



Institut luxembourgeois de la normalisation
de l'accréditation, de la sécurité et qualité
des produits et services

ILNAS-EN 1090-2:2008+A1:2011

**Execution of steel structures and
aluminium structures - Part 2:
Technical requirements for steel
structures**

Exécution des structures en acier et des
structures en aluminium - Partie 2:
Exigences techniques pour les structures
en acier

Ausführung von Stahltragwerken und
Aluminiumtragwerken - Teil 2:
Technische Regeln für die Ausführung
von Stahltragwerken

08/2011



National Foreword

This European Standard EN 1090-2:2008+A1:2011 was adopted as Luxembourgish Standard ILNAS-EN 1090-2:2008+A1:2011.

Every interested party, which is member of an organization based in Luxembourg, can participate for FREE in the development of Luxembourgish (ILNAS), European (CEN, CENELEC) and International (ISO, IEC) standards:

- Participate in the design of standards
- Foresee future developments
- Participate in technical committee meetings

<https://portail-qualite.public.lu/fr/normes-normalisation/participer-normalisation.html>

THIS PUBLICATION IS COPYRIGHT PROTECTED

Nothing from this publication may be reproduced or utilized in any form or by any mean - electronic, mechanical, photocopying or any other data carries without prior permission!

ILNAS-EN 1090-2:2008+A1:2011

EUROPEAN STANDARD **EN 1090-2:2008+A1**

NORME EUROPÉENNE

EUROPÄISCHE NORM

August 2011

ICS 91.080.10

Supersedes EN 1090-2:2008

English Version

**Execution of steel structures and aluminium structures - Part 2:
Technical requirements for steel structures**

Exécution des structures en acier et des structures en
aluminium - Partie 2: Exigences techniques pour les
structures en acier

Ausführung von Stahltragwerken und Aluminiumtragwerken
- Teil 2: Technische Regeln für die Ausführung von
Stahltragwerken

This European Standard was approved by CEN on 11 April 2008 and includes Amendment 1 approved by CEN on 25 June 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword.....	9
Introduction	10
1 Scope	11
2 Normative references	12
2.1 General.....	12
2.2 Constituent products	12
2.2.1 Steels	12
2.2.2 Steel castings.....	14
2.2.3 Welding consumables.....	14
2.2.4 Mechanical fasteners	15
2.2.5 High strength cables	17
2.2.6 Structural bearings.....	17
2.3 Preparation	17
2.4 Welding	17
2.5 Testing	19
2.6 Erection.....	19
2.7 Corrosion protection	20
2.8 Tolerances	20
2.9 Miscellaneous	20
3 Terms and definitions	21
4 Specifications and documentation	23
4.1 Execution Specification	23
4.1.1 General.....	23
4.1.2 Execution classes.....	23
4.1.3 Preparation grades	23
4.1.4 Geometrical tolerances	24
4.2 Constructor's documentation	24
4.2.1 Quality documentation.....	24
4.2.2 Quality plan	24
4.2.3 Safety of the erection works.....	25
4.2.4 Execution documentation.....	25
5 Constituent products	25
5.1 General.....	25
5.2 Identification, inspection documents and traceability	25
5.3 Structural steel products	26
5.3.1 General.....	26
5.3.2 Thickness tolerances	28
5.3.3 Surface conditions	28
5.3.4 Special properties.....	29
5.4 Steel castings.....	29
5.5 Welding consumables.....	29
5.6 Mechanical fasteners	31
5.6.1 General.....	31
5.6.2 Terminology	31
5.6.3 Structural bolting assemblies for non preloaded applications	31
5.6.4 Structural bolting assemblies for preloading.....	31
5.6.5 Direct tension indicators.....	32
5.6.6 Weather resistant assemblies	32
5.6.7 Foundation bolts.....	32

