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## *03-Structural Structural steel*

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## **1 Responsibility**

This Standard Technical Specification (STS) is the responsibility of the owner. The revision and date of issue are on the front page.

All deviations from the specifications must be approved in writing by the Owner.

## **2 Scope and Field of Application**

### **2.1 Scope Definition**

This Standard Technical Specification details the minimum technical requirements for design, execution and erection of structural steel.

### **2.2 Document Conflicts**

Eventual conflicts between the referenced documents shall be reported, without delay, to the Owner in writing for resolution.

## **3 References and Definitions**

### **3.1 References**

All materials, workmanship, design calculation and tests shall be performed in compliance and read in conjunction with the NA-00-STS001 General Technical Standard and other relevant standards.

The relevance order of standards shall be according to NA-00-STS001.

All materials intended for use at Norðurál (NA) shall be approved by the Owner. The following referenced documents should be considered for the application of this document.

Generally the latest edition of the referenced documents shall be used. Exception is for example when mandatory regulations stipulate the use of previous versions, where the edition stipulated shall be used.

If this standard specification references an outdated version the Owner shall be notified.

*Table 3.1- References / Standards*

Standard Nr.	Subject/Name
<b>Icelandic and European standards</b>	
ÍST EN 1990:2002	Eurocode 0 - Basis of structural design
ÍST EN 1991-1-1:2002	Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads for buildings
ÍST EN 1991-1-2:2002	Eurocode 1: Actions on structures - Part 1-2: General actions - Actions on structures exposed to fire
ÍST EN 1991-1-3:2003	Eurocode 1: Actions on structures - Part 1-3: General actions - Snow loads
ÍST EN 1991-1-4:2005	Eurocode 1: Actions on structures - General actions - Part 1-4: Wind actions
ÍST EN 1991-1-5:2003	Eurocode 1: Actions on structures - Part 1-5: General actions - Thermal actions
ÍST EN 1991-1-6:2005	Eurocode 1: Actions on structures - Part 1-6: General actions - Actions during execution
ÍST EN 1991-1-7:2006	Eurocode 1 - Actions on structures - Part 1-7: General actions - Accidental actions
ÍST EN 1991-2:2003	Eurocode 1: Actions on structures - Part 2: Traffic loads on bridges
ÍST EN 1991-3:2006	Eurocode 1 - Actions on structures - Part 3: Actions induced by cranes and machinery
ÍST EN 1991-4:2006	Eurocode 1: Actions on structures - Part 4: Silos and tanks
ÍST EN 1993-1-1:2005	Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings
ÍST EN 1993-1-2:2005	Eurocode 3 - Design of steel structures - Part 1-2: General rules - Structural fire design
ÍST EN 1993-1-3:2006	Eurocode 3 - Design of steel structures - Part 1-3: General rules - Supplementary rules for cold-formed members and sheeting
ÍST EN 1993-1-4:2006	Eurocode 3 - Design of steel structures - Part 1-4: General rules - Supplementary rules for stainless steels
ÍST EN 1993-1-5:2006	Eurocode 3 - Design of steel structures - Part 1-5: Plated structural elements
ÍST EN 1993-1-6:2007	Eurocode 3: Design of steel structures - Part 1-6: Strength and Stability of Shell Structures
ÍST EN 1993-1-7:2007	Eurocode 3 - Design of steel structure - Part 1-7: Strength and stability of planar plated structures subject to out of plane loading
ÍST EN 1993-1-8:2005	Eurocode 3: Design of steel structures - Part 1-8: Design of joints
ÍST EN 1993-1-9:2005	Eurocode 3: Design of steel structures - Part 1-9: Fatigue
ÍST EN 1993-1-10:2005	Eurocode 3: Design of steel structures - Part 1-10: Material toughness and through-thickness properties
ÍST EN 1993-1-11:2006	Eurocode 3 - Design of steel structures - Part 1-11: Design of structures with tension components
ÍST EN 1993-1-12:2007	Eurocode 3 - Design of steel structures - Part 1-12: Additional rules for the extension of EN 1993 up to steel grades S 700
ÍST EN 1993-2:2006	Eurocode 3 - Design of steel structures - Part 2: Steel Bridges
ÍST EN 1993-3-1:2006	Eurocode 3 - Design of steel structures - Part 3-1: Towers, masts and chimneys - Tower and masts

