness of a single storey column</p> 	<p>柱子在平面上相对于轴线偏差</p> <p>Location of the column in plan, relative to a straight line between position points at top and bottom</p>	<p>$\Delta \leq h/1000$ 且 $\Delta \leq 8 \text{ mm}$</p> <p>$\Delta \leq h/1000$ and $\Delta \leq 8 \text{ mm}$</p>	<p>$\Delta \leq h/1500$ 且 $\Delta \leq 5 \text{ mm}$</p> <p>$\Delta \leq h/1500$ and $\Delta \leq 5 \text{ mm}$</p>

4.	多层建筑 Multi-storey buildings			
4.1	相对于基础上 n 层的 楼层平面位置 Location at the storey level n levels above the base, relative to that at the base		无要求 No requirement	无要求 No requirement
4.2	相邻楼层之间的柱倾斜度 Inclination of a column, between adjacent storey levels		无要求 No requirement	无要求 No requirement
4.3	相邻楼层之间连续柱的直 线度 Straightness of a continuous column between adjacent storey levels		无要求 No requirement	无要求 No requirement
4.4	相邻楼层之间拼接柱的直 线度 Straightness of a spliced column, between adjacent storey levels		无要求 No requirement	无要求 No requirement

<p>4.5</p>	<p>分段柱的直线度</p> <p>Straightness of a sectioned column</p> 	<p>分段柱在平面上相对于上下位置点之间直线的位置</p> <p>Location of the sectioned column in plan, relative to a straight line between position points at top and bottom</p> <p>注：一般通过内部检查对每一段进行验收，而不是每层。</p> <p>NOTE: Verified by receiving inspection in-house, generally, and estimated at each tier, not each floor.</p>	<p>$\Delta \leq h/1000$ 且 $\Delta \leq 8 \text{ mm}$</p> <p>$\Delta \leq h/1000$ and $\Delta \leq 8 \text{ mm}$</p>	<p>$\Delta \leq h/1500$ 且 $\Delta \leq 5 \text{ mm}$</p> <p>$\Delta \leq h/1500$ and $\Delta \leq 5 \text{ mm}$</p>
<p>4.6</p>	<p>分段柱的倾斜度</p> <p>Inclination of sectioned columns</p> 	<p>分段柱高度 h 内的倾斜度</p> <p>Inclination in a sectioned column height h</p> <p>注：对于短柱而言，这些标准往往较难遵循。</p> <p>NOTE: The criteria tend to be difficult to observe for short columns.</p>	<p>$\Delta \leq h/700$ 且 $\Delta \leq 15 \text{ mm}$</p> <p>$\Delta \leq h/700$ and $\Delta \leq 15 \text{ mm}$</p>	<p>$\Delta \leq h/1000$ 且 $\Delta \leq 10 \text{ mm}$</p> <p>$\Delta \leq h/1000$ and $\Delta \leq 10 \text{ mm}$</p>

4.7	<p>现场接头处的楼层高度</p> <p>Story height at field joint</p> 	<p>现场接头处的楼层高度</p> <p>Story height at field joint</p>	$\Delta = \pm 8\text{mm}$	$\Delta = \pm 5\text{mm}$
5.	<p>全接触端承面</p> <p>Full contact end-bearing</p>			
5.1	<p>立柱拼接对齐和支承面之间的间隙</p> <p>Column splice alignment and gap between bearing surfaces</p> 	<p>在“X”点处出现间隙 Δ 的同时发生的局部角度偏差 $\Delta \theta$</p> <p>Local angular misalignment $\Delta \theta$ occurring at the same time as gap Δ at point "X"</p>	无要求 No requirement	无要求 No requirement
5.1a	<p>接触面</p> <p>Mating surface</p> 	<p>接触面与柱的水平面之间的距离</p> <p>Distance between the mating surface and the horizontal plane of the column</p>	$\Delta \leq 2.5 D/700$	$\Delta \leq 1.5 d/1000$

6.	柱位 Positions of columns			
6.1	位置 Location		无要求 No requirement	无要求 No requirement
6.2	建筑物总长度 Overall length of a building		无要求 No requirement	无要求 No requirement
6.3	柱间距 Column spacing		无要求 No requirement	无要求 No requirement
6.4	柱中心对齐 Column alignment generally		无要求 No requirement	无要求 No requirement
6.5	边柱对齐 Perimeter column alignment		无要求 No requirement	无要求 No requirement
6.6	位置 Location  1 立柱中心线 1 Column centreline	地脚螺栓在基准面相对于立柱中心线的位置 Location of the anchor bolt at the base level, relative to the centrelines of the column	$\Delta = \pm 5\text{mm}$	$\Delta = \pm 3\text{mm}$

6.7	分段柱倾斜度 Inclination of sectioned columns 	高度为 h 的分段柱倾斜度 Inclination in a sectioned column height h	$\Delta \leq h/700$ 且 $\Delta \leq 15 \text{ mm}$ $\Delta \leq h/700$ and $\Delta \leq 15 \text{ mm}$	$\Delta \leq h/1000$ 且 $\Delta \leq 10 \text{ mm}$ $\Delta \leq h/1000$ and $\Delta \leq 10 \text{ mm}$
6.8	建筑物倾斜度 Inclination of buildings 	高度为 h 的建筑整体倾斜度 Overall inclination in a building height h	$\Delta \leq h/2500+10$ mm 且 $\Delta \leq 50 \text{ mm}$ $\Delta \leq h/2500+10$ mm and $\Delta \leq 50$ mm	$\Delta \leq h/4000+7$ mm 且 $\Delta \leq 20$ mm $\Delta \leq h/4000+7$ mm and $\Delta \leq 20$ mm

C.7 俄罗斯公差

C.7 Tolerances for Russian Federation

除非另有说明，表 C.6 的参考标准为 SP 70.13330-2012。

Unless otherwise noted, the reference standard for Table C.6 is SP 70.13330-2012.

表 C.6 -俄罗斯

Table C.6 - Russian Federation

编号 No	标准 Criterion	参数 Parameter	公差 Tolerances
1.	概述 General		

1.1	安装前 Before assembly	<p>公称尺寸间隔 Intervals of nominal dimensions</p> <p>对于线性尺寸, mm for linear dimensions, mm</p> <p>500 to 2500 2 500 to 4000 4 000 to 8000 8 000 to 16000 16 000 to 25000 25 000 to 40000</p> <p>对于等对角线, mm for equal diagonals, mm</p> <p>500 to 2500 2 500 to 4000 4 000 to 8000 8 000 to 16 000 16 000 to 25000 25 000 to 40 000</p>	<p>5 mm 6 mm 8 mm 10 mm 12 mm 16 mm</p> <p>无要求 No requirement 16 mm 20 mm 24 mm 30 mm 40 mm</p>
2.	立柱及支撑 Columns and supports		
2.1	柱和支座支撑面标高与设计标高的偏差 Deviations of the elevation of the supporting surfaces of the column and supports from the design elevation	<p>支撑面标高偏差, mm Elevation deviations of supporting surfaces, mm</p>	± 5 mm

2.2	<p>一排和一跨内相邻柱和支座支撑面标高与设计标高的偏差</p> <p>The difference in elevations of the supporting surfaces of adjacent columns and supports in a row and in a span</p>	<p>支撑面标高差, mm</p> <p>Difference in elevations of supporting surfaces, mm</p>	± 3 mm
2.3	<p>柱和支座的轴线相对于基准面中心轴线的偏移量</p> <p>Offset of the axes of columns and supports relative to the center axes in the reference section</p>	<p>立柱和支座轴线偏移, mm</p> <p>Displacement of axes of columns and supports, mm</p>	± 5 mm
2.4	<p>在柱长范围内, 柱上部截面轴线相对于垂线的最大偏差, mm</p> <p>Maximum deviation of column axes from the vertical in the upper section with the length of the columns, mm</p>	<p>立柱长度, mm</p> <p>length of the columns, mm</p> <p>4000 to 8000</p> <p>8 000 to 16 000</p> <p>16 000 to 25 000</p> <p>25 000 to 40 000</p>	<p>± 10mm</p> <p>± 12mm</p> <p>± 15mm</p> <p>± 20 mm</p>
2.5	<p>柱、支座以及系杆沿柱方向的挠度 (曲率), mm</p> <p>Deflection (curvature) of the column, support and ties along the columns, mm</p>		<p>固定点之间距离的 0.0013, 但不超过 15mm</p> <p>0,0013 of the distance between fixing points, but not more than 15 mm</p>

2.6	柱节点处铣削面之间的单边间隙 One-sided clearance between milled surfaces at column joints		柱截面的 0.07%; 0,0007 of the cross-section of the column; 接触面积应至少达到横截面面积的 65% contact area should be at least 65% of the cross-sectional area
3.	单层建筑立柱 Columns of Single Storey Buildings		
3.1	参考点的标高, mm Elevations of reference nodes, mm		$\pm 10\text{mm}$
3.2	框架平面内柱顶轴线处桁架与主梁偏移量 Offset of trusses, girder beams from the axes on the column heads from the frame plane		$\pm 15\text{mm}$
3.3	桁架弦杆受压段和主梁与锚固点之间的挠度 (曲率) Arrow of deflection (curvature) between the anchoring points of the compressed sections of the truss chord and the girder beam		固定节段长度的 0,0013, 但不超过 15mm 0,0013 of the length of the fixed section, but not more than 15 mm

3.4	<p>桁架、横梁与主梁上弦杆锚固点处轴线间距</p> <p>The distance between the axes of trusses, beams, girders, along the upper chords between the anchoring points</p>		$\pm 15\text{mm}$
3.5	<p>桁架上下弦轴线的偏差</p> <p>Alignment of the axes of the lower and upper chords of trusses relative to each other (in plan)</p>		<p>桁架高度的 0.004</p> <p>0,004 of the truss height</p>
3.6	<p>桁架、梁、楼板及面层安装对称性偏差</p> <p>Deviation of the symmetry of the installation of the truss, beam, girder, floor panel and covering (with a support area of 50 mm or more)</p>		$\pm 10\text{mm}$
3.7	<p>灯柱和底板相对于垂直线的偏差</p> <p>Deviation of the lamp posts and panels from the vertical</p>		$\pm 8\text{mm}$
3.8	<p>檩条间距</p> <p>Distance between purlins</p>		$\pm 5\text{mm}$
4	<p>150 米以上的多层建筑</p> <p>Multi-storey buildings Up to 150 m tall</p>		

4.1	柱上部截面几何轴线定位点与柱中心轴线的偏差 , mm Deviation from the alignment of the marks of the geometric axes of the columns in the upper section with the marks of the center axes at the length of the columns, mm	立柱长度, mm length of the columns, mm 500 to 4000 4 000 to 8000 8000 to 16000 16000 to 25000 25000 to 40 000	无要求 No requirement ± 12 mm ± 15 mm ± 20 mm ± 25 mm
4.2	各层立柱顶部标高偏差 Difference in elevation of the top of the columns of each tier	N 为层数 n is the number of the tier	$0.5n+9$ mm
4.3	梁轴线相对于柱轴线的偏差 Offset of the girder axis, girder from the column axis	—	8 mm
4.4	跨中主梁和次梁轴线间距偏差 Deviation of the distance between the axes of the girders and beams in the middle of the span	—	10 mm
4.5	两根相邻轨道梁顶部标高差值 Difference between the top marks of two adjacent girth rail	—	15 mm
4.6	横梁两端顶部高差 Difference in the marks of the top of the crossbar at its ends	—	$0.001L$,但不超过 15 毫米 but not more than 15 mm

C.8 英国公差

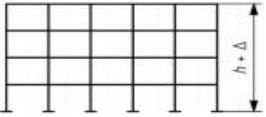
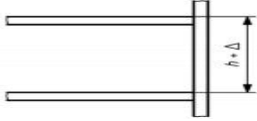
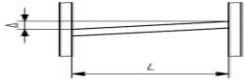
C.8 Tolerances for United Kingdom

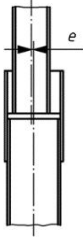
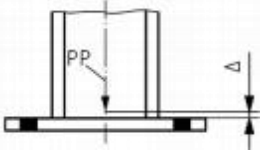

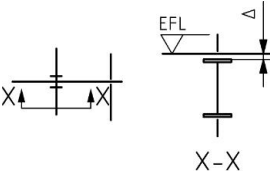
除非另有说明，表 C.7 的参考标准为 BCSA NSSS:2021。

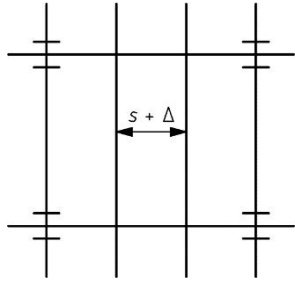
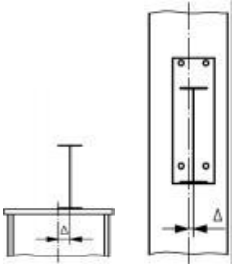
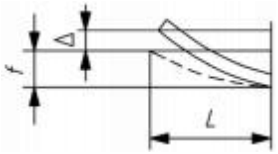
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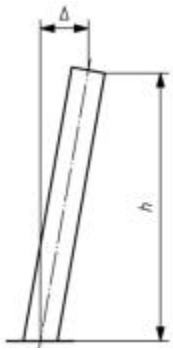
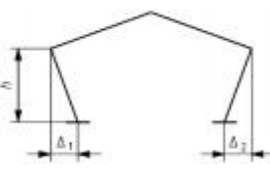
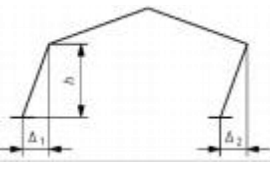
表 C.7 -英国


