# GENERAL WORK SPECIFICATION STEEL BRIDGES – STRUCTURAL STEELWORK – GWS

**TENDER SPECIFICATION** 

DECEMBER 2018

## DISCLAIMER

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## 1 GENERAL

"General Work Specification (GWS), Steel Bridges - Structural Steelwork" covers general requirements for execution (production, assembly and mounting) of load-carrying steel structures for steel and composite bridges, including requirements for quality.

Corrosion protective surface treatment of steel structures is described separately in "Steel Bridges - Surface protection - GWS".

Outline in this work specification follows at level 2 the outline of DS/EN 1090-2, where brackets after a heading indicate reference (section no.) to DS/EN 1090-2.

#### 1.1 References

The following standards (including national annexes and amendment sheets) as well as the reference documents cited in the standards apply to the extent that these provisions do not replace corresponding provisions in the standards, and if they are relevant to the current instruction:

- DS/EN 1090-1 Execution of steel structures and aluminium structures Part 1: Requirements for conformity assessment of construction components
  DS/EN 1090-2 Execution of steel structures and aluminium structures Part 2: Technical
- DS/EN 1090-2 Execution of steel structures and aluminium structures Part 2: Technical requirements for steel structures.
- DS/EN 1090-4 Execution of steel structures and aluminium structures Part 4: Technical requirements for cold-worked thin plate elements
- DS/EN 1993-2 Eurocode 3: Steel structures part 2 Bridges

Standard texts, including national annexes, shall be regarded as requirements. This means that "should" in the text shall be understood as "shall", and annexes in the standards apply as code of practice, even if they are termed as "informative".

Codes of practice, standards and recommendations, specified in the description as applicable to the work or parts thereof are listed in SWS Steel Bridges - Structural Steelwork, Annex 1.

#### 1.2 CE marking

Steel structures shall be delivered CE-marked according to DS/EN 1090-1 Before commencement of the work, the current certificate of the factory's production control (FPC), the responsible welding coordinator as well as welding certificate according to DS/EN 1090-1, table B.1, shall be submitted to the Employer.

#### **1.3** Execution specification (4.1)

#### 1.3.1 General (4.1.1)

For construction parts, which on the General Note, drawings or, in SWS Steel Bridges - Structural Steelwork, are indicated as impacted by fatigue, all requirements in EN 1090-2 shall be observed, which relate to a high utilization of fatigue, unless acceptance exists, from the Employer of non-conformance.

The workshop camber, specified on the drawings, do not include deformations due to welding contraction/ shrinkage. The Contractor shall consider deformations as a result of welding, etc. and

make the related necessary regulation of dimensions and tolerances to eliminate the impact of weld shrinkage etc.

Fabrication drawings shall cover all reinforcements and bracings, etc. that are a result of the applied assembling method. In addition, welding and assembling fittings as well as bracings, etc. which are only embedded temporarily in the structure, shall be indicated on fabrication drawings.

Hollow items that will later be hot dip galvanised shall be provided with vent holes of a size and location as agreed with the hot dip galvaniser and the Employer. Holes shall be shown in fabrication drawings. Proposals for sealing holes/possible omission of sealing of holes shall be submitted to the Employer for acceptance.

Overlap joints in items to be hot dip galvanised are only allowed if they are sealed airtight by welding and smaller than 0.01 m<sup>2</sup>.

#### 1.3.2 Execution classes (4.1.2)

The division of the structure (or work) into execution classes is specified in the General Note. Execution class EXC1 is not allowed to be used for welded structures in bridges and other infrastructure structures. EXC2 shall, as a minimum, be used in case of construction elements which are not covered by a general note.

Temporary supporting structures to be used for assembling shall be assigned to the following consequence classes, unless otherwise indicated in the General Note:

- Assembling of bridges above tracks and motorways or other busy roads in operation: CC3
- Assembling of other bridges: CC2.

#### 1.3.3 Preparation grades (4.1.3)

Requirements for preparation grades are pursuant to DS/EN ISO 8501-3:

- Welds P3
- Sheet and profile edges: P3
- Surfaces of steel: P3.