ÍST EN 1993-3-2:2006	Eurocode 3 - Design of steel structures - Part 3-2: Towers, masts and chimneys - Chimneys
ÍST EN 1993-4-1:2007	Eurocode 3: Design of steel structures - Part 4-1: Silos
ÍST EN 1993-4-2:2007	Eurocode 3: Design of steel structure - Part 4-2: Tanks
ÍST EN 1993-4-3:2007	Eurocode 3: Design of steel structures - Part 4-3: Pipelines
ÍST EN 1993-5:2007	Eurocode 3: Design of steel structures - Part 5: Piling
ÍST EN 1993-6:2007	Eurocode 3: Design of steel structures - Part 6: Crane supporting structures
ÍST EN 1998 -1:2004	Eurocode 8: Design of structures for earthquake resistance - Part 1: General rules, seismic actions and rules for buildings
ÍST EN 1998 -2:2005	Eurocode 8: Design of structures for earthquake resistance - Part 2: Bridges
ÍST EN 1998 -4:2006	Eurocode 8: Design of structures for earthquake resistance - Part 4: Silos, tanks and pipelines
ÍST EN 1998 -6:2004	Eurocode 8: Design of structures for earthquake resistance - Part 6: Towers, masts and chimneys
ÍST EN 1090-1	Execution of steel structures and aluminium structures - Part 1: Requirements for conformity assessment of structural components
IST EN 1090-2	Execution of steel structures and aluminium structures - Part 2: Technical requirements for the execution of steel structures
EN 15048-2:2007	Non-preloaded structural bolting assemblies
ISO/TS 8000	Data quality
ISO 8601:2004	Data elements and interchange formats
<b>Regulations</b>	
Byggingarreglugerð 112/2012	Building regulation of Iceland (Byggingareglugerð, nr. 112/2012)
<b>NA Standards</b>	
00/00/STS001	General Standard Technical Specification
00/03/STS001	Surface treatment and painting
00/03/STS002	Structural steel
00/03/STS003	Cladding
<b>NA Guidelines/ Rules</b>	
NAG-HSE	Safety Rules

## 4 Design

All structural design shall be according to the Icelandic building regulation and the Icelandic Eurocodes with accompanying National Annexes.

### 4.1 Norðurál's specific requirements

Enclosed are Norðuráls specific requirements

#### 4.1.1 Materials

Materials shall be new and of first class quality, free from defects and imperfections and shall fulfill the designated classification.

Generally, steel shall be grade S235 or S355 except for:

- a) Purlins and girts, S350GD, EN 10346, hot dip galvanized and painted in accordance with NA-03-STS001
- b) Crane rails for heavy cranes, "A" type rails, St 60-2 with a minimum tensile strength of 690MPa according to DIN 536. Crane rails for light cranes (e.g. in compressor buildings) shall be of a suitable type.  
Rails type are subject to prior approval by the Owner.
- c) Generally bolts shall be none preloaded grade 8.8 assembly according to EN 15048 hot dip galvanized and painted after assembly in accordance with NA-03-STS001

Members and sections requiring routine maintenance or exchange shall be from standard sections are subject to prior approval by the Owner.

#### **4.1.2 Imposed loads**

If codes, regulations or design brief do not specify higher loads, the following loads shall be used as a minimum (live loads, characteristic values):

- |   |                       |
|---|-----------------------|
| a) Vertical point load on roof                                  | 1,5 kN                |
| b) Vertical uniform loads on platforms, walkways and staircases | 3,0 kN/m <sup>2</sup> |
| c) Vertical point loads on platforms, walkways and staircases   | 2,0 kN                |
| d) Horizontal load on top of handrails                          | 1,0 kN/m              |

#### **4.1.3 Equipment load**

Equipment load and reactions (dead, static, dynamic, wind and earthquake loads e.t.c) shall be obtained from the equipment vendor. The loads shall be multiplied by impact/dynamic load factors when applicable.

Same applies to specific events like impact and explosions as relevant

#### **4.1.4 Connections**

Generally, all field connections shall be bolted. Where absolutely necessary welded field connection shall be subject to prior approval by the Owner.

Bolts to be "snug tight" shall be tightened to at least 50% of yield strength to prevent loosening. Information on tightening force of the bolts shall be provided on the drawings.

Preloaded bolts are subject to prior approval by the Owner.

Permanent bracings shall be tensionable on Site by a simple mechanism and without welding.

#### **4.1.5 Welding**

All welds shall be made continuous and watertight. The minimum size of fillet welds shall be the lesser of  $a=4\text{mm}$  or  $a=\text{thickness of welded section}$ , unless otherwise approved.

All butt welds shall be full penetration welds.

Welding between corrosion resistant steel components shall be done with filler material appropriate to the base material.

#### **4.1.6 Stability of members**

Floor grating and floor steel plate shall not be considered as restraining the top flange of its supporting beam or used as diaphragm.

#### **4.1.7 Deformations**

The limits on maximum allowable deflection are based on the Icelandic building regulation (Byggingareglugerð/112, 2012).

#### **4.1.8 Symbols and units**

All measuring units shall be expressed in the metric system and shall be used in all information and communication. All documents, drawings, calculations shall use metric units.