5.6.8	Locking devices.....	32
5.6.9	A1 Washers A1	32
5.6.10	Hot rivets.....	33
5.6.11	Fasteners for thin gauge components.....	33
5.6.12	Special fasteners.....	33
5.6.13	Delivery and identification.....	33
5.7	Studs and shear connectors.....	34
5.8	Grouting materials.....	34
5.9	Expansion joints for bridges.....	34
5.10	High strength cables, rods and terminations.....	34
5.11	Structural bearings.....	35
6	Preparation and assembly.....	35
6.1	General.....	35
6.2	Identification.....	35
6.3	Handling and storage.....	35
6.4	Cutting.....	38
6.4.1	General.....	38
6.4.2	Shearing and nibbling.....	38
6.4.3	Thermal cutting.....	38
6.4.4	Hardness of free edge surfaces.....	39
6.5	Shaping.....	39
6.5.1	General.....	39
6.5.2	Hot forming.....	40
6.5.3	Flame straightening.....	40
6.5.4	Cold forming.....	40
6.6	Holing.....	42
6.6.1	Dimensions of holes.....	42
6.6.2	Tolerances on hole diameter for bolts and pins.....	43
6.6.3	Execution of holing.....	43
6.7	Cut outs.....	44
6.8	Full contact bearing surfaces.....	45
6.9	Assembly.....	45
6.10	Assembly check.....	46
7	Welding.....	46
7.1	General.....	46
7.2	Welding plan.....	46
7.2.1	Requirements for a welding plan.....	46
7.2.2	Content of a welding plan.....	46
7.3	Welding processes.....	47
7.4	Qualification of welding procedures and welding personnel.....	48
7.4.1	Qualification of welding procedures.....	48
7.4.2	Welders and welding operators.....	50
7.4.3	Welding coordination.....	50
7.5	Preparation and execution of welding.....	52
7.5.1	Joint preparation.....	52
7.5.2	Storage and handling of welding consumables.....	53
7.5.3	Weather protection.....	53
7.5.4	Assembly for welding.....	54
7.5.5	Preheating.....	54
7.5.6	Temporary attachments.....	54
7.5.7	Tack welds.....	54
7.5.8	Fillet welds.....	55
7.5.9	Butt welds.....	55
7.5.10	Welds on steels with improved atmospheric corrosion resistance.....	56
7.5.11	Branch connections.....	56
7.5.12	Stud welding.....	56
7.5.13	Slot and plug welds.....	56
7.5.14	Spot welds for thin gauge components.....	57

7.5.15	Other weld types	57
7.5.16	Post-weld heat treatment	57
7.5.17	Execution of welding	57
7.5.18	Welding of bridge decks	58
7.6	Acceptance criteria	58
7.7	Welding of stainless steels	59
7.7.1	Amendments to EN 1011-1 requirements	59
7.7.2	Amendments to EN 1011-3 requirements	60
7.7.3	Welding dissimilar steels	61
8	Mechanical fastening	61
8.1	General	61
8.2	Use of bolting assemblies	61
8.2.1	General	61
8.2.2	Bolts	62
8.2.3	Nuts	62
8.2.4	Washers	62
8.3	Tightening of non-preloaded bolts	63
8.4	Preparation of contact surfaces in slip resistant connections	63
8.5	Tightening of preloaded bolts	64
8.5.1	General	64
8.5.2	Torque reference values	66
8.5.3	Torque method	66
8.5.4	Combined method	66
8.5.5	HRC method	67
8.5.6	Direct tension indicator method	68
8.6	Fit bolts	68
8.7	Hot riveting	68
8.7.1	Rivets	68
8.7.2	Installation of rivets	68
8.7.3	Acceptance criteria	69
8.8	Fastening of thin gauge components	69
8.8.1	General	69
8.8.2	Use of self-tapping and self-drilling screws	70
8.8.3	Use of blind rivets	70
8.8.4	Fastening sidelaps	71
8.9	Use of special fasteners and fastening methods	71
8.10	Galling and seizure of stainless steels	71
9	Erection	72
9.1	General	72
9.2	Site conditions	72
9.3	Erection method	73
9.3.1	Design basis for the erection method	73
9.3.2	Constructor's erection method	73
9.4	Survey	74
9.4.1	Reference system	74
9.4.2	Position points	75
9.5	Supports, anchors and bearings	75
9.5.1	Inspection of supports	75
9.5.2	Setting out and suitability of supports	75
9.5.3	Maintaining suitability of supports	75
9.5.4	Temporary supports	75
9.5.5	Grouting and sealing	76
9.5.6	Anchoring	77
9.6	Erection and work at site	77
9.6.1	Erection drawings	77
9.6.2	Marking	78
9.6.3	Handling and storage on site	78
9.6.4	Trial erection	79