#### 1.3.4 Geometrical tolerances (4.1.4)

Requirements for functional tolerance are class 2 in DS/EN 1090-2, annex B.

Dimensions shown on drawings apply at +10°C under the impact of dead weight. If the temperature during fabrication deviates from +10°C, the dimensions shall be corrected to the extent necessary.

In respect of general tolerances for workshop activities/fabrication, reference is made to DS/EN 1090-2, Sections 11.2.1 and 11.2.2, supplemented by the following provisions:

- For steel plates, webs and stiffeners and similar, the requirements in DS/EN 1090-2, Annexes D1.6 and B.7 apply. For steel plates where the width b is greater than4 m, the deviation shall be less than 5mm
- If necessary, the Contractor shall make additional stricter tolerances where permanent elements exposed to tensile forces during the construction phase are exposed to pressure
- Staggering of edges of plates in weld seams shall comply with the requirements of DS/EN ISO 5817 for the current category and must not be greater than 2.0mm
- For butt welds in steel decks, staggering shall be less than 1.0mm
- Where areas of plates are interrupted by a continuous plate in a perpendicular or angled plane, the staggering in the interrupted plate shall be less than a fourth of the minimum plate

thickness, where this is 20mm, and less than or equal to half, where this is 10mm, and less than or equal to 5mm for the intermediate plate.

In respect of general tolerances for assembling work, reference is made to DS/EN 1090-2, sections 11.2.3 and 11.3.

#### **1.4** Constructor's documentation (4.2)

#### 1.4.1 Quality documentation (4.2.1)

Quality documentation which shall be submitted to the Employer, shall include documentation according to the quality plan. Including certificates of materials, weld staff, qualification reports, execution protocols, WPSs, NDT control, result of test samples, inspection and tests, as well as any non-conformance reports.

Normal due dates/frequencies for when the material is to be submitted to the Employer, when the Employer is to be summoned or when procedures etc. are to be submitted to the Employer, shall appear from the inspection plan with references to the respective points, in this GWS and relevant codes of practice and standards.

#### 1.4.2 Quality plan (4.2.2)

Before the work commences, the Contractor shall prepare a quality plan. The plan shall be prepared in accordance with DS/EN 1090-2, section 4.2.2 and subsequent provisions in this GWS and related documents. In addition, reference is made to the general requirements specified in GWS Management and Cooperation.

Drawings, plans, procedures, etc. shall not be deviated from before changes or deviations have been reviewed and commented by the Employer.

The Contractor shall, through appropriate planning and regular dimension control, show that the final tolerances are observed by using the specified tolerances for the individual steps of the production process - including tolerances for workshop activities.

#### 1.4.3 Safety of the assembling works (4.2.3)

Reduced safety and loads shall not be applied during the construction phase.

However, during the actual assembling situation, wind loading shall be reduced if a program is in place for monitoring of wind velocities, which makes it possible to verify the assumptions forming the basis of the assembling situation. Moreover, to the extent necessary, a procedure description shall be available for initiating remedial measures, e.g. in the form of a device consisting of supplementary bracing, if the assumptions are not observed and the assembling process shall be changed or interrupted.

The Contractor shall – in addition to the rules set out in this GWS and DS/EN 1090-2 – base planning, design, execution and checking of the assembling work on the principles in *Supervision Handbook for Falsework*, as described in SWS Steel Bridges - Structural Steelwork.

In connection with the use of the Supervision Handbook, the terms used in the Handbook for falsework shall be interpreted as follows:

- Scaffolding Project: Assembling Project
- Scaffolding Coordinator: Assembling Coordinator
- Scaffolding Supervision: Assembling Supervision

- Scaffolding: temporary steel structure in connection with the assembling, which may include both temporary supporting structures and permanent structures,
- Casting: assembling of permanent steel structures
- Casting authorisation: authorisation to erect permanent steel structures.

For composite bridges, the provisions in GWS Concrete Bridges – Falsework and Formwork shall be observed in respect of falsework and formwork for the concrete deck, since the steel part of the composite cross section forms part of the scaffolding structure. This entails that *Supervision Handbook on Falsework* shall be used in the usual way for the concrete deck.

