

# DIN EN 1090-2:2024-09 (E)

## Execution of steel structures and aluminium structures - Part 2: Technical requirements for steel structures (includes Amendment A1:2024)

---

### Contents

Page

European foreword .....	9
Introduction .....	11
1 Scope.....	12
2 Normative references.....	12
2.1 Constituent products.....	12
2.1.1 Steels.....	12
2.1.2 Steel castings .....	15
2.1.3 Welding consumables .....	15
2.1.4 Mechanical fasteners .....	16
2.1.5 High strength cables .....	17
2.1.6 Structural bearings .....	17
2.2 Preparation.....	17
2.3 Welding.....	17
2.4 Testing .....	19
2.5 Erection .....	20
2.6 Corrosion protection .....	20
2.7 Miscellaneous.....	20
3 Terms and definitions.....	21
4 Specifications and documentation .....	24
4.1 Execution Specification.....	24
4.1.1 General.....	24
4.1.2 Execution classes .....	24
4.1.3 Requirements for surface preparation for corrosion protection .....	24
4.1.4 Geometrical tolerances.....	24
4.2 Constructor's documentation.....	25
4.2.1 Quality documentation .....	25
4.2.2 Quality plan.....	25
4.2.3 Safety of the erection works .....	25
4.2.4 Execution documentation.....	25
5 Constituent products.....	26
5.1 General.....	26
5.2 Identification, inspection documents and traceability .....	26
5.3 Structural steel products .....	28
5.3.1 General.....	28
5.3.2 Thickness tolerances.....	29
5.3.3 Surface conditions .....	30
5.3.4 Additional properties.....	30
5.4 Steel castings .....	31
5.5 Welding consumables .....	31
5.6 Mechanical fasteners .....	33
5.6.1 General.....	33
5.6.2 Terminology .....	33
5.6.3 Structural bolting assemblies for non-preloaded applications .....	33
5.6.4 Structural bolting assemblies for preloading.....	34

5.6.5	Direct tension indicators .....	34
5.6.6	Weather resistant assemblies.....	34
5.6.7	Foundation bolts .....	34
5.6.8	Locking devices .....	35
5.6.9	Washers.....	35
5.6.10	Solid rivets for hot riveting .....	35
5.6.11	Special fasteners .....	35
5.6.12	Delivery and identification .....	35
5.7	Studs and shear connectors .....	36
5.8	Reinforcing steel welded to structural steel.....	36
5.9	Grouting materials .....	36
5.10	Expansion joints for bridges.....	36
5.11	High strength cables, rods and terminations .....	36
5.12	Structural bearings .....	37
6	Preparation and assembly .....	37
6.1	General .....	37
6.2	Identification.....	37
6.3	Handling and storage .....	37
6.4	Cutting.....	39
6.4.1	General .....	39
6.4.2	Shearing and nibbling.....	39
6.4.3	Thermal cutting.....	39
6.4.4	Hardness of free edge surfaces.....	40
6.5	Shaping.....	40
6.5.1	General .....	40
6.5.2	Hot forming.....	41
6.5.3	Flame straightening.....	41
6.5.4	Cold forming.....	42
6.6	Holing.....	43
6.6.1	Dimensions of holes.....	43
6.6.2	Tolerances on hole diameter for bolts and pins.....	44
6.6.3	Execution of holing.....	45
6.7	Cut outs.....	46
6.8	Full contact bearing surfaces .....	46
6.9	Assembly.....	46
6.10	Assembly check .....	47
7	Welding .....	47
7.1	General .....	47
7.2	Welding plan .....	47
7.2.1	Requirements for a welding plan.....	47
7.2.2	Content of a welding plan .....	48
7.3	Welding processes.....	48
7.4	Qualification of welding procedures and welding personnel .....	49
7.4.1	Qualification of welding procedures .....	49
7.4.2	Welders and welding operators.....	51
7.4.3	Welding coordination .....	52
7.5	Preparation and execution of welding.....	54
7.5.1	Joint preparation .....	54
7.5.2	Storage and handling of welding consumables .....	55
7.5.3	Weather protection.....	55
7.5.4	Assembly for welding.....	55
7.5.5	Preheating.....	56