9.6.5	Erection methods	79
10	Surface treatment	80
10.1	General	80
10.2	Preparation of steel A_1 substrates for paints and related products A_1	81
10.3	Weather resistant steels	82
10.4	Galvanic coupling	82
10.5	Galvanizing	82
10.6	Sealing of spaces	82
10.7	Surfaces in contact with concrete	83
10.8	Inaccessible surfaces	83
10.9	Repairs after cutting or welding	83
10.10	Cleaning after erection	83
10.10.1	Cleaning of thin gauge components	83
10.10.2	Cleaning of stainless steels components	83
11	Geometrical tolerances	84
11.1	Tolerance types	84
11.2	Essential tolerances	84
11.2.1	General	84
11.2.2	Manufacturing tolerances	84
11.2.3	Erection tolerances	85
11.3	Functional tolerances	86
11.3.1	General	86
11.3.2	Tabulated values	86
11.3.3	Alternative criteria	87
12	Inspection, testing and correction	87
12.1	General	87
12.2	Constituent products and components	87
12.2.1	Constituent products	87
12.2.2	Components	88
12.2.3	Non conforming products	88
12.3	Manufacturing: geometrical dimensions of manufactured components	88
12.4	Welding	89
12.4.1	Inspection before and during welding	89
12.4.2	Inspection after welding	89
12.4.3	Inspection and testing of welded shear studs for composite steel and concrete structures	92
12.4.4	Production tests on welding	92
12.5	Mechanical fastening	93
12.5.1	Inspection of non-preloaded bolted connections	93
12.5.2	Inspection and testing of preloaded bolted connections	93
12.5.3	Inspection, testing and repairs of hot rivets	96
12.5.4	Inspection of cold formed components and sheeting fastening	97
12.5.5	Special fasteners and fastening methods	97
12.6	Surface treatment and corrosion protection	98
12.7	Erection	98
12.7.1	Inspection of trial erection	98
12.7.2	Inspection of the erected structure	98
12.7.3	Survey of geometrical position of connection nodes	98
12.7.4	Other acceptance tests	100
Annex A	(normative) Additional information, list of options and requirements related to the execution classes	101
A.1	List of required additional information	101
A.2	List of options	104
A.3	Requirements related to the execution classes	108
Annex B	(informative) Guidance for the determination of execution classes	112
B.1	Introduction	112
B.2	Governing factors for choice of execution class	112
B.2.1	Consequence classes	112