Assembling procedures shall be prepared in accordance with GWS Management and Cooperation. The assembling procedures shall be incorporated in the constructor's plan for Health and Safety in accordance with the Executive Order regarding the Employer's obligations.

#### 1.4.4 Execution documentation (4.2.4)

The Contractor shall make all drawings, calculations and specifications, which are necessary for the carrying out of workshop, transport and assembling activities, etc., concluding audit "as built".

## 2 MATERIALS

#### 2.1 General (5.1)

Strength and quality designations and delivery options for the specified materials as well as requirements for documentation have been briefly specified in the General Note (GN).

Before the conclusion of the contract, the Contractor shall ensure that the materials listed on the general note sheet can be acquired in a timely manner.

Before the final material order is submitted, the Contractor shall send the following documents to the Employer:

- The technical specification for the material manufacturer or the supplier/wholesaler shall be drafted in accordance with relevant steel standards with a position being taken on all the options specified in the standards
- To the extent that there are no (provisional) construction drawings, an account shall be given of butt locations in sketches or principle specifications
- General information about the desired/applied welding methods and jointing principles, etc.

The technical part of the material manufacturer's order confirmation shall be included in the Contractor's quality documentation.

Stainless steel shall be specified with an EN-number according to table 4 in DS/EN 10088 and with a minimum corresponding to 1.4435 or better corrosion resistance. Corrosion resistance can be assessed from the PREN-value calculated as PREN = %Cr + 3.3·%Mo + 30·%N for austenitic stainless steel

PREN = % Cr + 3.3% M0 + 30% M for austenitic stamess steepense PREN = % Cr + 3.3% M0 + 16% M for duplex steel

#### 2.2 Identification, inspection documents and traceability (5.2)

Structural steel shall be delivered with inspection documents corresponding to DS/EN 1090-2 Table 1. For construction elements designed in intensified control class, materials shall be delivered with inspection document type 3.2 according to DS/EN 10204 as specified in SWS Steel Bridges - Structural Steelwork.

Steel specifications and requirements for inspection documents are listed in the General Note.

#### 2.3 Products of structural steel products (5.3)

#### 2.3.1 General (5.3.1)

Efforts should be made to ensure that the steel is delivered with a suitable low carbon in order to obtain the best possible weldability and avoid, to the extent possible, any pre-heating in connection with welding.

Flats and plates to be cold deformed shall be delivered pursuant to DS/EN 1090-2, Table 3.

Steel, for which documented through-thickness properties are required, Z steel, option 4 in DS/EN 10025, shall be delivered in compliance with DS/EN 10164, in a quality as specified on drawings or in SWS Steel Bridges - Structural Steelwork.

Steel to be hot-dip galvanised, option 5 in DS/EN 10025, shall, regardless of thickness and steel type (strength), be delivered in, at least, quality J2.

Steel types beyond S355 under DS/EN 10025-3 and DS/EN 10025-4, can only be used for hot-dip galvanised structures, provided it is ensured that

- Steel in accordance with DS/EN 10025-3 is delivered appropriate for hot-dip galvanising (contents of Si and P etc.)
- Steel in accordance with DS/EN 10025-4 is only hot-dip galvanised after approval from the steel manufacturer
- Procedure testing of hot dip-galvanisation is carried out

Steel in accordance with DS/EN 10025-6 are not be used for hot-dip galvanised structures.

Steel profiles to be hot-dip galvanised shall not be made by cold-rolling, unless it is documented by pre-testing on a current steel item that layer thickness requirements can be met.

#### 2.3.2 Thickness tolerances (5.3.2)

Nothing to add.

#### 2.3.3 Surface conditions (5.3.3)

With regard to surface condition, steel sheets shall meet the requirements in DS/EN 10163, with quality classes as specified in the General Note.

Less significant defects (small pits, blisters, etc.) may be removed by grinding in accordance with DS/EN 10025-1 item 7.5.

On delivery, the steel shall not display a rust grade that exceeds rust grade C according to DS/EN ISO 8501-1.