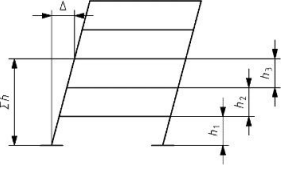
Table C.7 - United Kingdom

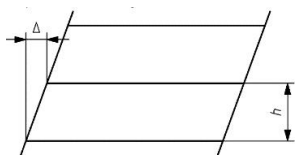
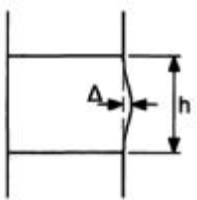
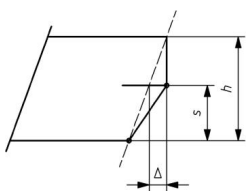
编号 NO	标准 Criterion	参数 Parameter	公差 Tolerances
1.	概述 General		
1.1	建筑总高度 Overall height 	相对于基准面的总高度： (h, 单位为 m): Overall height, relative to the base level (h in metres) $h \leq 20 \text{ m}$ $20 \text{ m} < h < 100 \text{ m}$ $h \geq 100 \text{ m}$	$\Delta = \pm 20 \text{ mm}$ $\Delta = \pm 0.5 (h+20) \text{ mm}$ $\Delta = \pm 0.2 (h+200) \text{ mm}$
1.2	楼层高度 Storey height 	相对于相邻楼层的高度 Height relative to the adjacent levels	$\Delta = \pm 10 \text{ mm}$
1.3	梁倾斜度 Beam slope 	相对于梁的另一端的高度偏差 Height relative to the other end of a beam	$\Delta = l/500$, 但不大于 10mm $\Delta = l/500$, but not greater than 10 mm

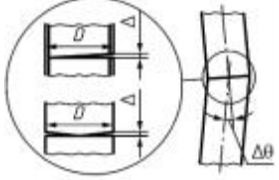
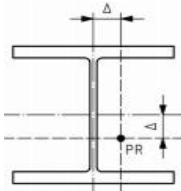
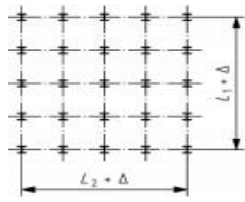
1.4	<p>柱拼接处的偏心距 Eccentricity at column splice</p> 	<p>绕任一轴线的偏心距 e Non-intended eccentricity e about either axis</p>	<p>$e \leq 5 \text{ mm}$</p>
1.5	<p>柱脚标高 Level of Columns at base</p> 	<p>柱底相对于定位点 (PP) 的标高偏差 (mm) Level of bottom of column shaft, relative to specified level of its position point (PP)</p>	<p>$\Delta = \pm 5 \text{ mm}$</p>
1.6	<p>梁相对标高 Relative beam levels</p> 	<p>相邻梁对应端部标高 Levels of adjacent beams, measured at corresponding ends</p>	<p>$\Delta = \pm 10 \text{ mm}$</p>
1.7	<p>梁标高 Beam levels</p> 	<p>梁柱连接处梁相对于楼层标高 (EFL) 的偏差 (单位: mm) Level of the beam at a beam-to-column connection, measured relative to the established floor level (EFL) 注: 楼层标高是指代表同一楼层一系列梁的标高。 NOTE: The established floor level is the level representing a series of beams at one storey level.</p>	<p>$\Delta = \pm 10 \text{ mm}$</p>
2.	<p>建筑物横梁 Beams in buildings</p>		

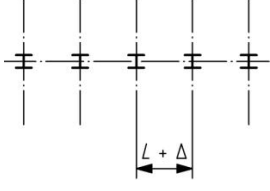
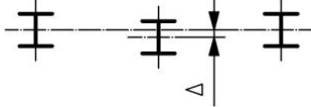
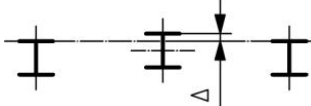
2.1	梁中心线间距 Spacing between beam centrelines 	在每端测量的相邻梁之间距离与设计距离 s 的偏差 Δ Deviation Δ from intended distance (s) between adjacent erected beams, measured at each end	$\Delta = \pm 10 \text{ mm}$
2.2	立柱位置 Beam location 	梁柱连接节点位置相对于柱轴线的偏差 Δ Deviation Δ from intended location of a beam-to-column connection, measured relative to the column	$\Delta = \pm 5 \text{ mm}$
2.3	梁平直度 Straightness in plan	—	无要求 No requirement
2.4	起拱度 Camber	—	没有要求 No requirement
2.5	悬臂梁预起拱 Pre-set of cantilever 	长度为 L 的悬臂梁端部与设计预调位置的偏差 Δ Deviation Δ from intended pre-set at end of an erected cantilever of length L	$\Delta = \pm L/200$
2.6	受弯梁和无约束受压构件的平直度 Straightness of beams subject to bending and components subject to compression if unrestrained	—	没有要求 No requirement

3.	单层建筑立柱 Columns of Single Storey Buildings		
3.1	单层建筑物柱倾斜度 Inclination of columns of single storey buildings 	主轴方向柱顶相对于柱底的倾斜度 Inclination of top relative to base on main axes. 注：不包括门式框架（见 BCSA NSSS:2021 的 9.6.6 和 9.6.7 节）以及支撑起重机龙门架的立柱（见 9.6.24 节）。 NOTE: Excluding portal frames, see BCSA NSSS:2021 9.6.6 and 9.6.7, and columns supporting crane gantries, see 9.6.24.	$\Delta = \pm h/300$
3.2	单层门式刚架单柱的倾斜度 Inclination of individual columns in single storey portal frame buildings 	各柱倾斜度 Δ $\Delta = \Delta_1$ 或 Δ_2 Inclination Δ of each Column $\Delta = \Delta_1$ or Δ_2	$\Delta = \pm h/150$
3.3	单层门式刚架的倾斜度 Inclination of single storey portal frame buildings 	同一框架内所有柱的平均倾斜度 对于两根柱子平均值为 $\Delta = (\Delta_1 + \Delta_2)/2$ Average inclination of all the columns in the same frame. For two columns, the average is $\Delta = (\Delta_1 + \Delta_2)/2$	$\Delta = \pm h/500$

3.4	<p>支撑起重机龙门架立柱的倾斜度</p> <p>Inclination of any column that supports a crane gantry</p> 	<p>从楼层平面到吊车梁支座的倾斜度</p> <p>Inclination from floor level to bearing of crane beam</p>	<p>$\Delta = \pm h/1000$</p> <p>最大可达 25mm</p> <p>up to a maximum of 25 mm</p>
3.5	<p>单层柱的直线度</p> <p>Straightness of a single storey column</p>	—	<p>无要求</p> <p>No requirement</p>
4.	<p>多层建筑</p> <p>Multi-storey buildings</p>		
4.1	<p>相对于基础以上 n 层的楼层平面位置</p> <p>Location at the storey level n levels above the base, relative to that at the base</p> 	<p>柱平面位置相对于基底中心垂直线</p> <p>Location of the column in plan, relative to a vertical line through its centre at base level</p>	<p>$\Delta = \pm \Sigma h / (300 \sqrt{n})$ 且</p> <p>$\Sigma h = h_1 + h_2 + h_3$, 等。</p> <p>$\Delta = \pm \Sigma h / (300 \sqrt{n})$ and</p> <p>$\Sigma h = h_1 + h_2 + h_3$, + etc.</p>

4.2	<p>相邻楼层之间的柱倾斜度</p> <p>Inclination of a column, between adjacent storey levels</p> 	<p>在平面上，柱子相对于垂直线偏差</p> <p>Location of the column in plan, relative to a vertical line through its centre at the next lower level</p>	$\Delta = \pm h/300$
4.3	<p>相邻楼层之间连续柱的直线度</p> <p>Straightness of a continuous column between adjacent storey levels</p> 	<p>在平面上，柱子相对于相邻楼层位置点之间直线的偏差</p> <p>Location of the column in plan, relative to a straight line between position points at adjacent storey levels</p>	$\Delta = \pm h/1000$
4.4	<p>相邻楼层之间拼接柱的直线度</p> <p>Straightness of a spliced column, between adjacent storey levels</p> 	<p>在平面上，柱子拼接处相对于相邻楼层位置点之间直线的偏差</p> <p>Location of the column in plan at the splice, relative to a straight line between position points at adjacent storey levels</p> <p>s 是柱子拼接处距离楼层的高度 s is the position of the column splice</p>	$\Delta = \pm s/1000, \text{且 } s \leq h/2$ $\Delta = \pm s/1000, \text{with } s \leq h/2$
5.	<p>全接触端轴承</p> <p>Full contact end-bearing</p>		

5.1	<p>立柱拼接对齐和支承面之间的间隙</p> <p>Column splice alignment and gap between bearing surfaces</p> 	<p>在“X”点处出现间隙 Δ 的同时发生的局部角度偏差 $\Delta\theta$</p> <p>Local angular misalignment $\Delta\theta$ occurring at the same time as gap Δ at point "X"</p> <p>注意：请参阅 BCSA NSSS:2021 4.3.3,7.2.3 和 9.6.12。</p> <p>NOTE: See BCSA NSSS:2021 4.3.3,7.2.3 and 9.6.12.</p>	<p>$\Delta\theta = \pm 1/500$, 且至少在 2/3 的面积上最大间隙 $\Delta = 0.5\text{mm}$,</p> <p>$\Delta\theta = \pm 1/500$, and $\Delta = 0.5\text{ mm}$ over at least 2/3 of the area,</p> <p>局部最大间隙 $\Delta = 1.0\text{mm}$</p> <p>$\Delta = 1.0\text{ mm}$ with a maximum of 1,0 mm locally</p>
6.	<p>柱位</p> <p>Positions of columns</p>		
6.1	<p>柱脚位置</p> <p>Position of columns at base</p> 	<p>柱子底部中心在平面上相对于参考定位点（PR）的位置</p> <p>Location in plan of the centre of the column at the level of its base, relative to the position point of reference (PR)</p>	<p>$\Delta = \pm 10\text{mm}$</p>
6.2	<p>建筑物总长度</p> <p>Overall length of a building</p> 	<p>底层每行端柱之间的距离（单位为 m）</p> <p>Distance between end columns in each line, at base level (L in metres)</p> <p>$L \leq 30\text{ m}$</p> <p>$30\text{ m} < L < 250\text{ m}$</p> <p>$L \geq 250\text{ m}$</p>	<p>$\Delta = \pm 20\text{ mm}$</p> <p>$\Delta = \pm 0.25(L+50)\text{mm}$</p> <p>$\Delta = \pm 0.1(L+500)\text{mm}$</p>

6.3	<p>柱间距 Column spacing</p> 	<p>底层相邻立柱中心之间的距离：（单位为 m） Distance between centres of adjacent columns at base level (L in metres) $L \leq 5 \text{ m}$ $L > 5 \text{ m}$</p>	<p>$\Delta = \pm 10 \text{ mm}$ $\Delta = \pm 0.2(L+45) \text{ mm}$</p>
6.4	<p>柱中心对齐 Column alignment, generally</p> 	<p>底层柱子中心相对于设计柱列线（ECL）的位置 Location of the centre of the column at base level, relative to the established column line (ECL) 注:边柱见 BCSA NSSS:2021 9.6.17。 NOTE: See BCSA NSSS:2021 9.6.17 设计柱列线表示同一直线上多根立柱的轴线对齐线。 for perimeter columns. The established column line is the alignment representing a series of columns in one line.</p>	<p>$\Delta = \pm 10 \text{ mm}$</p>
6.5	<p>边柱对齐 Perimeter column alignment</p> 	<p>底层边柱外表面相对于相邻立柱外表面的距离 Location of the outer face of a perimeter column at base level, relative to the line joining the faces of the adjacent columns</p>	<p>$\Delta = \pm 10 \text{ mm}$</p>

C.9 美国公差

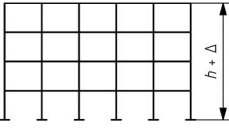
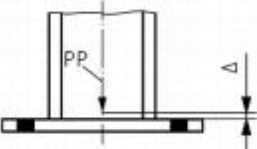
C.9 Tolerances for United States

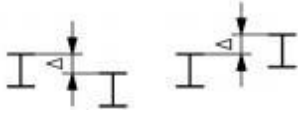

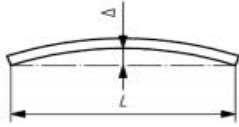
除非另有说明，表 C.8 的参考标准为 AISC 303:2016。

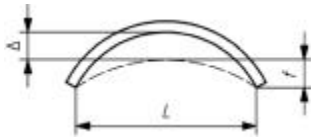
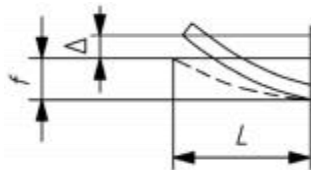
Unless otherwise noted, the reference standard for Table C.8 is AISC 303:2016.