B.2.2	Hazards connected with execution and use of the structure	112
B.3	Determination of execution classes	113
Annex C	(informative) Check-list for the content of a quality plan	115
C.1	Introduction	115
C.2	Content	115
C.2.1	Management.....	115
C.2.2	Specification review	115
C.2.3	Documentation.....	115
C.2.4	Inspection and testing procedures.....	116
Annex D	(normative) Geometrical tolerances	117
D.1	Essential tolerances	117
D.1.1	Essential manufacturing tolerances – Welded profiles	118
D.1.2	Essential manufacturing tolerances – Press braked cold formed profiles	119
D.1.3	Essential manufacturing tolerances – Flanges of welded profiles	120
D.1.4	Essential manufacturing tolerances – Flanges of welded box sections	121
D.1.5	Essential manufacturing tolerances – Web stiffeners of profiles or box sections.....	123
D.1.6	Essential manufacturing tolerances – Stiffened plating	125
D.1.7	Essential manufacturing tolerances – Cold formed profiled sheets.....	126
D.1.8	Essential manufacturing tolerances – Fastener holes, notches and cut edges	127
D.1.9	Essential manufacturing tolerances – Cylindrical and conical shells	128
D.1.10	Essential manufacturing tolerances – Lattice components.....	129
D.1.11	Essential erection tolerances – $\square$ Columns of single storey buildings $\square$	130
D.1.12	Essential erection tolerances – Multi-storey columns	131
D.1.13	Essential erection tolerances – Full contact end bearing	133
D.1.14	Essential erection tolerances – Towers and masts	133
D.1.15	Essential erection tolerances – Beams subject to bending and components subject to compression	134
D.2	Functional tolerances.....	135
D.2.1	Functional manufacturing tolerances – Welded profiles	136
D.2.2	Functional manufacturing tolerances – Press braked cold formed profiles	137
D.2.3	Functional manufacturing tolerances – Flanges of welded profiles	138
D.2.4	Functional manufacturing tolerances – Welded box sections	139
D.2.5	Functional manufacturing tolerances – Webs of welded profiles or box sections	141
D.2.6	Functional manufacturing tolerances – Web stiffeners of welded profiles or box sections	142
D.2.7	Functional manufacturing tolerances – Components	143
D.2.8	Functional manufacturing tolerances – Fastener holes, notches and cut edges.....	144
D.2.9	Functional manufacturing tolerances – Column splices and baseplates	146
D.2.10	Functional manufacturing tolerances – Lattice components	147
D.2.11	Functional manufacturing tolerances – Stiffened plating	148
D.2.12	Functional manufacturing tolerances – Towers and masts	150
D.2.13	Functional manufacturing tolerances – Cold formed profiled sheets	151
D.2.14	Functional manufacturing tolerances – Bridge decks.....	151
D.2.15	Functional erection tolerances – Bridges	153
D.2.16	Functional erection tolerances – Bridge decks (sheet 1/3).....	153
D.2.17	Functional erection tolerances – Bridge decks(sheet 2/3).....	154
D.2.18	Functional erection tolerances – Bridges decks (sheet 3/3).....	156
D.2.19	Functional manufacturing and erection tolerances – Crane beams and rails	157
D.2.20	Functional tolerances – Concrete foundations and supports	158
D.2.21	Functional erection tolerances – Crane runways	160
D.2.22	Functional erection tolerances – Positions of columns.....	161
D.2.23	Functional erection tolerances – $\square$ Columns of single storey buildings $\square$	162
D.2.24	Functional erection tolerances – Multi-storey columns	163
D.2.25	Functional erection tolerances – Buildings	164
D.2.26	Functional erection tolerances – Beams in buildings	166
D.2.27	Functional erection tolerances - Roof sheeting designed as a stressed-skin.....	167
D.2.28	Functional erection tolerances - Profiled steel sheeting.....	167
Annex E	(informative) Welded joints in hollow sections	168
E.1	General.....	168

E.2	Guidance for start and stop positions	168
E.3	Preparation of joint faces	168
E.4	Assembly for welding	169
E.5	Fillet welded joints	177
Annex F	(normative) Corrosion protection	178
F.1	General	178
F.1.1	Field of application	178
F.1.2	Performance specification	178
F.1.3	Prescriptive requirements	178
F.1.4	Work method	179
F.2	Surface preparation of carbon steels	179
F.2.1	Surface preparation of carbon steels prior to painting and metal spraying	179
F.2.2	Surface preparation of carbon steels prior to galvanizing	180
F.3	Welds and surfaces for welding	180
F.4	Surfaces in preloaded connections	180
F.5	Preparation of fasteners	180
F.6	Coating methods	181
F.6.1	Painting	181
F.6.2	Metal spraying	181
F.6.3	Galvanizing	182
F.7	Inspection and checking	182
F.7.1	General	182
F.7.2	Routine checking	182
F.7.3	Reference areas	182
F.7.4	Galvanized components	182
Annex G	(normative) Test to determine slip factor	184
G.1	General	184
G.2	Significant variables	184
G.3	Test specimens	184
G.4	Slip test procedure and evaluation of results	186
G.5	Extended creep test procedure and evaluation	186
G.6	Test results	187
Annex H	(normative)  Calibration test for preloaded bolts under site conditions 	189
H.1	Scope	189
H.2	Symbols and units	189
H.3	Principle of the test	189
H.4	Test apparatus	190
H.5	Test assemblies	190
H.6	Test set up	190
H.7	Test procedure	191
H.8	Evaluation of test results	192
H.9	Test report	193
Annex J	(normative) Use of compressible washer-type direct tension indicators	194
J.1	General	194
J.2	Fitting	194
J.3	Checking	196
Annex K	(informative) Hexagon injection bolts	199
K.1	General	199
K.2	Hole sizes	199
K.3	Bolts	199
K.4	Washers	200
K.5	Nuts	201
K.6	Resin	201
K.7	Tightening	201
K.8	Installation	201
Annex L	(informative) Guide to flow diagram for development and use of a WPS	203