#### 2.3.4 Special properties (5.3.4)

Where drawings show sheets and profiles or special areas of sheets and profiles that shall be investigated for any lamination, such checking shall be performed using ultrasound in accordance with DS/EN 10160 for sheets and DS/EN 10306 for profiles.

Sheets shall comply with the following requirements in DS/EN 10160:

- Surface checks: table 3 or 4, class S2
- Surface layer checks: table 5, class E2.

Profiles shall comply with the following requirements in DS/EN 10306:

- Surface checks: table 2, class 2.4
- End checks: table 1, class 1.2.

The extent of the ultrasound check shall be +50 mm or more if stated in the reference standard.

#### 2.4 Steel castings (5.4)

Nothing to add.

#### 2.5 Welding consumables (5.5)

The supplier's indications for transport, storage and commissioning, as well as storage after opening the original packaging, shall be carefully observed.

#### 2.6 Mechanical fastening (5.6)

Bolts shall consist of geometrically related screws, nuts and washers in accordance with the DS/EN 1090-2, in quality classes as specified in detail in the General Note.

Non-stainless bolts shall be delivered as hot-dip galvanised. Hot-dip galvanising of all bolt products shall be carried out at the bolt factory. DS/EN 1090-2, section 8.2.3, also applies to hot dip galvanised bolt products.

If bolts and nuts in class 10.9 with related washers are delivered as hot dip galvanised, it shall be documented that the bolts are protected against hydrogen embrittlement.

Bolts smaller than M12 together with possible pins shall be delivered in stainless steel in quality A4 in accordance with to DS/EN 3506-1 and -2.

Foundation bolts shall be made as embedded threaded rods in stainless steel in quality A4 according to DS/EN 150483506. Studs shall be delivered with 3.1 Certificate.

Stainless fasteners shall be used where mechanical fastening of stainless elements is made.

#### 2.7 Studs and shear connectors (5.7)

Nothing to add.

#### 2.8 Reinforced steel welded as supporting steel (5.8)

Nothing to add.

#### 2.9 Grouting materials (5.9)

The bearings shall be underpinned or grouted by synthetically enriched cement mortar, which, in addition to the necessary strength, shall also have such properties to prevent shrinkage and creep. Deformations from creep, apart from what can be accepted by the supplier, must not occur.

Mortars for bedding or underflow shall have a compressive strength, which, as a minimum, corresponds to Class R4, pursuant to DS/EN 1504-3. The class R4 properties listed in DS/EN 1504-3, concerning the chloride ion content, adhesion capacity, controlled shrinkage/ expansion, resistance to carbonization, elasticity module and thermal compatibility frost/ thaw, shall be declared under the control of an independent accredited European testing institute.

#### 2.10 Expansion joints for bridges (5.10)

Reference is made to SWS Concrete Bridges - Mechanical Joints, with related SWS.

#### 2.11 High-strength cables, rods and terminations (5.11)

Nothing to add.

#### 2.12 Structural bearings (5.12)

Reference is made to GWS - Concrete Bridge - Bearings with related SWS.

### 3 EXECUTION

#### 3.1 General

Workshop activities may not be commenced before drawings and a welding plan have been commented by the Employer.

The Contractor shall notify the Employer after it has been verified that the delivered material and inspection documents are in accordance, and before cutting and preparation of materials commence.

#### 3.2 Preparation and assembly (6)

#### 3.2.1 General (6.1)

Sharp-edged centre marks or scratched measuring indications shall not be used.

#### 3.2.2 Identification (6.2)

Plan for marking by cutting of materials that ensures the required traceability (see item 4.1.) shall be submitted to the Employer for acceptance.

#### **3.2.3** Handling and storage (6.3)

During transport, the structures shall be supported or, if necessary, be packaged in such a way that they are not subjected to harmful tensions or in any other way suffer any damage.

Boxes containing hot dip galvanised small items shall be strong, covered against rain and wellventilated so as to prevent accumulation of condensation in them. Proposals for cranes and other equipment for loading and unloading as well as the entire procedure for the execution of transport shall be submitted to the Employer for acceptance.

In connection with sea transport of large units on a barge, "seafastening" shall be ensured to take dynamic accelerations during the transport into account.