7.5.6	Temporary attachments.....	56
7.5.7	Tack welds.....	56
7.5.8	Fillet welds.....	56
7.5.9	Butt welds.....	57
7.5.10	Welds on steels with improved atmospheric corrosion resistance .....	58
7.5.11	Branch connections.....	58
7.5.12	Stud welding .....	58
7.5.13	Slot and plug welds.....	59
7.5.14	Other weld types .....	59
7.5.15	Post-weld heat treatment .....	59
7.5.16	Execution of welding.....	59
7.5.17	Welding of orthotropic bridge decks.....	59
7.6	Acceptance criteria.....	59
7.6.1	Routine requirements.....	59
7.6.2	Fatigue requirements.....	60
7.6.3	Orthotropic bridge decks.....	60
7.7	Welding of stainless steels.....	60
8	Mechanical fastening.....	60
8.1	General.....	60
8.2	Use of bolting assemblies.....	61
8.2.1	General.....	61
8.2.2	Bolts .....	61
8.2.3	Nuts .....	62
8.2.4	Washers.....	62
8.3	Tightening of non-preloaded bolting assemblies .....	63
8.4	Preparation of contact surfaces in slip resistant connections .....	63
8.5	Tightening of preloaded bolting assemblies.....	65
8.5.1	General.....	65
8.5.2	Torque reference values .....	66
8.5.3	Torque method .....	67
8.5.4	Combined method .....	67
8.5.5	HRC method .....	68
8.5.6	Direct tension indicator method.....	69
8.6	Fit bolts.....	69
8.7	Hot riveting.....	69
8.7.1	Rivets.....	69
8.7.2	Installation of rivets.....	69
8.7.3	Acceptance criteria.....	70
8.8	Use of special fasteners and fastening methods.....	70
8.9	Galling and seizure of stainless steels.....	71
9	Erection .....	71
9.1	General.....	71
9.2	Site conditions.....	71
9.3	Erection method.....	72
9.3.1	Design basis for the erection method.....	72
9.3.2	Constructor's erection method.....	73
9.4	Survey.....	74
9.4.1	Reference system .....	74
9.4.2	Position points.....	74
9.5	Supports, anchors and bearings.....	74
9.5.1	Inspection of supports .....	74
9.5.2	Setting out and suitability of supports.....	74

9.5.3	Maintaining suitability of supports.....	75
9.5.4	Temporary supports .....	75
9.5.5	Grouting and sealing.....	75
9.5.6	Anchoring .....	76
9.6	Erection and work at site .....	76
9.6.1	Erection drawings .....	76
9.6.2	Marking .....	76
9.6.3	Handling and storage on site.....	76
9.6.4	Trial erection .....	77
9.6.5	Erection works.....	77
10	Surface treatment.....	79
10.1	General .....	79
10.2	Preparation of steel substrates for paints and related products.....	79
10.3	Weather resistant steels .....	80
10.4	Galvanic coupling.....	80
10.5	Hot dip galvanizing .....	80
10.6	Sealing of spaces .....	81
10.7	Surfaces in contact with concrete.....	81
10.8	Inaccessible surfaces.....	81
10.9	Repairs after cutting or welding .....	81
10.10	Cleaning of stainless steel components.....	82
11	Geometrical tolerances.....	82
11.1	Tolerance types.....	82
11.2	Essential tolerances.....	82
11.2.1	General .....	82
11.2.2	Manufacturing tolerances .....	82
11.2.3	Erection tolerances.....	83
11.3	Functional tolerances.....	84
11.3.1	General .....	84
11.3.2	Tabulated values.....	85
11.3.3	Alternative criteria .....	85
12	Inspection, testing and correction.....	85
12.1	General .....	85
12.2	Constituent products and components.....	85
12.2.1	Constituent products.....	85
12.2.2	Components.....	86
12.2.3	Non-conforming products .....	86
12.3	Manufacturing: geometrical dimensions of manufactured components .....	86
12.4	Welding .....	87
12.4.1	General .....	87
12.4.2	Inspection after welding .....	87
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
12.4.5	Inspection and testing of welding of reinforcing steel.....	92
12.5	Mechanical fastening.....	92
12.5.1	Inspection of non-preloaded bolted connections .....	92
12.5.2	Inspection and testing of preloaded bolted connections.....	93
12.5.3	Inspection and repairs of solid rivets for hot riveting.....	96
12.5.4	Special fasteners and fastening methods.....	96
12.6	Surface treatment and corrosion protection.....	97

12.7	Erection .....	97
12.7.1	Inspection of trial erection.....	97
12.7.2	Inspection of the erected structure.....	97
12.7.3	Survey of geometrical position of connection nodes .....	97
12.7.4	Other acceptance tests .....	99
Annex A (normative) Additional information, options and requirements related to the execution classes.....		100
A.1	Additional information.....	100
A.2	Options.....	103
A.3	Requirements related to the execution classes .....	108
Annex B (normative) Geometrical tolerances.....		112
B.1	General.....	112
B.2	Manufacturing tolerances.....	112
B.3	Erection tolerances .....	139
Annex C (informative) Check-list for the content of a quality plan.....		156
C.1	General.....	156
C.2	Content.....	156
C.2.1	Management .....	156
C.2.2	Specification review.....	156
C.2.3	Documentation .....	156
C.2.4	Inspection and testing procedures.....	158
Annex D (informative) Procedure for checking capability of automated thermal cutting processes.....		159
D.1	General.....	159
D.2	Description of the procedure.....	159
D.2.1	General.....	159
D.2.2	Average surface roughness $R_{z5}$ .....	160
D.2.3	Perpendicularity and angularity tolerance.....	161
D.2.4	Hardness test.....	161
D.3	Range of qualification.....	162
D.3.1	Material groups .....	162
D.3.2	Material thickness .....	163
D.3.3	Pressures of gases.....	163
D.3.4	Cutting speed and height.....	163
D.3.5	Preheat temperature .....	163
D.4	Test report.....	163
Annex E (informative) Welded joints in hollow sections .....		167
E.1	General.....	167