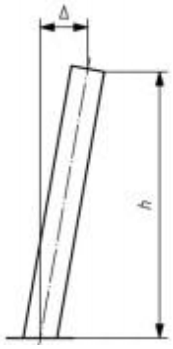
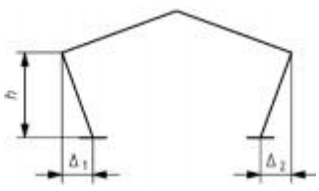
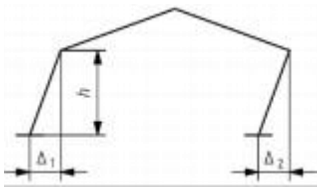
表 C.8 -美国

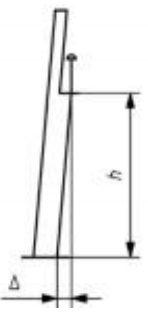
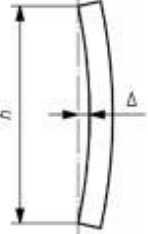
Table C.8 - United States

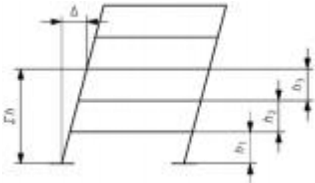
编号 NO	标准 Criterion	参数 Parameter	公差 Tolerances
1.	建筑 Buildings		
1.1	建筑总高度 Height 	相对于基准面的总高度: Overall height, relative to the base level: $h \leq 20 \text{ m}$ $20 \text{ m} < h < 100 \text{ m}$ $h \geq 100 \text{ m}$	取决于基础标高公差和柱长公差 Function of base elevation tolerance and column length tolerance
1.2	楼层高度 Storey height	—	无要求 No requirement
1.3	梁倾斜度 Slope	—	无要求 No requirement
1.4	立柱拼接 Column splice	—	无要求 No requirement
1.5	柱脚定位 Column base 	柱底部相对于其定位点（PP）设计标高的偏差 Level of bottom of column shaft, relative to specified level of its position point (PP)	$\Delta = \pm 1/8 \text{ 英寸} [3 \text{ mm}]$ $\Delta = \pm 1/8 \text{ in} [3 \text{ mm}]$

1.6	<p>相对标高 Relative levels</p> 	<p>相邻梁在对应端部测量的标高 Levels of adjacent beams, measured at corresponding ends</p>	<p>制造公差控制 Function of fabrication tolerances</p>
1.7	<p>连接标高 Connection levels</p> 	<p>相对于设计的楼板标高 (EFL) 测量, 梁柱连接处梁的标高 Level of the beam at a beam-to-column connection, measured relative to the established floor level (EFL)</p>	<p>$\Delta = +5 \text{ mm}, -8 \text{ mm}$ [$\Delta = +3/16 \text{ 英寸}, -5/16 \text{ 英寸}$] $\Delta = +5 \text{ mm}, -8 \text{ mm}$ [$\Delta = +3/16 \text{ in}, -5/16 \text{ in}$] 从下一个更高的拼接处 from the next higher splice</p>
2.	<p>建筑物横梁 Beams in buildings</p>		
2.1	<p>梁中心线间距 Spacing between beam centrelines</p>	—	<p>无要求 No requirement</p>
2.2	<p>立柱位置 Location at columns</p>	—	<p>无要求 No requirement</p>
2.3 ¹	<p>梁平直度 Straightness in plan</p> 	<p>长度为 L 的梁或悬臂梁直线度偏差 Δ Deviation Δ from straightness of an erected beam or cantilever of length L $L < 14 \text{ m}$ [45 英尺] $L < 14 \text{ m}$ [45 ft] 对于 $L > 14 \text{ 米}$ [45 英尺] for $L > 14 \text{ m}$ [45 ft]</p>	<p>$\Delta = 3 \text{ mm} (L_{\text{mm}}/3 \text{ m})$ [$\Delta = 1/8 \text{ 英寸} (L \text{ 英尺}/10 \text{ 英尺})$] $\Delta = 10 \text{ mm} + 3 \text{ mm} (L_{\text{mm}}/3 \text{ m})$ [$\Delta = 3/8 + 1/8 \text{ 英寸} (L \text{ 英尺} - 45)/10 \text{ 英尺}$] $\Delta = 3 \text{ mm} (L_{\text{mm}}/3 \text{ m})$ [$\Delta = 1/8 \text{ in} (L_{\text{ft}}/10 \text{ ft})$] $\Delta = 10 \text{ mm} + 3 \text{ mm} (L_{\text{mm}}/3 \text{ m})$ [$\Delta = 3/8 + 1/8 \text{ in} (L_{\text{ft}} - 45)/10 \text{ ft}$]</p>

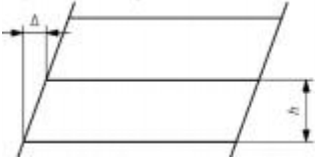
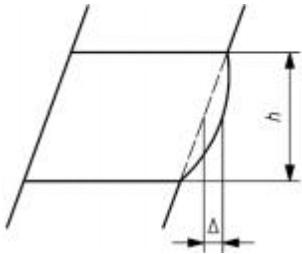
2.3a	现场拼接构件在平面和立面上的直线度 Straightness of field spliced members in plan and elevation	与设计值的角度偏差 Angular variation from theoretical	$\Delta = L/500$
2.4	起拱度 Camber 	长度为 L 的梁或格构构件在跨中处与设计起拱度 f 的偏差 Δ Deviation Δ at mid span from intended camber f of an erected beam or lattice component of length L 对于 $L \leq 15\text{m}$ [50 英尺] 对于 $L > 15\text{m}$ [50 英尺] For $L \leq 15\text{ m}$ [50 ft] For $L > 15\text{ m}$ [50 ft] For lattice	+12mm[1/2 英寸], -0 最小为规定拱度的 75% +12mm+3mm (L-15m) /3, -0 [+1/2 英尺+1/8 英尺 (L - 50 英尺) /10], -0 最小为规定拱度的 75% $\Delta = L/800$ + 12 mm [1/2 in], - 0 Minimum 75% specified camber + 12 mm + 3 mm (L - 15 m)/3, - 0 [+ 1/2 in + 1/8 in (L - 50 ft)/10], - 0 Minimum 75% specified camber $\Delta = L/800$
2.5	悬臂梁预起拱 Pre-set of cantilever 	长度为 L 的悬臂梁端部与设计预调位置的偏差 Δ Deviation Δ from intended pre-set f at end of an erected cantilever of length L	$\Delta = \pm 1/500$
注 ASTM A6/A6M Notes ¹ ASTM A6/A6M			
3.	单层建筑立柱 Columns of Single Storey Buildings		

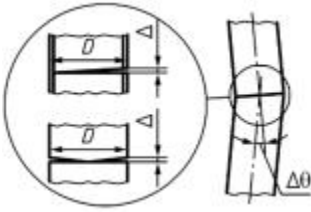
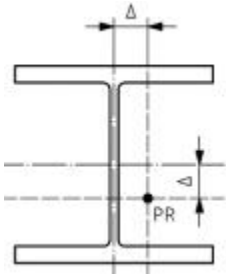
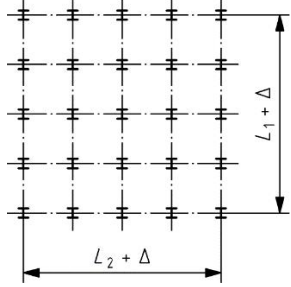
3.1	<p>单层建筑物柱倾斜度</p> <p>Inclination of columns of single storey buildings</p> 	<p>楼层高度 h 范围内的总倾斜度</p> <p>Overall inclination in storey height h</p>	<p>$\Delta = \pm h/500^*$</p>
3.2	<p>单层门式刚架中单柱的倾斜度</p> <p>Inclination of individual columns in single storey portal frame buildings</p> 	<p>各柱的倾斜度 Δ</p> <p>$\Delta = \Delta_1$ 或 Δ_2</p> <p>Inclination Δ of each column</p> <p>$\Delta = \Delta_1$ or Δ_2</p>	<p>与其他立柱相同</p> <p>Same as other columns</p>
3.3	<p>单层门式刚架的倾斜度</p> <p>Inclination of single storey portal frame buildings</p> 	<p>同一框架中所有柱的平均倾斜度</p> <p>(对于两根柱子平均值为</p> <p>$\Delta = (\Delta_1 + \Delta_2)/2$</p> <p>Average inclination of all the columns in the same frame</p> <p>(For two columns the average is</p> <p>$\Delta = (\Delta_1 + \Delta_2)/2$</p>	<p>与其他立柱相同</p> <p>Same as other columns</p>

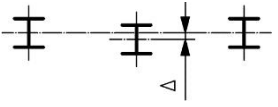
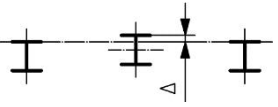
3.4	<p>支撑起重机龙门架的立柱的倾斜度</p> <p>Inclination of any column that supports a crane gantry</p> 	<p>从楼层平面到吊车梁支座的倾斜度</p> <p>Inclination from floor level to bearing of crane beam:</p>	<p>起重机结构公差见 AISC 设计指南 7。</p> <p>立柱垂直度无特殊公差规定。</p> <p>See AISC Design Guide 7 for crane structure tolerances.</p> <p>No different tolerances for column plumbness.</p>
3.5	<p>单层柱的直线度</p> <p>Straightness of a single storey column</p> 	<p>柱子在平面上相对于轴线偏差</p> <p>Location of the column in plan, relative to a straight line between position points at top and bottom</p>	<p>制造公差，不是安装公差</p> <p>$\Delta = \pm h/1000$</p> <p>Fabrication tolerance, not an erection tolerance</p> <p>$\Delta = \pm h/1000$</p>
4.	<p>多层建筑</p> <p>Multi-storey buildings</p>		

<p>4.1</p>	<p>相对于基础以上 n 层的 楼层平面位置 Perimeter Columns — Location at the storey level n levels above the base, relative to that at the base</p> 	<p>在平面上，柱子相对于通过其基 础中心的垂直线偏差： 对于 n=1-20 对于 n>20 Location of the column in plan, relative to a vertical line through its centre at base level: For n = 1 - 20 For n > 20</p>	<p>自周边柱基准柱列线起测 拼接处点位位于 38 毫米（1.5 英 寸）范围内 Measured from the established column line at perimeter columns. Working point at a splice inside a 38 mm [1-½ in] envelope</p> <p>+表示朝向建筑外部， -表示朝向建筑内部 + indicates toward building exterior, - indicates toward building interior</p> <p>$\Delta = h/500 + 6\text{mm}$ [1/4 英寸] 不超过 -50mm, +25mm [不超过 -2 英寸, +1 英寸] $\Delta = h/500 + 6\text{ mm}$ [1/4 inch] not to exceed - 50 mm, + 25 mm [not to exceed - 2 in, + 1 in]</p> <p>$\Delta = \Delta_{20} + \Sigma (n-20)(2\text{ mm}),$ 不超过 -75mm, +50 mm [$\Delta = \Delta_{20} + \Sigma (n-1) (1/16\text{ 英寸})$, 不超过 -3 英寸, +2 英寸] $\Delta = \Delta_{20} + \Sigma (n-20)(2\text{ mm}),$ not to exceed - 75, + 50 mm [$\Delta = \Delta_{20} + \Sigma (n-1)(1/16\text{ in}),$ not to exceed - 3, + 2 in]</p>
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4.1a	<p>电梯井立柱—在楼层平面上的位置</p> <p>相对于基础以上 n 层处</p> <p>Elevator columns —</p> <p>Location at the storey level</p> <p>n levels above the base, relative to that at the base</p>	<p>在平面上相对于柱轴线位置</p> <p>Location of the column in plan, relative to a vertical line through its centre at base level</p> <p>对于 n = 1-20</p> <p>For n = 1-20</p> <p>对于 n > 20</p> <p>For n > 20</p>	<p>自电梯井道结构柱基准柱列线起测</p> <p>拼接处点位位于 38 毫米 (1.5 英寸) 范围内</p> <p>Measured from the established column line at columns at elevator shaft.</p> <p>Working point at a splice inside a 38 mm [1½ in] envelope</p> <p>+表示朝向建筑外部,</p> <p>-表示朝向建筑内部</p> <p>+ indicates toward building exterior,</p> <p>- indicates toward building interior</p> <p>$\Delta = h/500 + 6\text{mm}$ [1/4 英寸]</p> <p>不超过 25mm [1 英寸]</p> <p>$\Delta = h/500 + 6\text{ mm}$ [1/4 in], not to exceed 25 mm [1 in]</p> <p>- $\Delta = \Delta_{20} + \Sigma (n-20)(1\text{ mm})$,</p> <p>不超过 50 mm [2 英寸]</p> <p>- $\Delta = \Delta_{20} + \Sigma (n-20)(1\text{ mm})$ [1/32 in],</p> <p>not to exceed 50 mm [2 in]</p>
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4.2	<p>相邻楼层之间的柱倾斜度</p> <p>Inclination of a column, between adjacent storey levels</p> 	<p>在平面上，柱子相对于垂直线偏差</p> <p>Location of the column in plan, relative to a vertical line through its centre at the next lower level</p>	$\Delta = \pm h/500$
4.3	<p>相邻楼层之间连续柱的直线度</p> <p>Straightness of a continuous column between adjacent storey levels</p> 	<p>在平面上，柱子相对于相邻楼层位置点之间的直线偏差</p> <p>Location of the column in plan, relative to a straight line between position points at adjacent storey levels</p>	$\Delta = \pm h/1000$
4.4	<p>相邻楼层之间拼接柱的直线度</p> <p>Straightness of a spliced column, between adjacent storey levels</p>	—	<p>无要求</p> <p>No requirement</p>
5.	<p>全接触端承面</p> <p>Full contact end-bearing</p>		

5.1	<p>立柱拼接对齐和支承面之间的间隙</p> <p>Column splice alignment and gap between bearing surfaces</p> 	<p>在“X”点处出现间隙 Δ 的同时发生的局部角度偏差 $\Delta\theta$</p> <p>Local angular misalignment $\Delta\theta$ occurring at the same time as gap Δ at point "X"</p>	<p>$\Delta\theta = \pm 2/500$</p> <p>和</p> <p>$\Delta = 6 \text{ mm}$ [1/4 英寸] 如果加了垫片</p> <p>或者 $\Delta = 2 \text{ mm}$ [1/16 英寸] 如果加了垫片</p> <p>$\Delta\theta = \pm 2/500$</p> <p>and</p> <p>$\Delta = 6 \text{ mm}$ [1/4 in] if shimmed or</p> <p>$\Delta = 2 \text{ mm}$ [1/16 in] if unshimmed</p>
6.	<p>柱位</p> <p>Positions of columns</p>		
6.1	<p>位置</p> <p>Location</p> 	<p>柱子底部中心在平面上相对于参考定位点（PR）的位置</p> <p>Location in plan of the centre of the column at the level of its base, relative to the position point of reference (PR):</p>	<p>$\Delta = \pm 6 \text{ mm}$ [1/4 英寸]</p> <p>$\Delta = \pm 6 \text{ mm}$ [1/4 in]</p>
6.2	<p>建筑物总长度</p> <p>Overall length of a building</p> 	<p>底层每行端柱之间的距离:</p> <p>Distance between end columns in each line, at base level:</p> <p>$L \leq 30 \text{ m}$</p> <p>$30 \text{ m} < L < 250 \text{ m}$</p> <p>$L \geq 250 \text{ m}$</p>	<p>柱基定位累积公差与柱身垂直度公差起控制作用</p> <p>Function of accumulated column location tolerance at base and column plumbness tolerances</p>
6.3	<p>柱间距</p> <p>Column spacing</p>	—	<p>无要求</p> <p>No requirement</p>