The Contractor shall carry out all necessary calculations for lifting and supporting large units during transport. Drawings and calculations shall be submitted to the Employer for acceptance.

In connection with sea transport, direct contact with waves shall be avoided, and the units shall be protected against the ingress of salt water. All external surfaces that are subsequently to be painted shall be washed so that all salt is removed from the surfaces.

On a continuing basis, the Employer shall be kept informed of schedules for transports from workshop to assembling site.

#### 3.2.4 Cutting (6.4)

Materials with a thickness of no more than 8 mm may be cut, provided that the cut edge is contained completely in a weld or that all visible traces are removed by grinding at a width corresponding to no less than half the material thickness on free cut edges.

Sheets may be cut lengthwise in larger sizes at steelworks, provided that the material along these edges are removed at a width corresponding to at least half of the material thickness.

Manually conveyed flame and plasma cutting is allowed only in exceptional cases and is only subject to agreement with the Employer, for example by adaptation during assembly, and, to the extent possible, a guide or similar shall be used for the torch. The joint edges shall then be ground.

#### 3.2.5 Shaping (6.5)

Heat treatment of stainless steel is not allowed.

#### 3.2.6 Holing (6.6)

Requirements for the type of bolt holes are specified in the General Note.

Punching without subsequent reaming is not allowed for material thicknesses larger than 10mm.

#### 3.2.7 Cut outs (6.7)

Nothing to add.

#### **3.2.8** Full contact bearing surfaces (6.8)

Nothing to add.

#### 3.2.9 Assembly (6.9)

Where metals with different electrical potential are assembled, the assembly method and any inserts shall be submitted to the Employer.

Reaming of holes after execution of surface protection is not allowed.

#### 3.2.10 Assembly check (6.10)

To ensure the proper fit of the structure, the Contractor shall perform a test assembly in the workshop.

The test assembly shall establish that an assembly between the sections is possibly without the use of force, and the test assembly shall show that the prescribed geometry in general is present.

In connection with assembling weld joints, special measures shall be taken to compensate for lack of welds.

The Contractor shall check the geometry of the completed structural elements. The result shall be entered into the control log.

The Contractor shall notify the Employer when the individual sections of the test set-up are complete and checked. The structure shall not be dismantled before the Employer has had the opportunity to carry out his or her independent check.

#### 3.3 Welding (7)

#### 3.3.1 General (7.1)

In structures that are not to be hot dip galvanised, all inaccessible spaces shall be sealed airtight by welding. Similarly, all overlapping joints shall be welded all the way round as to seal any gaps between items airtight.

Butt joints in sheets or profiles in addition to what is specified on design drawings shall be made as fully penetrated butt joints. The location and execution of the butt joint shall be accepted in advance by the Employer.

#### 3.3.2 Welding plan (7.2)

Prior to the commencement of the works, the Contractor shall submit his welding plan to the Employer for acceptance. The welding plan covers all relevant topics stated in EN 1090-2, section 7.2.2 a) to m). Including consideration that NDT can be carried out, in cases where access to welding becomes limited, e.g. from the back. Moreover, the following plans etc. shall be submitted to the Employer for acceptance and form part of the quality documentation:

• Inspection plan, see item 4.1.

#### 3.3.3 Welding processes (7.3)

Nothing to add.

#### 3.3.4 Qualification of welding procedures and welding personnel (7.4)

Before welding starts, the certificates for all welders working on the structure as well as documentation of qualification of the relevant welding procedures shall be submitted to the Employer.

#### 3.3.5 Preparation and execution of welding (7.5)

In his planning, the Contractor shall take into account:

- that all edge joints shall be continued and closed
- that load-relieving holes, in addition to those stated in the design, may only be carried out subject to agreement with the Employer,
- that welded on temporary fittings to fix joints shall be limited as much as possible in favour of clamping brackets that do not require welding to permanent steel parts
- that penetrations for temporary clamping in connection with welding are not allowed
- that assembling fittings shall be removed by cutting outside the permanent structure. The last min. 2 mm shall be removed by grinding and be checked subject to the provisions in DS/EN 1090-2, section 7.5.6. Exempt from this are assembling fittings, which are left untouched

subject to agreement with the Employer, provided that they do not scar the appearance of the structure, reduce the fatigue strength or are a nuisance to operational purposes

