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Steel structures — Execution of structural steelwork —

Part 4: Erection

Structures en acier – Exécution des charpentes et ossatures en acier —
Partie 4: Montage

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Foreword

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

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

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

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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

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

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

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

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

Introduction

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

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

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

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

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

— ISO 17607-2 (Steels);

— ISO 17607-3 (Fabrication);

— ISO 17607-5 (Welding);

— ISO 17607-6 (Bolting).

Steel structures — Execution of structural steelwork —

Part 4: Erection

1 Scope

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.

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

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

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

ISO 22966, *Execution of concrete structures*

3 Terms and definitions

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

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

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

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

4 Execution specification and quality requirements

4.1 General

See ISO 17607-1.

This clause specifies the requirements for the 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.

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 Execution specification

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

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

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

a) additional information, see A.1;

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

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

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

e) geometrical tolerances, see Clause 7.

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

5 Constituent products

5.1 General

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

5.2 Anchorages, foundation bolts and other anchorages

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

5.3 Grouting materials

5.3.1 General

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 Cement-based grout

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

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

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) 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 Special grout

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

Special grout shall be accompanied by detailed instructions for use that are in conformity with the manufacturer's recommendations.

5.3.4 Fine concrete

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 Expansion joints for bridges

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

6 Erection

6.1 General

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.

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.

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

6.2 Site conditions

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) provision and maintenance of hard standing for cranes, and access equipment;

b) access routes to the site, and within the site suitable for delivery, and movement of material, components, equipment and personnel;

c) soil conditions affecting the safe operations, and construction at the site;

d) possible settlement of erection supports for the structure;

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) limitations on dimensions, or weights of components that can be delivered onto the site;

g) special environmental, and climatic conditions on, and around the site;

h) particulars of adjacent structures affecting, or affected by the works;

i) adequate and suitable storage space for material, and components.

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.

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) prearranged procedures for co-operation with other constructors, including availability of hoisting equipment;

k) availability of site services;

l) analysis and definition of maximum construction and storage loads permitted on the steelwork;

m) control of concrete placement during composite construction (see ISO 22966).

6.3 Erection method

6.3.1 Design basis for the erection method

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) positions and types of site connections;

b) maximum piece size, weight and location;

c) identification of critical lifts, such as lifts above a selected proportion of crane capacity and multi-crane lifts;

d) sequence of erection;

e) stability concept for the part-erected structure, including any requirements for temporary bracing or propping (shoring);

f) propping or other measures for the execution of phased concreting of composite structures;

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) features that can create a safety hazard during construction;

i) timing and method for adjustment of foundation connections or bearings and for grouting;

j) camber and pre-sets required in relation of those provided at fabrication stage;

k) use of diaphragms (e.g. profiled steel sheeting, precast panel) to ensure stability;

l) use of diaphragms to provide lateral restraint;

m) transportation of units, including attachments for lifting, turning or pulling;

n) positions and conditions for supporting and jacking;

o) stability concept for the bearings;

p) expected settlements of the supports;

q) particular positions and loads from, e.g. cranes, stored components, counterweight, for the various construction phases;

r) instructions for the delivery, storage, lifting, positioning, and pre-tensioning of stay cables;

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 pre-stress;

t) analysis, design and details of all temporary works and attachments to permanent works with instructions as to their removal.

6.3.2 Constructor's erection method statement

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.

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

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

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.

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

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

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

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

c) lifting devices necessary;

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

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

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) methods of minimizing risk from identified safety hazards;

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

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

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) 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) 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.

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 Survey

6.4.1 Reference system

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.

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.

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

6.4.2 Position points

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

6.5 Supports

6.5.1 General

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

6.5.2 Measuring and documenting suitability of supports

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.

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.

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.

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

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

6.5.3 Maintaining suitability of supports

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

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

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 Temporary supports

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.

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.

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.

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.

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

6.5.5 Grouting

Grouting shall be carried out in accordance with Annex B.

6.5.6 Anchoring

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 Erection and work at site

6.6.1 Erection drawings

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).

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.

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.

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.

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

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.

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.

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 Marking

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.

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

6.6.3 Handling and storage on site

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.

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.

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

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

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

6.6.4 Trial assembly

Any site trial assembly shall be performed in accordance with ISO 17607-3.

Trial assembly should be considered:

a) to confirm fit between components;

b) to prove methodology to maintain stability during erection if the erection sequence needs evaluating in advance;

c) to prove duration of operations if site conditions are restricted by limited possession time.

6.6.5 Erection methods

6.6.5.1 General

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.