6.4	<p>柱中心对齐</p> <p>Column alignment, generally</p> 	<p>底层柱子中心相对于设计柱列线（ECL）的位置</p> <p>Location of the centre of the column at base level, relative to the established column line (ECL)</p>	<p>$\Delta = \pm 6 \text{ mm}$ [1/4 英寸]</p> <p>$\Delta = \pm 6 \text{ mm}$ [1/4in]</p>
6.5	<p>边柱对齐</p> <p>Perimeter column alignment</p> 	<p>底层边柱外表面相对于相邻立柱外表面的距离</p> <p>高度最大 90m [300 英尺]</p> <p>高度在 90m [300 英尺] 以上</p> <p>Location of the centreline of a perimeter column at base level, relative to the line joining the faces of the adjacent columns:</p> <p>up to 90 m [300 ft] tall</p> <p>\pm above 90m [300 feet] tall</p>	<p>在 38mm (1-1/2 英寸) 的范围内</p> <p>每 30m 增加 12mm (每 100 英尺增加 1/2 英寸), 最大 75mm (3 英寸)</p> <p>within an envelope that is 38 mm [1-1/2 in] wide</p> <p>add 12 mm per 30 m [1/2 in per 100 ft], maximum 75 mm [3 in]</p>

附录 D

Annex D

(资料性附录)

(informative)

几何公差-桥梁

Geometrical tolerances – Bridges

D.1 各国公差-桥梁

D.1 Tolerances per country - Bridges

桥梁几何公差的允许偏差详见以下国家标准：

Permitted deviations for geometrical tolerances in bridges are referenced in national standards in:

Table D.1: 欧洲；

Table D.1: Europe;

Table D.2: 澳大利亚 / 新西兰；

Table D.2: Australia / New Zealand;

Table D.3: 加拿大；

Table D.3: Canada;

Table D.4: 中国；

Table D.4: China;

Table D.5: 日本；

Table D.5: Japan;

Table D.6: 俄罗斯；

Table D.6: Russian Federation;

Table D.7: 英国；

Table D.7: United Kingdom;

Table D.8: 美国;

Table D.8: United States;

D.2 欧洲公差

D.2 Tolerances for Europe

表 D.1 -欧洲

Table D.1 – Europe

标准 Standard	标题 Title	备注 Notes
EN 1090-2	钢结构和铝结构的施工 - 第 2 部分: 钢结构的技术要求 Execution of steel structures and aluminium structures – Part 2: Technical requirements for steel structures	
EN 1993-2	欧洲规范 3: 钢结构设计—第 2 部分: 钢桥 Eurocode 3: Design of steel structures – Part 2: Steel Bridges	

D.3 澳大利亚和新西兰公差

D.3 Tolerances for Australia and New Zealand

表 D.2 -澳大利亚和新西兰

Table D.2 – Australia and New Zealand

标准 Standard	标题 Title	备注 Notes
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AS/NZS 5100.6	钢结构-制造和安装 Structural steelwork – Fabrication and erection	引自 AS/NZS 5100.6 《桥梁设计 — 第 6 部分：钢结构及组合结构施工》 Referenced from AS/NZS 5100.6 Bridge design – Part 6: Steel and composite construction
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D.4 加拿大公差

D.4 Tolerances for Canada

表 D.3 -加拿大

Table D.3 – Canada

标准 Standard	标题 Title	备注 Notes
CAN/CSA-S6	加拿大公路桥梁设计规范 Canadian Highway Bridge Design Code	
CAN/CSA-W59	焊接钢结构 Welded Steel Construction	

D-.5 中国公差

D.5 Tolerances for China

表 D.4 -中国

Table D.4 – China

标准 Standard	标题 Title	备注 Notes
Q/ CR 9211	《铁路钢桥制作规范》 Code for Fabrication of Railway Steel Bridge	

D.6 日本公差

D.6 Tolerances for Japan

表 D.5 -日本

Table D.5 – Japan

标准 Standard	标题 Title	备注 Notes
JARA, 第一部分 JARA, Part 1	日本公路桥梁设计规范, 第 1 部分通用篇 Japanese Design Specifications for Highway Bridges, Part I Common	JARA:日本道路协会 JARA: Japan Road Association
JARA, 第二部分 JARA, Part 2	日本公路桥梁设计规范, 第 2 部分钢桥篇 Japanese Design Specifications for Highway Bridges, Part II Steel Bridges	

D.7 俄罗斯联邦的公差

D.7 Tolerances for Russian Federation

表 D.6 -俄罗斯

Table D.6 – Russian Federation

标准 Standard	标题 Title	备注 Notes
SP 70.13330	承载和分隔结构 Load-bearing and separating constructions	

D.8 英国的公差

D.8 Tolerances for United Kingdom

表 D.7 -英国

Table D.7 – United Kingdom

标准 Standard	标题 Title	备注 Notes

EN 1090-2	钢结构和铝结构的施工 Execution of steel structures and aluminium structures	
PD 6705 - 2	钢和铝结构用途:第 2 部分:符合 BS EN 1090-2-标准的钢 桥施工—指南 Structural use of steel and aluminium: Part 2: Execution of steel bridges conforming to BS EN 1090-2 – Guide	
MCHW	公路工程合约文件手册 第 1 卷, 公路工程规范, 1800 系列-钢结构 Manual of Contract Documents for Highway Works Volume 1, Specification for Highway Works, Series 1800 - Structural Steelwork	

D.9 美国公差

D.9Tolerances for United States

表 D.8 -美国

Table D.8 – United States

标准 Standard	标题 Title	备注 Notes
AASHTO	LRFD 桥梁施工规范 LRFD Bridge Construction Specifications	
AREMA	铁路工程手册, 第 15 章 Manual for Railway Engineering, Chapter 15	
AASHTO AWS D1.5M/D1.5	桥梁焊接规范 Bridge Welding Code	适用于焊接构件 For welded components

附录 E

Annex E

(资料性附录)

(informative)

几何公差--起重机轨道

Geometrical tolerances - Crane runways

E.1 各国的公差规定一起重机轨道

E.1 Tolerances per country - Crane runways

起重机轨道中几何公差的允许偏差见以下表格:

Permitted deviations for geometrical tolerances in crane runways are given in:

- Table E.1: 欧洲; Europe;
- Table E.2: 澳大亚/新西兰; Australia / New Zealand;
- Table E.3: 加拿大; Canada;
- Table E.4: 中国; China;
- Table E.5: 日本; Japan;
- Table E.6: 俄罗斯; Russian Federation;
- Table E.7: 英国; United Kingdom;
- Table E.8: 美国.。 United States.

E.2 欧洲公差

E.2 Tolerances for Europe

除非另有说明, 表 E.1 的参考标准为 EN 1090-2:2018。表 E.1 的专用术语定义如下:

Unless otherwise noted, the reference standard for Table E.1 is EN 1090-2:2018.

Definitions specific to Table E.1 are:

基本公差:

Essential tolerances:

基本公差对于竣工结构的结构抗力和稳定性至关重要, 必须严格保证。

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

功能公差:

Functional tolerances:

功能公差是满足其他标准(如装配和外观)所需的公差。

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

一级:

Class 1:

除非执行规范中另有规定，一般情况下应采用一级公差。

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

二级:

Class 2:

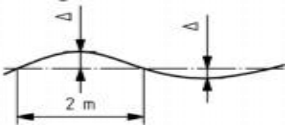
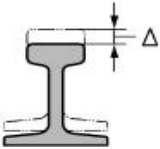


当需要更小公差偏差时(例如安装玻璃幕墙的场景),二级公差可替代一级公式使用。

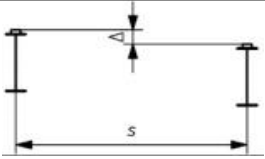
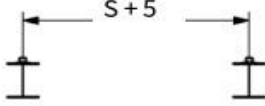
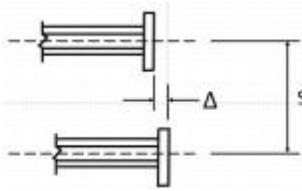
Tolerance Class 2 can substitute Class 1 if smaller tolerance deviations are required, for example, if glazed facades are to be fitted.

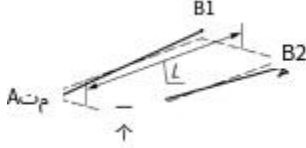
表 E.1 -欧洲

Table E.1 – Europe

编号 NO	标准 Criterion	参数 Parameter	基本公差 Essential tolerances	功能 Functional	公差 Tolerances
			一级和二级 Class 1 and 2	一级 Class 1	二级 Class 2

1	轨道在平面上的位置 Location of rail in plan	相对于设计的位置 Relative to the intended location		$\Delta = \pm 10\text{mm}$	$\Delta = \pm 5\text{mm}$
2	轨道局部平直度 Local alignment of rail 	2 米轨距长度上的平直度 Alignment over 2 m gauge length		$\Delta = \pm 1.5\text{mm}$	$\Delta = \pm 1\text{mm}$
3	轨道标高偏差 Level of rail 	跨度 L 的吊车梁的标高相对于设计标高 Relative to the intended level		$\Delta = \pm 15\text{mm}$	$\Delta = \pm 10\text{mm}$
4	轨道平直度 Level of rail 	跨距为 L 的吊车横梁的平直度 Level over span L of crane beam		$\Delta = \pm L/500$, but $ \Delta \geq 10\text{mm}$ $\Delta = \pm L/500$, but $ \Delta \geq 10\text{mm}$	$\Delta = \pm L/1000$, but $ \Delta \geq 10\text{mm}$ $\Delta = \pm L/1000$, but $ \Delta \geq 10\text{mm}$
5	建筑物的总长度 Overall length of a building 	2 米标距长度内偏差 Variation over 2 m gauge length		$\Delta = \pm 3\text{mm}$	$\Delta = \pm 2\text{mm}$
6	跨度为 s 的两侧轨道的相对高差 Relative levels of rails on the two sides of a runway with span s	标高偏差: 对于 $s \leq 10\text{m}$ 对于 $s > 10\text{m}$ Deviation of level: for $s \leq 10\text{m}$ for $s > 10\text{m}$		$\Delta = \pm 20\text{mm}$ $\Delta = \pm s/500$	$\Delta = \pm 10\text{mm}$ $\Delta = \pm s/1000$

					
7	<p>起重机轨道中心间距偏差</p> <p>Spacing over span s between centres of crane rails</p> 	<p>间距偏差: (s, 单位:m) 当 $s \leq 16\text{m}$ 时 对于 $s > 16\text{m}$</p> <p>Deviation of spacing: (s in metres) for $s \leq 16\text{ m}$ for $s > 16\text{ m}$</p>		<p>$\Delta = \pm 10\text{mm}$ $\Delta = \pm (10 + [s-16]/3)\text{ mm}$</p>	<p>$\Delta = \pm 5\text{mm}$ $\Delta = \pm (5 + [s-16]/4)\text{ m}$</p>
8	<p>结构端部挡块</p> <p>Structural end stops</p> 	<p>在轨道运行方向上， 同一端止挡的相对位置差</p> <p>Relative location of the stops at the same end, measured in the direction of travel on the runway</p>		<p>$\Delta = \pm s/1000$, 但是 $\Delta \leq 10\text{mm}$ $\Delta = \pm s/1000$, but $\Delta \leq 10\text{ mm}$</p>	<p>$\Delta = \pm s/1000$, 但是 $\Delta \leq 10\text{mm}$ $\Delta = \pm s/1000$, But $\Delta \leq 10\text{ mm}$</p>
9	<p>相临轨道的倾斜度</p> <p>Inclination of opposite rails</p> <p>相邻轨道的距离 L</p> <p>L distance of adjacent supports</p>	<p>轨道的相对倾斜度偏移量: $\Delta = N1 - N2$</p> <p>式中: N1 倾斜度—A1 B1 N2 倾斜度—A2 B2</p> <p>Inclination of opposite rails Offset: $\Delta = N1 - N2$</p>		$\Delta = L/500$	$\Delta = L/1000$

		where: N1 inclination — A1 B1 N2 inclination — A2 B2			
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E.3 澳大利亚和新西兰公差

E.3 Tolerances for Australia and New Zealand

除非另有说明，表 E.2 的参考标准为 AS/NZS 5131:2016。表 E.2 专用术语定义如下：

Unless otherwise noted, the reference standard for Table E.2 is AS/NZS 5131:2016.

Definitions specific to Table E.2 are:

a) 基本公差:

a) Essential tolerances:

满足结构在设计能力和稳定性方面的设计假定所需的几何公差的基本限值(见 AS 4100:2020, AS 5100.6:2017 和 NZS 3404:2018)。

Basic limit for a geometrical tolerance necessary to satisfy the design assumptions for a structure in terms of design capacity and stability (see AS 4100:2020, AS 5100.6:2017 and NZS 3404:2018).

b) 功能公差:

b) Functional tolerances:

除基本公差功能（如外观或装配要求）外，为满足其他功能而要求的公差。

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

c) 一级:

c) Class 1:

除非执行规范中另有规定，一般情况下应采用一级公差。

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

d) 二级:

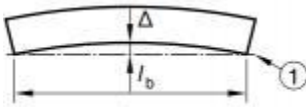
d) Class 2:

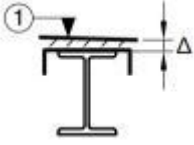
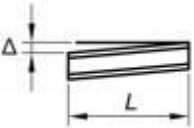
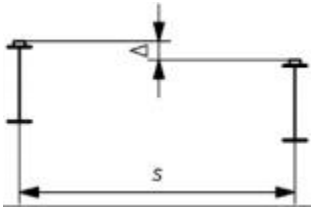
当需要更小公差偏差时(例如安装玻璃幕墙的场景),二级公差可替代一级公式使用。

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

表 E.2 -澳大利亚和新西兰

Table E.2 – Australia and New Zealand

编号 NO	标准 Criterion	参数 Parameter	基本公差 1 级和 2 级 Essential tolerances Class 1 and 2	功能公差 1 级 Functional Class 1	功能公差 2 级 Tolerances Class 2
1	轨道梁拱度 Sweep of erected beam 	梁翼缘相对设计位置的偏差 (Δ), 其中: l _b =有效支撑或约束间距 Deviation (Δ) of beam flange from intended position 1 where: l _b = length between points of effective bracing or restraint	$\Delta = \pm l_b / 500 \text{mm}$		