- that plug welds may not be used in bridge structures, see DS/EN 1993-2 DK NA section 8.2.1.5 (1)
- that single-sided fillet welds may not be used in bridge structures. In this context, partially burnt through welds should not be considered as fillet welds, see EN 1993-2 DK NA section 8.2.10 (1)
- that welded joints between cover plate and web plates may not be carried out as a double fillet welds where the web plate butt up to the cover plate and where traffic loads come directly from above. The assembly shall be made as a fully or partially burnt through weld without throat depth, see DK NA EN 1993-2 section C1.2.4
- that where trough fitted piece is placed against trough with steel backing, a double V-sharpening with root gap 2-5mm and less than 1mm gap between fitted piece and backing, see DK NA EN 1993-2 item C3.3, Table C4 7)
- that the gap, when fitting between any trough and cross girder, must be made with s ≤ 1.0mm. A complete and partly burned through seam with root error < 2mm, if s > 1mm, cf. DS/EN 1993-2 DK NA item C3.3, Tables C4 8) and 9)
- that protection shall be established against weather impacts.

#### **3.3.6** Acceptance criteria (7.6)

Nothing to add.

#### 3.3.7 Welding of stainless steels (7.7)

When welding stainless steel, cooling after welding shall take place quickly enough to avoid the risk of carbide precipitation.

All grinding of stainless steel shall be to 160 grain or finer.

All manufactured parts of stainless steel shall as the last process in the workshop before assembling be subjected to professional, correct performed pickling (not only in welded areas). Coloured oxide film after welding shall be removed.

If pickling of all surfaces is not possible (this may be the case inside pipe systems or for large items), measures shall be taken to render pickling superfluous.

#### 3.4 Mechanical fastening (8)

#### 3.4.1 General (8.1)

Bolting assemblies shall be carried out in accordance with DS/EN 1090-2 section 8. Tension bolts and bolts for friction assemblies shall be carried out as distorted bolts. Displacement connections shall be carried out as non-distorted bolts.

Drawings show where distorted bolts, friction or rotation type connections shall be used.

Stainless steel elements shall be assembled using stainless steel fasteners, see section 2.6.

Hybrid assembly is not allowed, see DK NA EN 1993-2, section 8.1.6.3 (1).

#### 3.4.2 Use of bolting assemblies (8.2)

For static load structures, nuts in friction and shear type connections shall be locked by tightening only. Spring washers shall not be used.

In connection with all bolting assemblies, a washer shall be used below bolt heads and nuts.

After assembling, any hot-dip galvanizing of bolt items shall be intact.

#### 3.4.3 Tightening of non-preloaded bolts (8.3)

Non-distorted bolts shall be tightened to torque wrench as indicated in the General Note.

Tightening shall be carried out in two steps, similar to the torque wrench method described in DS/EN 1090-2 item 8.5.3, where the final wrench shall be as indicated in the General Note. If lubricant is used, it shall be applied on the thread of the bolts, and contact sheet between the washer and the nut (or head if this is allowed). Lubrication shall, before use, be submitted to the Employer for approval.

Bolts which are to permit movement (rotation, displacement) shall only be tightened so that the head and nut make contact. They shall be provided with a locknut tightened hard against the nut below, or with another agreed type of locking.

#### 3.4.4 Preparation of contact surfaces in slip-resistant connections (8.4)

Requirements for surface dressing of contact surfaces in slip-resistant connections are specified in the General Note.

#### 3.4.5 Tightening of preloaded bolts (8.5)

Requirements for bolt types and distortion is specified in the General Note.

Tightening shall, as a starting point, be carried out by means of the torque wrench method, described in DS/EN 1090-2 item 8.5.1. Method and procedure for tightening shall be submitted to the Employer for acceptance.

Irrespective of the tightening method, calibration on the work site shall be carried out pursuant to DS/EN 1090-2, Annex H. The calibration shall comprise all dimensions and clamping lengths of distorted bolts used in the structure. The Employer shall be given the opportunity to monitor the calibrations and the results shall be presented to the Employer.

