Appendix B
(PNAP APP-168)

Amendments to Code of Practice for the Structural Use of Steel 2011

(May 2021)

Legends:

Amended

Deleted

(3/2023)

Major amendments to the Code of Practice for the Structural Use of Steel 2011 in May 2021 included:

(a) clause 1.5 – addition of a symbol λ_{eff} corresponding to the amendments to clause 8.7.9;

(b) clause 3.1.2 – clarification on the definition of yield strength;

(c) Table 3.9 – addition of BS EN 10268 to supersede the withdrawn BS 1449-1-1.5 & 1.11;

(d) 3rd paragraph of clause 8.7.9 – revision of the formulas defining the effective slenderness ratios about different minor axes;

(e) clause 11.7.5(iii) – deletion of the requirement to submit Welding Procedure Specification prior to the commencement and carrying out of welding works in cold-formed hollow sections;

(f) Table 11.5 – elaboration of the conditions for welding cold-formed areas and adjacent materials;

(g) clause Al of Annex A – addition of a criterion for using the latest version of the standards listed in Annex A;

(h) clause Al.1.5 of Annex A – addition of BS EN 10147:2000; and

(i) clause Al.7.5 of Annex A – addition of BS EN 10268:2006.

Amendments to the Code of Practice for the Structural Use of Steel 2011 (May 2021)

Item	Current version	Amendments
1. Clause 1.5[1]	λ_{cr} Elastic critical load factor λ_{L0} Limiting equivalent slenderness (lateral-torsional buckling)	λ_{cr} Elastic critical load factor λ_{eff} Effective slenderness ratio λ_{L0} Limiting equivalent slenderness (lateral-torsional buckling)
2. Clause 3.1.2[2]	**3.1.2 Design strength for normal strength steels** The design strength, p_y, for steel is given by: $p_y = \frac{Y_S}{\gamma_{m1}}$ but not greater than $\frac{U_S}{\gamma_{m2}}$ where Y_s is the yield strength which is defined as the upper yield strength, R_{eH}, the stress at the initiation of yielding for steel materials with clearly defined yield point;or 0.2% proof stress, $R_{p\,0.2}$, or the stress at 0.5% total elongation, $R_{t\,0.5}$ for steel materials with no clearly defined yield point, whichever is smaller. In case of dispute, the 0.2% proof stress, $R_{p\,0.2}$, shall be adopted.	**3.1.2 Design strength for normal strength steels** The design strength, p_y, for steel is given by: $p_y = \frac{Y_S}{\gamma_{m1}}$ but not greater than $\frac{U_S}{\gamma_{m2}}$ where Y_s the yield strength is defined as : (a) the upper yield strength, R_{eH}, the stress at the initiation of yielding for steel materials with clearly defined yield point; or (b) if the yield point cannot be clearly defined, then the 0.2% proof stress, $R_{p\,0.2}$, or the stress at 0.5% total elongation, $R_{t\,0.5}$ for steel materials whichever is smaller.

[1] Addition of a symbol λ_{eff} corresponding to the amendments to clause 8.7.9.
[2] Clarification on the definition of yield strength.

<table>
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<tr><td></td><td></td><td>(c) In case of dispute, the 0.2% proof stress, $R_{p\,0.2}$, shall be adopted.</td></tr>
<tr><td>3. Table 3.9[3]</td><td>Table 3.9 - Yield and ultimate strengths for steels supplied in accordance with various national standards
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<tr><th>Type of steel</th><th>Grade</th><th>Yield strength Y_s (N/mm^2)</th><th>Tensile strength U_s (N/mm^2)</th></tr>
<tr><td>British standard:
BS EN 10025
Hot rolled steel sheet of structural quality</td><td>S235
S275
S355</td><td>235
275
355</td><td>360
430
510</td></tr>
<tr><td>British standard:
BS EN 10147
Continuous hot dip zinc coated carbon steel sheet of structural quality</td><td>S220 G
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</table>

[3] Addition of BS EN 10268 to supersede the withdrawn BS 1449-1-1.5 & 1.11.