<b>E.2</b>	<b>Guidance for start and stop positions .....</b>	<b>167</b>
<b>E.3</b>	<b>Preparation of joint faces .....</b>	<b>167</b>
<b>E.4</b>	<b>Assembly for welding.....</b>	<b>168</b>
<b>E.5</b>	<b>Fillet welded joints.....</b>	<b>175</b>
<b>Annex F (normative) Corrosion protection.....</b>		<b>176</b>
<b>F.1</b>	<b>General .....</b>	<b>176</b>
<b>F.1.1</b>	<b>Field of application .....</b>	<b>176</b>
<b>F.1.2</b>	<b>Performance specification .....</b>	<b>176</b>
<b>F.1.3</b>	<b>Prescriptive requirements.....</b>	<b>176</b>
<b>F.1.4</b>	<b>Work method .....</b>	<b>177</b>
<b>F.2</b>	<b>Surface preparation of carbon steels .....</b>	<b>177</b>
<b>F.2.1</b>	<b>Surface preparation of carbon steels prior to painting or metal spraying.....</b>	<b>177</b>
<b>F.2.2</b>	<b>Surface preparation of carbon steels prior to hot dip galvanizing.....</b>	<b>178</b>
<b>F.3</b>	<b>Welds and surfaces for welding .....</b>	<b>178</b>
<b>F.4</b>	<b>Surfaces in preloaded connections .....</b>	<b>178</b>
<b>F.5</b>	<b>Preparation of fasteners .....</b>	<b>178</b>
<b>F.6</b>	<b>Coating methods .....</b>	<b>179</b>
<b>F.6.1</b>	<b>Painting .....</b>	<b>179</b>
<b>F.6.2</b>	<b>Metal spraying .....</b>	<b>179</b>
<b>F.6.3</b>	<b>Hot dip galvanizing .....</b>	<b>179</b>
<b>F.7</b>	<b>Inspection and checking .....</b>	<b>179</b>
<b>F.7.1</b>	<b>General .....</b>	<b>179</b>
<b>F.7.2</b>	<b>Routine checking .....</b>	<b>179</b>
<b>F.7.3</b>	<b>Reference areas.....</b>	<b>180</b>
<b>F.7.4</b>	<b>Hot dip galvanized components.....</b>	<b>180</b>
<b>Annex G (normative) Determination of slip factor.....</b>		<b>181</b>
<b>G.1</b>	<b>General .....</b>	<b>181</b>
<b>G.2</b>	<b>Significant variables .....</b>	<b>181</b>
<b>G.3</b>	<b>Test specimens .....</b>	<b>181</b>
<b>G.4</b>	<b>Slip test procedure and evaluation of results.....</b>	<b>184</b>
<b>G.5</b>	<b>Extended creep test procedure and evaluation.....</b>	<b>186</b>
<b>G.6</b>	<b>Test results.....</b>	<b>186</b>
<b>Annex H (normative) Calibration test for preloaded bolting assemblies under site conditions.....</b>		<b>188</b>
<b>H.1</b>	<b>General .....</b>	<b>188</b>
<b>H.2</b>	<b>Symbols and units.....</b>	<b>188</b>
<b>H.3</b>	<b>Principle of the test.....</b>	<b>189</b>

H.4	Test apparatus .....	189
H.5	Test assemblies.....	189
H.6	Test set up.....	189
H.7	Test procedure.....	190
H.8	Evaluation of test results.....	190
H.9	Test report.....	192
<b>Annex I (informative) Determination of loss of preload for thick surface coatings.....</b>		<b>193</b>
I.1	General.....	193
I.2	Test procedure.....	194
<b>Annex J (informative) Resin injection bolts .....</b>		<b>196</b>
J.1	General.....	196
J.2	Hole sizes .....	196
J.3	Bolts .....	196
J.4	Washers.....	197
J.5	Nuts .....	198
J.6	Resin .....	198
J.7	Tightening .....	198
J.8	Installation .....	198
<b>Annex K (informative) Guide to flow diagram for development and use of a WPS.....</b>		<b>200</b>
<b>Annex L (informative) Guidance on the selection of weld inspection classes .....</b>		<b>201</b>
L.1	General.....	201
L.2	Selection criteria.....	201
L.3	Extent of supplementary testing .....	202
<b>Annex M (normative) Sequential method for fasteners inspection .....</b>		<b>204</b>
M.1	General.....	204
M.2	Application .....	205
<b>Bibliography .....</b>		<b>207</b>