Lubricant shall be used when tightening of distorted bolts. It shall appear from the execution protocols how to ensure that the bolt producer's indications are carefully observed, including securing correct lubricant condition during assembly.

It shall be ensured that the bolts and the structure have the same temperature during tightening. Before mounting, bolts shall therefore be kept together with the structure. It shall be taken care of that all bolt products, when stored, are protected against exposure to weather, dust or similar.

Tightening of bolts shall be carried out at temperatures above -5°C.

The Employer shall be notified, well in advance before tightening of bolting assemblies, and be given the opportunity to monitor this work.

**3.4.6**Fit bolts (8.6)Nothing to add.

**3.4.7 Hot riveting (8.7)** Nothing to add.

## **3.4.8 Use of special fasteners and fastening methods (8.8)** Nothing to add.

**3.4.9 Galling and seizure of stainless steels (8.9)** Nothing to add.

#### 3.5 Assembling (9)

3.5.1 General (9.1)

Nothing to add.

#### 3.5.2 Conditions at the work site (9.2)

Nothing to add.

#### 3.5.3 Assembling method (9.3)

The Contractor shall, no later than eight weeks before the assembling is planned to commence, submit project documentation (drawings, calculations and methodologies) of the assembling project to the Employer. The documentation shall meet the requirements in section 9 of DS/EN 1090-2 and ensure that the structures in all phases of the assembling have the necessary strength, stiffness and stability. The documentation shall also contain instructions for important work operations, location of lifting points, establishment of supports for temporary storage, temporary supporting structures as well as data relating to cranes, their location, their operations and capacities.

During construction, the Contractor shall take account of the fact that the functions and/or forces on permanent structural elements may be different than in the completed structure, depending on e.g. the selected sequence of construction and special influences during the construction period.

No assembling activities may start before the Employer has given his written approval of the assembling project.

Safety measures and loads may not be reduced for the assembling project, see section 1.4.3. For selection of consequence class for temporary supporting structures, see section 1.3.2.

In accordance with section 1.4.3, the Contractor shall also base his planning, design, execution and checks of the assembling work on the principles of *Supervision Handbook for Falsework*, as specified in SWS Steel Bridges - Structural Steelwork.

Measures shall be taken to deal with contamination of permanent structures by oil spill, rust or similar. Any such contaminations shall be removed immediately.

When mounting, any damages to corrosion protection must be remedied as quickly as possible, following the procedure, approved by the Employer, for repair of surface protection, cf. GWS and SWS Steel Bridges - Surface Protection.

#### 3.5.4 Survey (9.4)

Nothing to add.

#### 3.5.5 Supports, anchors and bearings (9.5)

The Contractor shall prove and document that tolerances for embedding are observed.

The Contractor shall as early as possible review the location of the adjoining structures to the necessary extent, to be able to determine any deviations from the indications on the drawings.

In case the control measurements or the scrutiny of drawings of existing structures show deviations that go beyond the specified tolerances for the adjoining structures, the Contractor shall immediately notify such deviations to the Employer, and collaborate with the Employer on remedying the consequences of the deviations.

#### 3.5.6 Assembling and work at site (9.6)

For main requirements for project documentation, see section 3.5.3.

#### 3.6 Surface protection (Surfaces to be protected) (10)

Coating may not be applied closer than 150 mm from assembling welds. This, however, does not apply to priming with welding and environmentally approved shop-primer at a thickness of no more than 20  $\mu$ m.

Reference is made to GWS and SWS Structural Steelwork - Surface protection.

## 4 CHECKING

#### 4.1 General (12.1)

The Contractors shall through monitoring and control provide documentation that the structure observes the requirements.

The Contractor and the inspection company shall regularly collect all plans, certificates, control reports, etc. in a control log.

By his endorsement, the Contractor shall document review of external quality documentation including inspection documents, control reports, etc. to comply with the requirements of the specification.