2	<p>梁的水平度</p> <p>Level of a beam</p> 	<p>在梁端连接处相对于规定水平度测量的偏差(Δ)</p> <p>Deviation (Δ) at a beam end connection measured relative to the specified level 1</p>	$\Delta = \pm 10\text{mm}$	$\Delta = \pm 15\text{mm}$	$\Delta = \pm 10\text{mm}$
3	<p>起重机梁两端的水平高差</p> <p>Level difference between opposite ends of a crane girder</p> 	<p>梁一端相对于另一端的偏差(Δ)</p> <p>注: L=梁跨</p> <p>Deviation (Δ) in level of one end of beam relative to other end where:</p> <p>L = girder span</p>	<p>$\Delta = \pm L/1000$, 和 $\Delta \leq 10\text{ mm}$</p> <p>注: 偏差按 AS1418.18</p> <p>Note: Deviation is as per AS 1418.18</p>	$\Delta = \pm L/500$	$\Delta = \pm L/1000$
4	<p>间距为 s 的两侧轨道的相对高度</p> <p>Relative levels of rails on the two sides of a runway with span s</p> 	<p>标高偏差</p> <p>对于 $s \leq 10\text{m}$</p> <p>对于 $s > 10\text{m}$</p> <p>Deviation of level for $s \leq 10\text{ m}$ for $s > 10\text{ m}$</p>	<p>$\Delta = \pm s/1000$ $\Delta \leq 10\text{mm}$</p> <p>注: 偏差按 AS1418.18</p> <p>Note: Deviation is as per AS 1418.18</p>	<p>$\Delta = \pm 20\text{ mm}$</p> <p>$\Delta = \pm s/500$</p>	<p>$\Delta = \pm 10\text{mm}$</p> <p>$\Delta = \pm s/1000$</p>

5	轨道平直度 Rail alignment	<p>应在施工规范中定义。</p> <p>固定装置应允许进行足够的调整，以使偏差在规定的限值范围内</p> <p>Responsibility to be defined in execution specification.</p> <p>Fixings shall allow sufficient adjustment to permit deviations to be within limit specified</p>	按照 AS1418.1 per AS 1418.1		
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E.4 加拿大公差标准

E.4 Tolerances for Canada

表 E.3 - 加拿大

Table E.3 – Canada

标准 Standard	标题 Title	备注 Notes
CAN/CSA-S16	钢结构设计 Design of Steel Structures	
文件 Document		

<p>CISC 设计指南</p> <p>CISC Design Guide</p>	<p>支承起重机的钢结构</p> <p>Crane-Supporting Steel Structures</p>	<p>本指南中的大多数公差参考美国起重机制造商协会（CMAA）规范第 74 号</p> <p>Most tolerances in this Guide refer to the Crane Manufacturers Association of America, Inc. (CMAA), Specification #74</p>
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E.5 中国公差标准


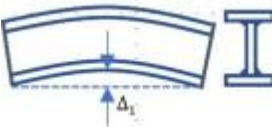
E.5 Tolerances for China

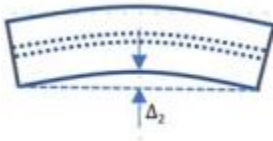
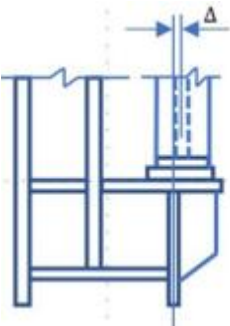
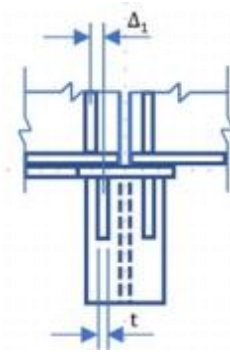
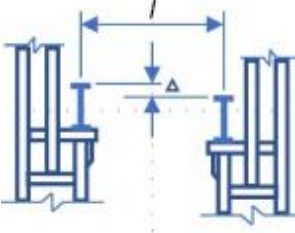
除非另有说明，表 E.4 的参考标准为 GB 50205 - 2020。


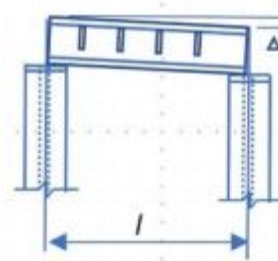
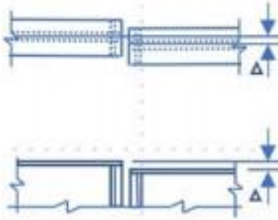
Unless otherwise noted, the reference standard for Table E.4 is GB 50205-2020.

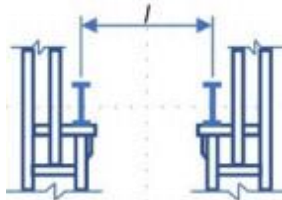
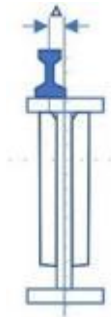
表 E.4 -中国

Table E.4 – China

序号 NO	标准 Criterion	参数 Parameter	公差 Tolerances
1		<p>梁跨中垂直度，Δ</p> <p>Verticality of the middle of beam's span,</p>	$h/500$
2		<p>垂直上拱矢高，Δ_1</p> <p>Vertical and upward bowed-height, Δ_1</p>	10 mm

3		侧向弯曲矢高, Δ_2 Lateral bowed-height Δ_2	1/1500, 且不大于 10mm 1/1500, But less than 10 mm	
4		两端支座中心位移, Δ Displacement of the center of bearings supporting beam end, Δ	安装在钢柱上时 与托架中心的偏差 Deviation from the center of bracket when mounted on steel column 安装在混凝土柱上时,对定位轴线的偏移 Deviation from the location axes when mounted on concrete column	5mm 5mm
		吊车梁支座加劲肋板中心与支承柱加劲肋板中的偏差, Δ_1 Deviation of the center of stiffener plate of crane beam's bearings from the center of stiffener plate of supporting column, Δ_1	$t / 2$	
5		同一跨且同一横截面吊车梁 顶面高差, Δ Height difference between the top surfaces of crane beams of the same span and section	支座处 其他处 Areas where support bearings are located Other areas	1 / 1000, 且不大于 10mm 15mm 1/1000, but less than 10 mm

		plane, Δ		15 mm
6		同一跨且同一横截面的悬挂式吊车梁底面高差, Δ Height difference between the bottom surfaces of hung crane beams of the same span and section plane, Δ	10mm	
7		同一列相邻两根吊车梁顶面高差, Δ Height difference between the top surfaces of two neighbouring crane beams of the same row, Δ	1 / 1500, 且不大于 10mm 1/1500, but less than 10 mm	
8		相邻两吊车梁接头部位, Δ Joint between two neighbouring crane beams, Δ	中心错位 承载面顶面高差 承载面底面高差 Misalignment of centres Height difference between the top surfaces bearing loads Height difference between the bottom surfaces bearing loads	3 mm 1 mm 1 mm

9		同跨间任意一截面的 吊车梁中心跨距,Δ Central span of crane beams of the same span and any section plane, Δ	$\pm 10 \text{ mm}$
10		轨道中心对吊车梁腹板 轴线的偏差,Δ Deviation of railway center from the axis of crane beam's web plate, Δ	$t/2$

E.6 日本公差标准

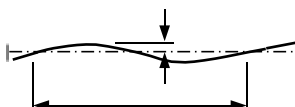
E.6 Tolerances for Japan


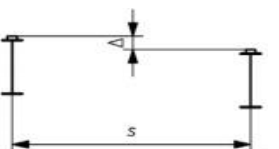
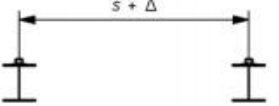
起重机轨道的公差由施工规范确定。一般公差见表 E.5。

Tolerances for crane runways are established by the execution specification. General tolerances are shown in Table E.5.

表 E.5 -日本

Table E.5 – Japan

序号 No	标准 Criterion	参数 Parameter	极限公差 Limit Tolerances	控制公差 Control Tolerances
1	轨道的局部平直度 Local alignment of rail 	跨度方向平直度 Alignment over span length		$\Delta \leq L/1000$

2	轨道水平度 Level of rail  1 吊车轨道 crane rail 2 吊车梁 crane beam	起重机梁跨距 L 上的水平度 Level over span L of crane beam	$\Delta \leq L/500$	$\Delta \leq L/1000$
3	轨道的局部平直度 Relative levels of rails on the two sides of a runway with span s 	水平度偏差 Deviation of level 对于 $s \leq 10\text{m}$ 对于 $s > 10\text{m}$	$\Delta \leq s/500$ $\Delta \leq s/500$	$\Delta \leq s/1000$ $\Delta \leq s/1000$
4	跨度 s 起重机轨道中心 间距 Spacing over span s between centres of crane rails 	间距偏差 Deviation of spacing 对于 $s \leq 16\text{ m}$ 对于 $s > 16\text{ m}$	$\Delta = \pm 10\text{ mm}$ $\Delta = \pm 10\text{ mm}$	$\Delta = \pm 5\text{ mm}$ $\Delta = \pm 5\text{ mm}$

E.7 俄罗斯公差标准

E.7 Tolerances for Russian Federation

除非另有说明，表 E.6 的参考标准为 SP 70.13330。

Unless otherwise noted, the reference standard for Table E.6 is SP 70.13330.

表 E.6 -俄罗斯

Table E.6 – Russian Federation

序号 No	标准 Criterion	允许偏差 Tolerance
	桥式起重机 Bridge cranes	
1	同一跨度内轨道轴线间的距离（沿柱轴线方向，至少每 6m 测量一次） Distance between the axes of the rails of one span (along the axes of the columns, but at least every 6 m)	$\pm 10 \text{ mm}$
2	轨道轴线相对于起重机大梁轴线的偏移量 Offset of the rail axis from the axis of the crane girder	$\pm 15 \text{ mm}$
3	40m 长度范围内轨道轴线的平直度偏差 Deviation of the rail axis from a straight line at a length of 40 m	$\pm 15 \text{ mm}$
4	建筑物跨度内同一横截面轨道顶面标高差 Difference in the marks of the rail heads in one cross section of the span of the building on supports in span	$\pm 15 \text{ mm}$ $\pm 20 \text{ mm}$
5	相邻柱上起重机轨道的标高差（柱间距为 L）： 当 $L < 10 \text{ m}$ 当 $L \geq 10 \text{ m}$ Difference in elevation of crane rails on adjacent columns (distance between columns L): with L less than 10 m at L = 10 m and more	$\pm 10 \text{ mm}$ 0.001 L, 但不超过 15mm $\pm 10 \text{ mm}$ 0,001 L, but not more than 15 mm
6	相邻轨道端部在平面和高度方向的相对偏差 Mutual displacement of the ends of the abutting rails in plan and height	$\pm 2 \text{ mm}$
7	轨道接头处的间隙（温度为 0°C 且轨道长度为 12.5m 时）；温度每变化 10°C ，间隙公差变化 1.5mm The gap in the rail joints (at a temperature of 0°C and a rail length of 12,5 m); when the temperature changes by 10°C , the gap tolerance changes by 1,5 mm	$\pm 4 \text{ mm}$
	悬臂起重机 Overhead cranes	

8	<p>相邻支撑上（沿轨道方向）下部传动带标高差（与支撑类型无关，支撑间距为 L），mm</p> <p>The difference between the lower driving belt marks on the adjacent supports (along the way), independently of the type of tap (distance between supports L), mm</p>	0.0007 L
9	<p>两跨及多跨悬挂起重机同一横截面内相邻梁下部传动带标高差，mm： 支座处 跨内</p> <p>The difference in the elevations of the lower driving belts of adjacent beams in the spans in the same cross-section of two- and multi-support suspension cranes, mm: on supports in span</p>	$\pm 6 \text{ mm}$ $\pm 10 \text{ mm}$
10	<p>同上，在有对接节点的情况下支座处及跨内</p> <p>The same, but with butt locks on the supports and in the span</p>	$\pm 2 \text{ mm}$
11	<p>梁轴线相对于轨道纵向中心线的偏差(不限于手动和电动葫芦)</p> <p>Offset of the beam axis from the longitudinal center line axis of the track (not limited for manual and electric hoists)</p>	$\pm 3 \text{ mm}$

E.8 英国公差标准

E.8 Tolerances for United Kingdom



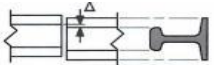
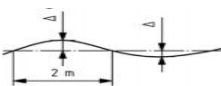
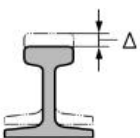
除非另有说明，表 E.7 的参考标准为 BCSCA NSSS:2021。


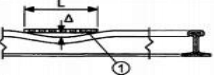


Unless otherwise noted, the reference standard for Table E.7 is BCSCA NSSS:2021.