- Units of the SI-System measurements are applied according to ISO/TS 8000
- Instruments shall be calibrated as per SI-System
- Numerical date representations shall comply with the ISO 8601 (EN 28601)
- A comma (,) is used as the decimal delimiter

Reference to other equivalent national and international Standards is subject to prior approval by the Owner.

#### **4.1.9 Other**

The design working life of permanent structures, including structures supporting equipment is 50yrs. Shorter working life is subject to prior approval by the Owner.

During design it shall be evaluated if the inside of buildings shall be classified in atmospheric-corrosivity category outdoors, see also NA-03-STS001. This depends e.g. on if building is heated, moisture and gases inside.

## **5 Execution**

Execution (procurement, preparation and assembly, welding, mechanical fastening, transportation, surface treatment, inspection and documentation) of structural steel work shall be according to ÍST EN1090-1 and ÍST EN1090-2

### **5.1 Execution specification**

The following consequence class shall be used:

- CC2 Medium consequence for loss of human life, economic, social or environmental consequence considerable.

The following service categories shall be used:

- SC1 Typically
- SC2 For fatigue design; crane classes S<sub>1</sub> to S<sub>9</sub>.

The following production category shall be used:

- PC2 Welded components from steel grade S355 and above Components essential for structural integrity and assembled by welding
- PC1 Otherwise
- Execution class EXC1 shall not be used.

This results in the following execution classes:

- EX3 For fatigue design; crane classes S<sub>1</sub> to S<sub>9</sub>.
- EX2 For all other steel structures subject to environmental action and where fatigue actions is not an issue.

### **5.2 Inspection**

Irrespective of execution class used the supplementary None Destructive Testing, NDT, shall be as specified for EXC4 in 12.4.2.2 in EN 1090-2.

Random spot checks of welds, including radiographic examination may be requested.

### **5.3 Tolerances**

Functional tolerances shall be according to Class 1 except for crane beams, rails and runways which shall be according to Class 2, see EN 1090.

## **5.4 Other**

### **Marking**

All members shall carry a distinguishing mark corresponding to marking on erection drawings. The mark shall be hard stamped and of such depth that it is clearly visible after final painting.

### **Handling devices**

The Contractor shall design and provide all slings, shackles, lifting eyes, brackets e.t.c required to safely fabricate, transport and erect all structural components. These shall be removed and the area of their attachments made good if necessary.

### **Submittals**

The Contractor shall submit certificates showing it has factory production control for the requested execution class

The Contractor shall submit mill test certificates showing that all material intended for use in the Work conforms to the requirements designated.

The Contractor shall submit a copy of welders certifications.

The Contractor shall submit a copy of welders qualification test if requested.

The Contractor shall submit a list of Welding Plans to be used. A copy of the tests of certain weld procedures may be requested.

## **6 Erection**

### **6.1 General**

Erection of structural steel shall be in accordance with Norðurál's (Owners) HSE Safety Rules, NAG-HSE.

The contractor shall set up column bases on steel packers and facing wedge sets as required. Packers distributed to maintain stability and avoid distortion in unstiffened areas of the base plates. The packing plates can be left in place if approved by the Owner. Then the packing shall not protrude beyond the column base plate edges and shall be covered by at least 10mm thick grout when the work is complete. A clear space of minimum 30 mm shall be available for grout between the top of the supporting concrete and bottom of base plate. The angle of the grout shall be 45°.

The Contractor shall provide and be responsible for the suitability, capacity and stability of all plant and equipment used on the Site for the erection of the steelwork.

Temporary bracing shall be introduced wherever necessary to provide for loads and stresses to which the structure may be subjected by the erection equipment and its operation. Temporary bracing shall be left in place as long as required for safeguarding all parts of the Works.

The Contractor shall propose a construction method and/or sequences for the Works. The Owner is responsible for reviewing and approving the proposed method. The Contractor shall be responsible for design and furnishing all temporary bracings e.t.c. for the proposed method.

Stacking and handling of steelwork before and during erection shall be done in such a way as to keep the members clean and avoid undue stress or damage to the steel and its painting.

### **6.2 Grouting**

All surfaces to be in contact with grout shall be unpainted and shall be thoroughly cleaned of all extraneous material and wetted immediately prior to the placement of the grout.

The grout mix shall be in accordance with NA-00-02-STS002. Curing e.t.c shall be according to mix manufacturers recommendation and be submitted to the Owner for information prior to placement.

When cured, the grouting material shall completely fill the space under the baseplate, completely enclosing the packers under the base plate and be neatly finished at a slope of 45°.



Grouting shall not be carried out under column base plates until a sufficient portion of the structure has been align, levelled, plumbed and adequately braced.