Item	Current version				Amendments			
	British standard: BS EN 10149- 2 & 3 High yield strength steels for cold forming	S315 MC S355 MC S420 MC S260 NC S315 NC S355 NC S420 NC	315 355 420 260 315 355 420	390 430 480 370 430 470 530	British standard: BS EN 10149- 2 & 3 High yield strength steels for cold forming	S315 MC S355 MC S420 MC S260 NC S315 NC S355 NC S420 NC	315 355 420 260 315 355 420	390 430 480 370 430 470 530
	British standard: BS 1449-1- 1.5 & 1.11 Cold rolled steel sheet based on minimum strength	34/20 37/23 43/25 50/35 40/30 43/35 40F30 43F35	200 230 250 350 300 350 300 350	340 370 430 500 400 430 400 430	British standard: BS EN 10268 Cold-rolled steel flat products with high yield strength for cold forming – Technical delivery conditions	34/20 37/23 43/25 50/35 40/30 43/35 40F30 43F35	200 230 250 350 300 350 300 350	340 370 430 500 400 430 400 430
	Australia standard: AS 1397 Steel sheet and strip	G250 G300 G350 G450 G500 G550	250 300 350 450 500 550	320 340 420 480 520 550	Australia standard: AS 1397 Steel sheet and strip	G250 G300 G350 G450 G500 G550	250 300 350 450 500 550	320 340 420 480 520 550

Item	Current version	Amendments
	Chinese standard: GB 50018 Technical code of cold-formed thin-wall steel structures: Q235 205 -; Q345 300 -	Chinese standard: GB 50018 Technical code of cold-formed thin-wall steel structures: Q235 205 -; Q345 300 -
4. 3rd paragraph of Clause 8.7.9[4]	For web members, buckling about principal axes and axes parallel to the legs should be considered. For angle sections connected by two or more bolts, the slenderness ratio should be calculated from the larger of the actual member length and the following: For buckling about minor v-v axis, $\lambda = 0.35 + 0.7\lambda_v / (93.9\varepsilon)$ For buckling about x-x axis, $\lambda = 0.5 + 0.7\lambda_x / (93.9\varepsilon)$ (8.76) For buckling about y-y axis, $\lambda = 0.5 + 0.7\lambda_y / (93.9\varepsilon)$ in which $\varepsilon = \sqrt{\frac{275}{p_y}}$ and λ is the effective slenderness ratio. λ_v, λ_x and λ_y are respectively the slenderness ratios	For web members, buckling about principal axes and axes parallel to the legs should be considered. For angle sections connected by two or more bolts, the slenderness ratio should be calculated from the following: For buckling about v-v axis, $\lambda_{eff,v} = 0.35 \times 85.8\varepsilon + 0.7\lambda_v$ or λ_v whichever is larger. For buckling about x-x axis, $\lambda_{eff,x} = 0.5 \times 85.8\varepsilon + 0.7\lambda_x$ or λ_x whichever is larger. (8.76) For buckling about y-y axis, $\lambda_{eff,y} = 0.5 \times 85.8\varepsilon + 0.7\lambda_y$ or λ_y whichever is larger. in which $\varepsilon = \sqrt{\frac{275}{p_y}}$ and λ_{eff} is the effective slenderness ratio. λ_v, λ_x and λ_y are respectively the slenderness ratios

[4] Revision of the formulas defining the effective slenderness ratios about different minor axes.