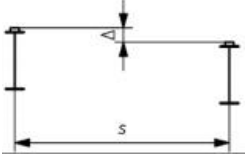

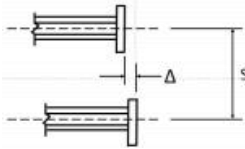
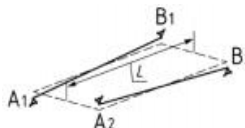
表 E.7 -英国

Table E.7 – United Kingdom

序号 NO	标准 Criterion	参数 Parameter	公差 Tolerances
1	<p>轨道在平面上的相对位置偏差</p> <p>Relative location of rail</p>	<p>注:相对于支撑钢结构的位置</p> <p>Note: Location is relative to supporting steelwork</p>	$\Delta = \pm 10 \text{ mm}$

	in plan		
			
1a	<p>轨道相对于腹板的偏心距</p> <p>Eccentricity of rail relative to web</p> 	<p>轨道相对于厚度为 t_w 腹板的偏心距 Δ</p> <p>$t_w \leq 10\text{mm}$</p> <p>$t_w > 10\text{mm}$</p> <p>Eccentricity Δ of rail relative to web of thickness t_w</p> <p>$t_w \leq 10\text{mm}$</p> <p>$t_w > 10\text{mm}$</p>	<p>$\Delta = 5\text{ mm}$</p> <p>$\Delta = t_w/2$</p>
1b	<p>轨道边缘</p> <p>Edge of rail</p> 	<p>轨道接头处边缘的错台 Δ</p> <p>Step Δ in edge of rail at joint</p>	<p>$\Delta = \pm 1\text{ mm}$</p>
2	<p>轨道局部平直度</p> <p>Local alignment of rail</p> 	<p>在 2m 轨距长度上轨道相对平面的错位</p> <p>Misalignment in plan of rail over gauge (1) of length L equal to 2m</p>	<p>$\Delta = \pm 1.5\text{ mm}$</p>
3	<p>轨道相对竖向偏差</p> <p>Relative level of rail</p> 	<p>相对于设计标高</p> <p>注:相对于支撑钢结构位置.</p> <p>Relative to the intended level</p> <p>Note: Location is relative to supporting steelwork.</p>	<p>$\Delta = \pm 15\text{ mm}$</p>

4	<p>起重机梁上轨道的水平度 Level of rail over crane beam</p> <p>1 起重机钢轨 Crane rail</p> <p>2 起重机横梁 Crane beam</p> 	<p>跨度为 L 的起重机梁上的轨道竖向变形 Variation on level of rail over crane beam of span L</p>	<p>$\Delta = \pm L/500$, 或 10 mm, 取较大值 $\Delta = \pm L/500$, or 10 mm, whichever is greater</p>
5	<p>轨道局部水平度 Local level of rail</p> 	<p>在 2m 轨距长度上轨道在竖向的偏差 Misalignment in elevation of rail over gauge (1) of length L equal to 2m</p>	<p>$\Delta = \pm 3 \text{ mm}$</p>
5a	<p>轨道顶面水平度 Level of rail</p> 	<p>轨道接头处顶面的错台 Δ Step Δ in top of rail at joint</p>	<p>$\Delta = \pm 1 \text{ mm}$</p>
5b	<p>轨道顶面坡度 Slope of rail surface</p> 	<p>宽度为 b 的起重机钢轨横截面顶面坡度 Δ Slope Δ of top surface of cross- section of crane rail of width b</p>	<p>$\Delta = \pm b/100$</p>

6	<p>跨度为 s 的两侧轨道梁 相对水平度</p> <p>Relative levels of rails on the two sides of a runway with span s</p> 	<p>水平度偏差</p> <p>$s \leq 10 \text{ m}$ $s > 10 \text{ m}$</p> <p>Deviation of level</p> <p>$s \leq 10 \text{ m}$ $s > 10 \text{ m}$</p>	<p>$\Delta = \pm 20 \text{ mm}$ $\Delta = \pm s/500$</p>
7	<p>结构端部止挡偏差</p> <p>Crane gantries gauge of rail tracks</p> 	<p>轨距与设计值的偏差 (s 以米为单位)</p> <p>$s \leq 16 \text{ m}$ $s > 16 \text{ m}$</p> <p>Deviation of spacing from nominal gauge s (s in metres)</p> <p>$s \leq 16 \text{ m}$ $s > 16 \text{ m}$</p>	<p>$\Delta = \pm 10 \text{ mm}$ $\Delta = \pm (10 + [s-16]/3) \text{ mm}$</p>
8	<p>结构端部止挡偏差</p> <p>Structural end stops</p> 	<p>在轨道运行方向上，同一端止挡的相对 位置差</p> <p>Relative location of the stops at the same end, measured in the direction of travel on the runway</p>	<p>$\Delta = \pm s/1000$, 但最大值在 10mm 以内 $\Delta = \pm s/1000$, but limited to a maximum of 10 mm</p>
9	<p>相邻轨道倾斜度</p> <p>Inclination of opposite rails</p> 	<p>长度为 L 的相邻轨道支撑之间，轨道的 相对倾斜度。偏移量: $\Delta = N1 - N2$, 其中 $N1$ 为倾斜度-A1 B1; $N2$ 为倾斜度 -A2 B2</p> <p>Relative inclination Δ of rails on opposite sides of a gantry of length L between adjacent supports.</p> <p>Offset: $\Delta = N1 - N2$ where: $N1$ inclination A1 B1 $N2$ inclination A2 B2</p>	<p>$\Delta = L/500$</p>

E.9 美国公差

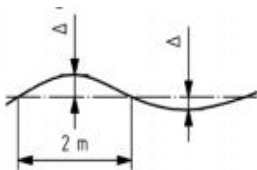
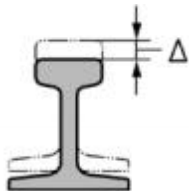

E.9 Tolerances for United States

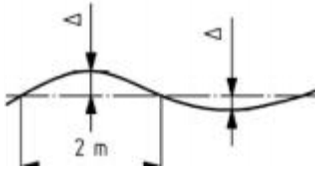
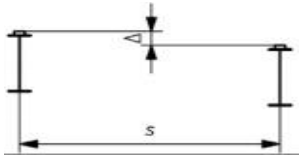
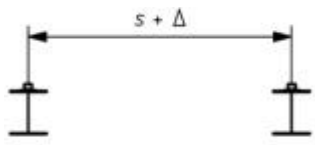
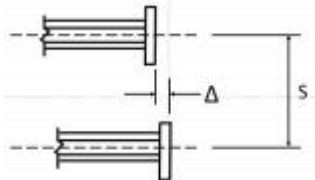
除非另有注明，表 E.8 的参考文件为美国钢结构学会（AISC）设计指南 7：2019 版。

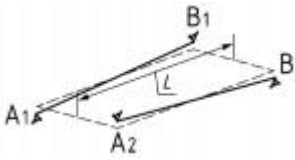
Unless otherwise noted, the reference document for Table E.8 is the AISC Design Guide 7:2019.

表 E.8 -美国

Table E.8– United States

序号 NO	标准 Criterion	参数 Parameter	公差类型 1 Tolerances Type 1
1	轨道局部平直度 Local alignment of rail 	轨道顶面水平度 轨道顶面水平度 Alignment over 15 m (50 ft) gauge length Max misalignment	$\Delta = \pm 6 \text{ mm}$ [1/4 英寸] 12 mm [1/2 英寸] $\Delta = \pm 6 \text{ mm}$ [1/4 in] 12 mm [1/2 in]
2	轨道相对水平度 Relative level of rail 	轨道顶面水平度 Vertical longitudinal misalignment measured at column centrelines	在 15 米（50 英尺）范围内允许偏差 $\pm 6 \text{ mm}$ [1/4 英寸] 在跑道全长范围内允许偏差 $\pm 12 \text{ mm}$ (1/2 英寸) $\pm 6 \text{ mm}$ [1/4 in] in 15m [50 ft] $\pm 12 \text{ mm}$ [1/2 in] over the length of the runway
3	轨道平面上相对位置差 Relative location of rail in plan 	轨道顶面水平度 Elevation misalignment of adjacent crane girders	3 mm [1/8 英寸] 3 mm [1/8 in]

4	<p>建筑物的总长度 Overall length of a building</p> 	<p>2m 长度范围轨道顶面水平度 Variation over 2 m gauge length</p>	$\Delta = \pm 3 \text{ mm}$
5	<p>间距为 s 的两侧轨道的 相对水平度 Relative levels of rails on the two sides of a runway with span s</p> 	<p>轨道顶面水平度 Deviation of level</p>	<p>$\Delta = \pm 10 \text{ mm}$ [3/8 英寸] 或者在 6m 距离公差为 6 mm [在 20 英尺范围公差为 1/4 英寸] $\Delta = \pm 10 \text{ mm}$ [3/8 in] or 6 mm in 6 m [1/4 in in 20 ft]</p>
6	<p>间距为 s 起重机轨道中 心差 Spacing over span s between centres of crane rails</p> 	<p>间距偏差 Deviation of spacing</p>	<p>在 20 摄氏度 (68 华氏度) 时, $\Delta = \pm 6 \text{ mm}$ [1/4 英寸] $\Delta = \pm 6 \text{ mm}$ [1/4 in] @ 20°C [68°F]</p>
7	<p>结构端部止挡 Structural end stops</p> 	<p>在轨道运行方向上测量的同一端 止挡的相对偏差 Relative location of the stops at the same end, measured in the direction of travel on the runway</p>	<p>$\Delta = \pm s/10$ 但 $\Delta \leq 10 \text{ mm}$ $\Delta = \pm s/1000$, but $\Delta \leq 10 \text{ mm}$</p>

8	<p>相邻轨道倾斜度 Inclination of opposite rails</p>  <p>L 相邻支架距离 L distance of adjacent supports</p>	<p>相邻轨道倾斜度： 偏移量： $\Delta = N1 - N2$，其中： N1 为倾斜度-A1 B1; N2 为倾斜度-A2 B2 Inclination of opposite rails: Offset: $\Delta = N1 - N2$ where: N1 inclination A1-B1 N2 inclination A2-B2</p>	<p>$\Delta = L/500$</p>
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附录 F

Annex F

(资料性附录)

(informative)

几何公差-混凝土基础与支承结构

Geometrical tolerances - Concrete foundations and supports

F.1 各国公差标准

F.1 Tolerances per country

允许偏差规定参见以下标准:

Permitted deviations are given in:

—表 F.1: 欧洲; Europe;

—表 F.2: 澳大利亚/新西兰 Australia / New Zealand;

—表 F.3: 加拿大; Canada;

—表 F.4: 中国; China;

—表 F.5: 日本; Japan;

—表 F.6: 俄罗斯; Russian Federation;

—表 F.7: 英国; United Kingdom;

—表 F.8: 美国; United States

F.2 欧洲公差

F.2 Tolerances for Europe

除另有说明, 表 F.1 的参考标准为 EN 1090-2:2018。

Unless otherwise noted, the reference standard for Table F.1 is EN 1090-2:2018.

表 F.1 专用术语定义如下:

Definitions specific to Table F.1 are:

功能公差:

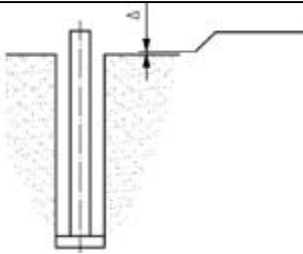
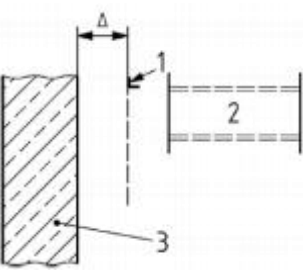
Functional tolerances:

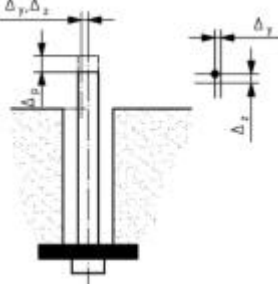
功能公差是指为满足装配和外观等其他要求所需的公差。

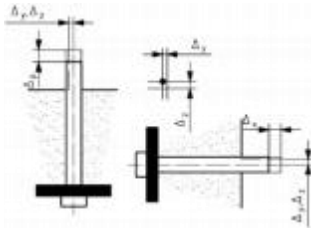
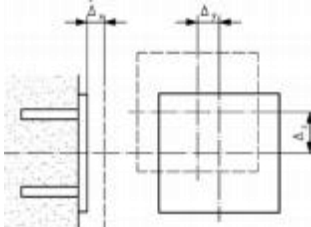
Functional tolerances are those required to fulfil other criteria such as fit-up and appearance.

表 F.1 -欧洲

Table F.1 – Europe

序号 NO	标准 Criterion	参数 Parameter	功能公差 Functional Tolerances
1	 <p>基础标高 Foundation level</p>	<p>标高偏差 Deviation from specified level</p>	<p>- $\Delta = 15$ mm(低于设计标高) + $\Delta = 5$ mm(高于设计标高)</p> <p>- $\Delta = 15$ mm (below) + $\Delta = 5$ mm (above)</p>
2	<p>垂直墙体 Vertical wall</p>  <p>关键点: 1 设计位置 2 钢构件 3 支撑墙</p> <p>Key: 1 specified position 2 steel component</p>	<p>钢构件支承点位置允许偏差 Deviation from specified position at support point for steel component</p>	<p>$\Delta = \pm 25$ mm</p>

	3 supporting wall		
3	<p>可调节预埋锚杆偏差 Pre-set foundation bolt where prepared for adjustment</p> 	<p>定位偏差 Δ 与外伸量 螺栓群中心位置允许偏差为 6mm 螺栓端部竖向外伸量 Δp</p> <p>Deviation Δ from specified location and protrusion The permitted deviation for location of the centre of a bolt group is 6 mm. Location at tip Vertical protrusion Δp</p>	<p>$\Delta y, \Delta z = \pm 10 \text{ mm}$ - $\Delta p = 5 \text{ mm}$ (低于) + $\Delta p = 25 \text{ mm}$ (高于)</p> <p>$\Delta y, \Delta z = \pm 10 \text{ mm}$ - $\Delta p = 5 \text{ mm}$ (low) + $\Delta p = 25 \text{ mm}$ (high)</p>

4	<p>固定式预埋锚杆偏差 Pre-set foundation bolt where not prepared for adjustment</p> 	<p>定位偏差 Δ (位置、标高及外伸量) 位置允许偏差同样适用于螺栓群中心 螺栓端部位置或标高 竖向外伸量 Δp 水平外伸量 Δx</p> <p>Deviation Δ from specified location, level and protrusion The permitted deviation for location also applies to the centre of a bolt group. Location or level at tip Vertical protrusion Δp Horizontal protrusion Δx</p>	<p>$\Delta y, \Delta z = \pm 3 \text{ mm}$ - $\Delta p = 5 \text{ mm}$ (低于) + $\Delta p = 45 \text{ mm}$ (高于) - $\Delta x = 5 \text{ mm}$ (向内) + $\Delta x = 45 \text{ mm}$ (向外)</p> <p>$\Delta y, \Delta z = \pm 3 \text{ mm}$ - $\Delta p = 5 \text{ mm}$ (low) + $\Delta p = 45 \text{ mm}$ (high) - $\Delta x = 5 \text{ mm}$ (in) + $\Delta x = 45 \text{ mm}$ (out)</p>
5	<p>预埋件 Steel anchor plate embedded in concrete</p> 	<p>与设计三维坐标允许偏差 (Δx, Δy, Δz)</p> <p>Deviations $\Delta x, \Delta y, \Delta z$ from the specified location and level</p>	<p>$\Delta x, \Delta y, \Delta z = \pm 10 \text{ mm}$</p>

F.3 澳大利亚和新西兰

F.3 Australia and New Zealand

除另有说明，表 F.2 的参考标准为 AS/NZS 5131:2016。

表 F.2 专用术语定义如下:

Unless otherwise noted, the reference standard for Table F.2 is AS/NZS 5131:2016.