The control log shall include documentation according to DS/EN 1090 corresponding to the used execution class and including the below mentioned documentation to the appropriate extent:

- Control plan and test plan
- Design change reports (project modifications)
- Non-conformance reports (deviations)
- As-is drawings (project)
- Plan for work procedures (order and nature of work operations)
- Inspection documents for materials
- Reports for checking lamination etc.
- Fabrication drawings
- Plan for labelling and type
- Weight lists to the extent agreed
- The used tolerances in production process
- Measuring report for geometry check at test assembly
- Welding procedure specifications
- Pre-production and procedure test certificates

- Certificate of staff responsible for the weld coordination
- Certificates for welders working on the production
- Certificates for personnel, who carry out non-destructive control of the structure and assess the related results
- Reports for checking weld seams
- Reports for leak detection test of sealed voids
- Checking procedure for tightness testing
- A final report for welding coordination and welding processes in accordance with the relevant part of DS/EN ISO 3834 (see DS/EN 1090-2, section 7.1)
- Work procedure for tightening of bolts
- Reports for checking bolting assemblies, including reports for calibrating tightening tools
- Assembling project
- Handover control reports
- Report for completion control.

#### 4.2 Constituent products and components (12.2)

When raw materials, semi-finished and finished products are received, a control report shall be prepared that clearly identifies the checked batch, scope of checking and checking status (approved/ rejected). Handover control shall be carried out before the materials are included in the production.

Surfaces on which the Contractor is planning to weld transport or assembling fittings/reinforcements shall be ultrasound examined for lamination in the underlying material.

Steel affected in the transverse direction shall be ultrasound examined – as specified on drawings – with flat and edge checking, cf. item 2.3.4.

# 4.3 Geometrical checking (Manufacture: geometrical dimensions of manufactured components) (12.3)

Welding on of local reinforcement plates according to DS/EN 1090-2, item 12.3, is only allowed subject to agreement with the Employer in non-fatigue-affected zones of fatigue-affected structures.

#### 4.4 Welding (12.4)

The NDT inspection company shall in consultation with the Contractor prepare an inspection plan for all welding according to DS/EN ISO 3834. It shall also be stated in the plan which methods that are planned to be used when inspecting the individual seam types and how welding work is to be divided into inspection lots.

The checking plan shall be submitted to the Employer before commencing welding works.

The Contractor shall regularly inform the control company of the progress of work, changed drawings, etc.

The execution class of the individual weld seams is stated on drawings or in the General Note.

In areas where there used to be welded fittings, the parent material shall be checked in the welding spots that have been ground off by means of magnetic powder testing.

Where sealed voids shall be tight, the Contractor shall carry out random tightness testing using over-/underpressure in the presence of the Employer. The related procedure shall be submitted to the Employer. If any leaks are found, all voids shall be tightness tested, and the Contractor shall remedy the defects.

Generally, full documentation is required in respect of the control technology, i.e. all relevant technical data about the execution of the control, including the applied equipment, shall be documented by indication on the inspection report, etc.

Full documentation is required in connection with X-ray and isotope examinations and repair of welding defects and cracks – with the exception of surface defects.

The possibility of easing the scope of the checking of NDT, cf. DS/EN 1090-2 item 12.4.2.3, to less than DS/EN 1090-2 Table 24, is not allowed to be used for bridges and infrastructure structures.

If, according to DS/EN 1090-2 item 12.4.2.3, there are uncovered welding faults, two additional samples of the same welding shall be taken. If non-admissible results continue to appear, the test scope shall be extended to 100%.

In case a section remains non-compliant after the third repair, the Employer may demand the area cut out and new materials welded in.

#### 4.5 Mechanical fastening (12.5)

Calibration of torque tools shall be documented by calibration certificate, see DS/EN 1090-2, item 12.5.2.3.

Tightening of non-distorted bolts shall be checked, following a procedure corresponding to DS/EN 1090-2 item 12.5.2.5. The extent of the checking is specified in SWS Steel Bridges - Structural Steelwork.

#### 4.6 Surface protection (12.6)

Reference is made to GWS and SWS Structural Steelwork - Surface Protection.

#### 4.7 Geometrical checking (mounting) (12.7)

Structures to be hot dip galvanised shall be checked geometrically after the hot dip galvanising.



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