Definitions specific to Table F.2 are:

功能公差:

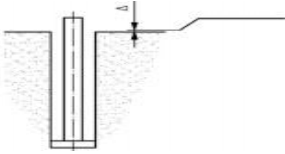
Functional tolerances:

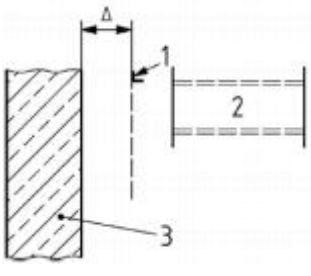
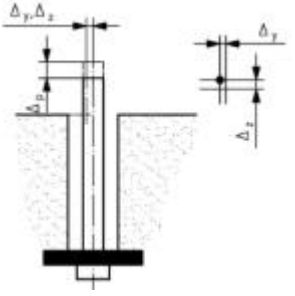
除基本公差功能（如外观或装配要求）外，为满足其他功能而要求的公差。

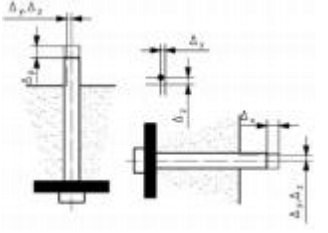
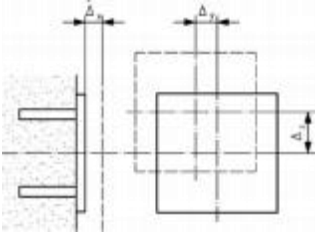
A tolerance which can be required to meet a function other than those of an essential tolerance, such as for appearance or fit-up.

表 F.2 -澳大利亚和新西兰

Table F.2 – Australia and New Zealand

序号 NO	标准 Criterion	参数 Parameter	功能公差 Functional Tolerances
1	基础标高 Foundation level 	标高偏差 Deviation from specified level	$-\Delta = 15 \text{ mm}$ (低于) $+\Delta = 5 \text{ mm}$ (高于) $-\Delta = 15 \text{ mm}$ (below) $+\Delta = 5 \text{ mm}$ (above)

2	<p>竖向墙体 Vertical wall</p>  <p>关键点: 1 设计位置 2 钢构件 3 支撑墙</p> <p>Key: 1 specified position 2 steel component 3 supporting wall</p>	<p>钢构件支座节点处的定位偏差</p> <p>Deviation from specified position at support point for steel component</p>	<p>$\Delta = \pm 25 \text{ mm}$</p>
3	<p>可调节预埋地脚螺栓偏差 Pre-set foundation bolt where prepared for adjustment</p> 	<p>定位偏差 Δ 与外伸量</p> <p>螺栓群中心位置的允许偏差为 6mm</p> <p>螺栓端部竖向外伸量 Δp</p> <p>Deviation Δ from specified location and protrusion</p> <p>The permitted deviation for location of the center of a bolt group is 6 mm.</p> <p>Location at tip Vertical protrusion Δp</p>	<p>$\Delta y, \Delta z = \pm 10 \text{ mm}$</p> <p>- $\Delta p = 5 \text{ mm}$ (低于)</p> <p>+ $\Delta p = 25 \text{ mm}$ (高于)</p> <p>$\Delta y, \Delta z = \pm 10 \text{ mm}$</p> <p>- $\Delta p = 5 \text{ mm}$ (low)</p> <p>+ $\Delta p = 25 \text{ mm}$ (high)</p>

4	<p>固定式预埋地脚螺栓偏差</p> <p>Pre-set foundation bolt where not prepared for adjustment</p> 	<p>定位偏差 Δ (位置、标高及外伸量)</p> <p>位置允许偏差同样适用于螺栓群中心</p> <p>螺栓端部位置或标高</p> <p>竖向外伸量 Δp</p> <p>水平外伸量 Δx</p> <p>Deviation Δ from specified location, level and protrusion:</p> <p>The permitted deviation for location also applies to the centre of a bolt group.</p> <p>Location or level at tip</p> <p>Vertical protrusion Δp</p> <p>Horizontal protrusion Δx</p>	<p>$\Delta y, \Delta z = \pm 3 \text{ mm}$</p> <p>- $\Delta p = 5 \text{ mm}$ (低于)</p> <p>+ $\Delta p = 45 \text{ mm}$ (高于)</p> <p>- $\Delta x = 5 \text{ mm}$ (向内)</p> <p>+ $\Delta x = 45 \text{ mm}$ (向外)</p> <p>$\Delta y, \Delta z = \pm 3 \text{ mm}$</p> <p>- $\Delta p = 5 \text{ mm}$ (low)</p> <p>+ $\Delta p = 45 \text{ mm}$ (high)</p> <p>- $\Delta x = 5 \text{ mm}$ (in)</p> <p>+ $\Delta x = 45 \text{ mm}$ (out)</p>
5	<p>预埋件</p> <p>Steel anchor plate embedded in concrete</p> 	<p>与设计三维坐标允许偏差 ($\Delta x, \Delta y, \Delta z$)</p> <p>Deviations $\Delta x, \Delta y, \Delta z$ from the specified location and level</p>	<p>$\Delta x, \Delta y, \Delta z = \pm 10 \text{ mm}$</p>
6	<p>地脚螺栓群间距</p> <p>注: 已确定的柱轴线是最能代表已建成的沿一列柱子的地脚螺栓组中心的实际现场线。</p> <p>Distances between anchor bolt groups</p> <p>NOTE: Established column</p>	<p>允许尺寸偏差 (Δ):</p> <p>任何螺栓群的中心与柱轴线偏差</p> <p>沿着柱轴线多个螺栓群累计偏差</p> <p>相邻螺栓群中心偏差</p> <p>Deviation (Δ) from specified dimensions:</p> <p>Centre of any bolt group to established</p>	<p>$\Delta = \pm 6 \text{ mm}$</p> <p>$\Delta = \pm 6 \text{ mm}$</p> <p>$\Delta = 6 \text{ mm}/30 \text{ m}$</p> <p>且不超过 25 mm</p> <p>$\Delta = \pm 6 \text{ mm}$</p> <p>$\Delta = \pm 6 \text{ mm}$</p>

	line is the actual field line most representative of the centres of the as-built anchor bolt groups along a line of columns.	column line through that group Accumulation along an established column line of multiple anchor bolt groups Centre-to-centre of adjacent bolt groups	$\Delta = 6 \text{ mm per } 30 \text{ m}$ $\leq 25 \text{ mm}$
	<p>锚栓 锚栓 锚栓 锚栓 锚栓 锚栓</p> <p>指定尺寸 (每 30 米允许偏差 $\pm 6\text{mm}$, 总体偏差不得超过 $\pm 25\text{mm}$)</p> <p>最大偏差 ± 6</p> <p>最大偏差 ± 6</p> <p>最大偏差 ± 6</p> <p>锚栓</p> <p>轴网</p> <p>锚栓偏心位置详情</p> <p>若柱子偏离主柱轴线, 最大偏差 ± 6</p> <p>直接浇筑时, $\Delta x, \Delta y = \pm 3 \text{ 毫米}$; 套管安装时, $\Delta x, \Delta y = \pm 10 \text{ 毫米}$</p>		
	<p>Anchor bolts Anchor bolts Anchor bolts Anchor bolts Anchor bolts Anchor bolts</p> <p>Specified dimension (± 6 in every 30m but not greater than ± 25 overall)</p> <p>Max. deviation ± 6</p> <p>Max. deviation ± 6</p> <p>Max. deviation ± 6</p> <p>Anchor bolts</p> <p>Grid</p> <p>Detail of off-centre location of anchor bolts</p> <p>Max. deviation ± 6 if column offset from main column line</p> <p>$\Delta x, \Delta y = \pm 3 \text{ mm rigidly cast-in}$ $\Delta x, \Delta y = \pm 10 \text{ mm sleeved}$</p>		

F.4 加拿大公差标准

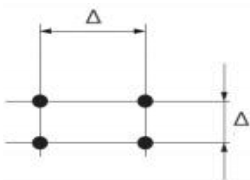
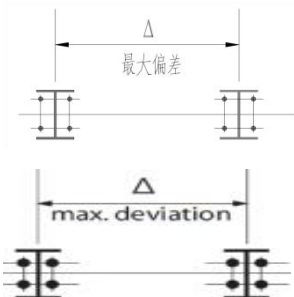
F.4 Tolerances for Canada

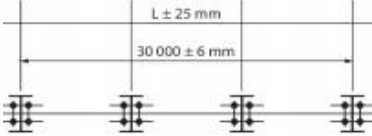
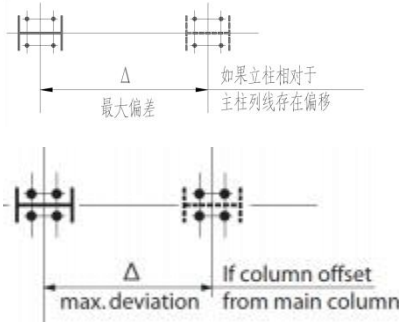
除非另有说明，表 F.3 的引用依据为加拿大钢结构协会（CISC）《标准实施规范》：2016 版。

Unless otherwise noted, the reference document for Table F.3 is the CISC Code of Standard Practice:2016.

表 F.3 -加拿大

Table F.3 – Canada

序号 NO	标准 Criterion	参数 Parameter	公差 Tolerances
1	<p>地脚螺栓间距 Distance between rods</p> 	<p>地脚螺栓群内任意两螺栓的中心距偏差（注：此处“锚杆群组”定义用于固定单根预制钢构件的一组锚杆）</p> <p>Centre-to-centre deviation of any two rods within an anchor rod group, where an anchor rod group is defined as the set of anchor rods which receive a single fabricated steel shipping piece.</p>	$\Delta = \pm 3\text{mm}$
2	<p>相邻螺栓组间距 Distance between adjacent groups</p> 	<p>相邻地脚螺栓群中心距偏差；</p> <p>处于同一柱轴线上的相邻任意螺栓群中心偏差</p> <p>Centre-to-centre deviation between adjacent anchor rod groups；</p> <p>Deviation from the centre of</p>	$\Delta = \pm 6\text{mm}$

		any anchor rod group adjacent to the established column line.	
3	<p>累积总偏差 Total accumulation</p> 	<p>沿确立柱轴线方向多地脚螺栓组的总累计偏差</p> <p>（注：确立柱轴线指现场实际放线确定的基准线，最能代表沿柱列线已安装地脚螺栓群中心的实际位置。）</p> <p>Maximum accumulation along the established column line of multiple anchor rod groups. The established column line is the actual field line most representative of the centres of the as-built anchor rod groups along a line of columns.</p>	<p>$\Delta = \pm 6 \text{ mm}$ 每 30000 mm $\Sigma \Delta < 25 \text{ mm}$</p> <p>$\Delta = \pm 6 \text{ mm}$ per 30000 mm $\Sigma \Delta < 25 \text{ mm}$</p>
4	<p>柱轴线偏移距离 Offset distance column line</p> 	<p>公差 2 和 3 同样适用于施工图中标注的偏移尺寸，这些尺寸是相对于最近确立柱轴线平行或垂直测量的，适用于图纸中标注需偏离确立柱轴线的单根钢柱。</p> <p>Tolerances 2 and 3 also apply to offset dimensions, shown on the construction drawings, measured parallel and perpendicular to the nearest established column line for individual columns shown on</p>	<p>$\Delta = \pm 6 \text{ mm}$</p>

		the drawings to be offset from established column lines.	
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F.5 中国公差

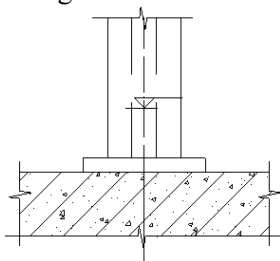
F.5 Tolerances for China

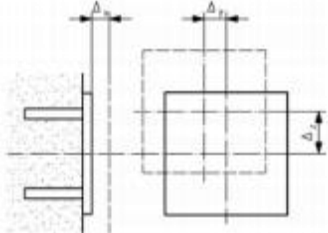

除非另有说明, 表 F.4 的引用标准为《钢结构工程施工质量验收标准》GB50205-2020。

Unless otherwise noted, the reference standard for Table F.4 is GB50205-2020.

表 F.4 -中国

Table F.4 – China

序号 NO	标准 Criterion	参数 Parameter	公差 Tolerances
1	支承面 Bearing surface 	标高 Elevation 水平度 Levelness	± 3mm 1/1000

2		<p>与设计三维坐标允许偏差 (Δx, Δy, Δz)</p> <p>Deviations Δx, Δy, Δz from the specified location and level</p>	10mm
3	<p>地脚螺栓 Anchor bolt</p> 	<p>柱底板中心线相对于定位轴线的偏移 Offset of the center line of the column base to the positioning axis</p> <p>螺栓轴线中心偏移 Bolt center offset</p> <p>预留孔中心偏移量 Center offset of reserved hole</p>	<p>5mm</p> <p>5mm</p> <p>10mm</p>

F.6 日本公差

F.6 Japan

除非另有说明，表 F.5 的引用标准为日本建筑学会标准《钢结构工程》JASS 6:2016。

Unless otherwise noted, the reference standard for Table F.5 is JASS 6:2016.

a) 本附录所示公差分为极限公差和控制公差两类。

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

tolerances.

b) 极限公差是验收标准的允许最大值或最小值，原则上不得超出。

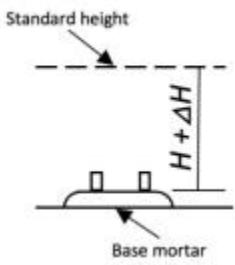
b) The limit tolerance is a maximum or minimum value for the acceptance criteria and shall not be exceeded, as a rule.

c) 控制公差是作为加工或安装标准的目标值，旨在确保至少 95%的产品符合要求，并在尺寸精度验收检验中作为判定单件产品合格与否的基准值，以决定该检验批是否可被接收。

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.

表 F.5 -日本

Table F.5 – Japan

序号 NO	标准 Criterion	参数 Parameter	极限公差 Limit Tolerances	控制公差 Control Tolerances
1	高度 Height 	立柱安装面高度 Height of column installation face	$\Delta = \pm 5 \text{ mm}$	$\Delta = \pm 3 \text{ mm}$

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F.7 俄罗斯公差标准

F.7 Tolerances for Russian Federation


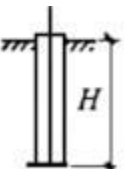
除非另有说明，表 F.6 的引用标准为《俄罗斯联邦建筑规范》SP 70.13330。

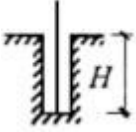
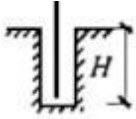
Unless otherwise noted, the reference standard for Table F.6 is SP 70.13330.

表 F.6 俄罗斯公差标准

Table F.6 – Russian Federation

序号 No	标准 Criterion	参数 Parameter	公差 Tolerances
1	带弯钩的螺栓，直径 d: 12–48mm Bolt with a bend, diameter d12–48mm 	最小埋置深度，H Minimum embedment depth,H	25d
		螺栓最小距离 the smallest distance between the bolts	6d
		螺栓中心至基础边缘的最小距离 the smallest distance from the bolt axis to the edge of the foundation	4d
		荷载系数 load factor	0,4
		紧固稳定系数，k tightening stability factor, k	1.9 (1.3)

2	<p>带锚板的螺栓 直径 12–140mm</p> <p>With blind anchor plate, diameter d12–140mm</p> 	<p>最小埋置深度, H Minimum embedment depth,H</p> <p>螺栓最小距离 the smallest distance between the bolts</p> <p>螺栓中心至基础边缘的最小距离 the smallest distance from the bolt axis to the edge of the foundation</p> <p>荷载系数 load factor</p> <p>紧固稳定系数, k tightening stability factor, k</p>	<p>15d</p> <p>8d</p> <p>6d</p> <p>0.4</p> <p>1.9 (1.3)</p>
3	<p>可拆卸式锚板的螺栓, 直径 56–125mm</p> <p>With removable anchor plate, diameter d56–125mm</p> 	<p>最小埋置深度, H Minimum embedment depth,H</p> <p>螺栓最小距离 the smallest distance between the bolts</p> <p>螺栓中心至基础边缘的最小距离 the smallest distance from the bolt axis to the edge of the foundation</p> <p>荷载系数 load factor</p> <p>紧固稳定系数, k tightening stability factor, k</p>	<p>30d</p> <p>10d</p> <p>6d</p> <p>0.25</p> <p>1.5</p>

4	直杆螺栓, 直径 $d = 12\text{--}48\text{mm}$ Straight, diameter $d12\text{--}48\text{mm}$ 	最小埋置深度, H Minimum embedment depth,H	10d
		螺栓最小距离 the smallest distance between the bolts	5d
		螺栓中心至基础边缘的最小距离 the smallest distance from the bolt axis to the edge of the foundation	5d
		荷载系数 load factor	0.6
		紧固稳定系数, k tightening stability factor, k	2.5 (2)
5	锥形垫片螺栓, 直径 $d = 6\text{--}48\text{mm}$ Conical spacer bolt, diameter $d6\text{--}48\text{mm}$ 	最小埋置深度, H Minimum embedment depth,H	10d (8d)
		螺栓最小距离 the smallest distance between the bolts	8d
		螺栓中心至基础边缘的最小距离 the smallest distance from the bolt axis to the edge of the foundation	8d
		荷载系数 load factor	0.55
		紧固稳定系数, k tightening stability factor, k	2.3 (1.8)

6	d-螺栓公称直径 d-bolt diameter
	a 括号中给出了直径小于 16mm 螺栓的插入深度。 a Insertion depth for bolts with a diameter of less than 16 mm is given in brackets.
	b 括号内数值为静荷载工况下的系数 k 值。 b In parentheses are the values of the coefficient k for static loads.
	c 所有螺栓必须拧紧到预紧值 F，对于静荷载应等于 0.75 P，对于动荷载应等于 1.1 P，其中 P 是作用在螺栓上的设计载荷。 c All bolts must be tightened to the pre-tightening value F, which for static loads should be taken equal to 0.75 P, for dynamic loads 1.1 P, where P is the design load acting on the bolt.

F.8 英国公差

F.8 Tolerances for United Kingdom

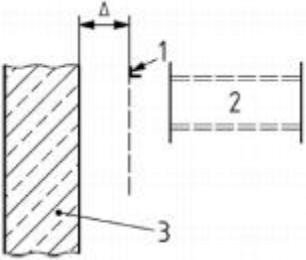
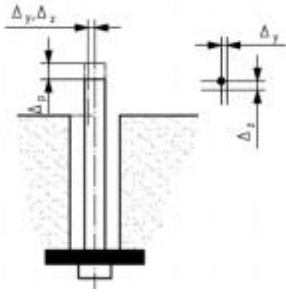
除非另有说明，表 F.7 的引用标准为英国钢结构协会《国家结构钢规范》BCSA NSSS:2021。

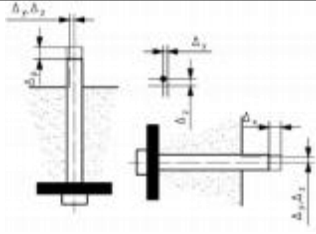
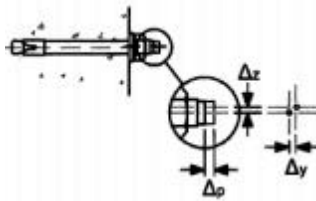
Unless otherwise noted, the reference standard for Table F.7 is BCSA NSSS:2021.

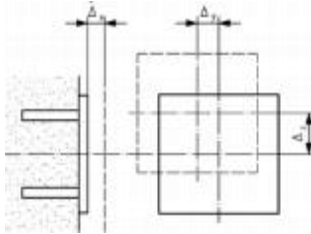
表 F.7 -英国

Table F.7 - United Kingdom

序号 NO	标准 Criterion	参数 Parameter	宽容 Tolerance
1	基础标高 Foundation level 	标高偏差 Deviation from specified level	- Δ = 15 mm(低于) + Δ = 5 mm(高于) - Δ = 15 mm (below) + Δ = 5 mm (above)
2	垂直墙体 Vertical wall	钢构件支座节点处的定位偏差 Deviation from specified position	Δ = ± 25 mm

	 <p>关键点: 1 设计位置 2 钢构件 3 支撑墙</p> <p>Key 1 specified position 2 steel component 3 supporting wall</p>	at support point for steel component	
3	<p>可调节预埋锚杆偏差 Pre-set foundation bolt or bolt groups where prepared for adjustment</p> 	<p>定位偏差 Δ 与伸出量偏差 Deviation Δ from specified location and protrusion</p> <p>混凝土顶部位置或标高偏差 Δ y、Δ z Location or level at top of concrete Δy, Δz</p> <p>竖向外伸量 Δ p Vertical protrusion Δp</p>	<p>螺栓群中心位置的允许偏差为 6mm。 The permitted deviation for location of the centre of a bolt group is 6 mm.</p> <p>$\Delta y, \Delta z = \pm 10\text{mm}$ - Δ p=5mm(低于) + Δ p=25mm(高于)</p> <p>$\Delta y, \Delta z = \pm 10\text{ mm}$ - Δ p= 5mm (low) + Δ p=25mm (high)</p>
4	<p>固定式预埋地脚螺栓或螺栓群 Pre-set foundation bolt or bolt groups where not prepared for adjustment</p>	<p>位置、标高及外伸量的偏差 Δ Deviation Δ from specified location, level and protrusion</p> <p>混凝土顶部位置偏差 Location at top of concrete</p>	<p>允许的位置偏差也适用于螺栓群的中心位置。 The permitted deviation for location also applies to the centre of a bolt group.</p> <p>$\Delta y, \Delta z = \pm 3\text{mm}$</p>

		<p>垂直偏差 Δp</p> <p>Vertical protrusion Δp</p> <p>水平偏差 Δx</p> <p>Horizontal protrusion Δx:</p>	<p>- $\Delta p = 5 \text{ mm}$ (低)</p> <p>+ $\Delta p = 45 \text{ mm}$ (高)</p> <p>- $\Delta x = 5 \text{ mm}$ (内)</p> <p>+ $\Delta x = 45 \text{ mm}$ (外)</p> <p>$\Delta y, \Delta z = \pm 3 \text{ mm}$</p> <p>- $\Delta p = 5 \text{ mm}$ (low)</p> <p>+ $\Delta p = 45 \text{ mm}$ (high)</p> <p>- $\Delta x = 5 \text{ mm}$ (in)</p> <p>+ $\Delta x = 45 \text{ mm}$ (out)</p>
4a	<p>固定式预埋墙螺栓或螺栓群</p> <p>Pre-set wall bolt or bolt groups if not prepared for adjustment</p> 	<p>螺栓伸出量的偏差 Δp</p> <p>Deviation Δp of bolt protrusion relative to intended position</p> <p>混凝土表面位置偏差 Δy 或 Δz</p> <p>Deviation Δy or Δz from specified position at face of concrete</p>	<p>$\Delta p = 5 \text{ mm}$ (向内)</p> <p>$\Delta p = +45 \text{ mm}$ (向外)</p> <p>$\Delta p = -5 \text{ mm}$ (inward)</p> <p>$\Delta p = +45 \text{ mm}$ (outward)</p> <p>地脚螺栓群中心位置的允许偏差也为 $\pm 3 \text{ mm}$</p> <p>The permitted deviation for the location of the centre of the foundation bolt group is also $\pm 3 \text{ mm}$.</p> <p>此类测量值均相对于墙体实际垂直度进行局部测量，具体标准参见第 9.1.5 条。</p> <p>These measurements are measured locally relative to the achieved verticality of the wall as specified in 9.1.5.</p>

5	<p>预埋件</p> <p>Steel anchor plate embedded in concrete</p> 	<p>预埋件中心线的位置与标高偏差 Δx、Δy、Δz</p> <p>Deviations Δx, Δy, Δz of centrelines of the plate from the specified location and level</p> <p>此类测量值均相对于墙体实际垂直度进行局部测量，具体标准参见第 9.1.5 条。</p> <p>These measurements are measured locally relative to the achieved verticality of the wall as specified in 9.1.5.</p>	<p>$\Delta x, \Delta y, \Delta z = \pm 10\text{mm}$</p>
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F.9 美国

F.9 United States

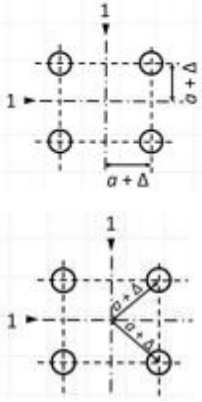
除非另有说明，表 F.8 的引用标准为 ANSI/AISC 303:2016。

Unless otherwise noted, the reference standard for Table F.8 is ANSI/AISC 303:2016.

表 F.8 -美国

Table F.8 - United States

序号 NO	标准 Criterion	参数 Parameter	公差 Functional Tolerances
1	<p>基础顶面/支座垫板顶面标高</p> <p>Elevation of top of base or bearing plate</p>		<p>$\Delta = \pm 3\text{mm}$ [1/8 英寸]</p> <p>$\Delta = \pm 3\text{mm}$ [1/8 in]</p>

<p>2</p>	<p>地脚螺栓平面定位 Anchor rod location in plan</p>  <p>1 中心线 1 Centreline</p>	<p>沿投影方向任意位置与设计位置的偏差 Deviation from specified location anywhere along the projection.</p> <p>锚栓直径 Anchor diameter</p> <p>[19 毫米, 22 毫米[3/4 英寸、7/8 英寸] [25 毫米、31 毫米、38 毫米] [1 英寸, 1¼英寸, 1½英寸] 44 毫米, 50 毫米, 63 毫米 [1¼英寸, 2 英寸, 2½英寸] 19 mm, 22 mm [3/4 in, 7/8 in] 25 mm, 31 mm, 38 mm [1 in, 1¼ in, 1½ in] 44 mm, 50 mm, 63 mm [1¾ in, 2 in, 2½ in]</p>	<p>$\Delta = 6\text{mm}$[1/4 英寸] $\Delta = 10\text{mm}$[3/8 英寸] $\Delta = 13\text{mm}$[1/2 英寸]</p> <p>$\Delta = 6\text{mm}$ [1/4 in] $\Delta = 10\text{mm}$ [3/8 in] $\Delta = 13\text{mm}$ [1/2 in]</p>
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- [2] ISO 3443-2, Tolerances for building — Part 2: Statistical basis for predicting fit between components having a normal distribution of sizes
- [3] ISO 3443-3, Tolerances for building — Part 3: Procedures for selecting target size and predicting fit
- [4] ISO 4463-2, Measurement methods for building – Setting-out and measurement – Part 2: Measuring stations and targets
- [5] ISO 17123 (all parts), Optics and optical instruments — Field procedures for testing geodetic and surveying instruments

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- [6] EN 1090-2, Execution of steel structures and aluminium structures -Part 2: Technical requirements for steel structures
- [7] EN 1993-2, Eurocode 3: Design of steel structures – Part 2: Steel Bridges

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- [9] AS/NZS 4100, Steel structures
- [10] AS/NZS 5100.6, Bridge design – Part 6: Steel and composite construction
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National standards — CISC and CSA (Canada)

- [12] CISC, Code of standard practice for structural steel

[13] CISC, Crane-supporting steel structures: design guide

[14] CSA S6, Canadian highway bridge design code

[15] CSA S16, Design of steel structures

国家标准-GB(中国)

National standard — GB (China)

[16] GB 50205, Standard for acceptance of construction quality of steel structures

国家标准-JASS,JARA(日本)

National standards— JASS, JARA (Japan)

[17] JASS 6, Japanese architectural standard specification

[18] JASS 6, Structural steelwork specification for building construction

[19] JARA, Japanese design specifications for highway bridges – Part I: Common

[20] JARA, Japanese design specifications for highway bridges – Part 2: Common

国家标准-ODM,SP(俄罗斯联邦)

National standards — ODM, SP (Russian Federation)

[21] ODM 218.2.025, Expansion joints of bridge structures on highways

[22] SP 43.13330, Constructions of the industrial enterprises

[23] P 46.13330, Bridges and pipes

[24] SP 70.13330, Load-bearing and separating constructions

[25] SP 78.13330, Automobile roads

国家标准-BCSA(英国)

National standard — BCSA (United Kingdom)

[26] BCSA NSSS, National structural steelwork specification

国家标准-AASHTO,AISC,AREMA,ASTM(美国)

National standards — AASHTO, AISC, AREMA, ASTM (United States)

- [27] AASHTO/AWS D1.5M/D1.5, Bridge welding code
- [28] AASHTO, LRFD bridge construction specifications
- [29] AISC 303, Code of standard practice for steel buildings and bridges
- [30] AISC Design Guide 7, Industrial Building Design
- [31] AREMA, Manual for railway engineering, Chapter 15
- [32] ASTM A6, Standard specification for general requirements for rolled structural steel bars, plates shapes, and sheet piling