Item	Current version	Amendments
	about minor v-axis and the x- and y-axes parallel to the two legs.	about the minor v-axis, and the x- and y-axes of the angle sections.
5. Clause 11.7.5(iii)[5]	**11.7.5 Welding at cold-formed zones** Welding may be carried out within a length 5*t* either side of a cold-formed area, provided that one of the following conditions is satisfied: (i) the cold formed areas are normalized after cold forming but before welding; (ii) the internal radius-to-thickness *r/t* ratio satisfies the relevant value given in Table 11.5; or (iii) the Responsible Engineer shall submit a Welding Procedure Specification (WPS) as stipulated in clause 14.3.3 for the approval of the Building Authority prior to the commencement and carrying out of welding works in cold-formed hollow sections.	**11.7.5 Welding at cold-formed zones** Welding may be carried out within a length 5*t* either side of a cold-formed area, provided that one of the following conditions is satisfied: (a) the cold-formed areas are normalized after cold forming but before welding; (b) the internal radius-to-thickness *r/t* ratio satisfies the relevant value given in Table 11.5; or (c) the welding procedure shall fulfill the Welding Procedure Specification (WPS) as stipulated in clause 14.3.3.

[5] Deletion of the requirement to submit Welding Procedure Specification prior to the commencement and carrying out of welding works in cold-formed hollow sections.

<table>
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<tr><td>6. Table 11.5[6]</td><td>

Table 11.5 Conditions for welding cold-formed areas and adjacent materials

<table>
<tr><th rowspan="3">Minimum internal radius/ thickness (r/t) ratio</th><th rowspan="3">Strain due to cold forming (%)</th><th colspan="3">Maximum thickness (mm)</th></tr>
<tr><th colspan="2">Generally</th><th rowspan="2">Fully killed Aluminium-killed steel (AL ≥ 0.02 %)</th></tr>
<tr><th>Predominantly static loading</th><th>Where fatigue predominates</th></tr>
<tr><td>≥ 3.0</td><td>≤ 14</td><td>22</td><td>12</td><td>22</td></tr>
<tr><td>≥ 2.0</td><td>≤ 20</td><td>12</td><td>10</td><td>12</td></tr>
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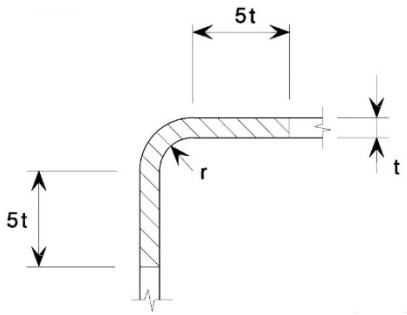
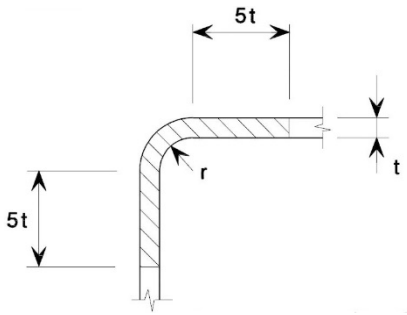
</td></tr>
</table>

[6] Elaboration of the conditions for welding cold-formed areas and adjacent materials.

Item	Current version	Amendments
	≥ 1.0 ≤ 33 4 4 6  	≥ 1.0 ≤ 33 4 4 6  NOTE: Cold-formed hollow sections according to BS EN 10219 which do not satisfy the limits given in Table 11.5 can be assumed to satisfy these limits if these sections have a thickness not exceeding 12.5 mm and are Aluminium-killed with a quality J2H, K2H, MH, MLH, NH or NLH as defined in BS EN 10219 and further satisfy C ≤ 0.18%, P ≤ 0.020% and S ≤ 0.012%. In other cases welding is only permitted within a distance of 5t from the corners if it can be shown by tests that welding is permitted for that particular application.

Item	Current version	Amendments
7. Clause A1 of Annex A[7]	**A1 ACCEPTABLE STANDARDS AND REFERENCES** This annex contains the standards considered acceptable to the Building Authority to be used together with the Code. Where it is intended to use other standards or technical references it should be demonstrated that they can achieve a performance equivalent to the acceptable standards as specified in the Code.	**A1 ACCEPTABLE STANDARDS AND REFERENCES** This annex contains the standards considered acceptable to the Building Authority to be used together with the Code. Where it is intended to use other standards or technical references, or latest version of the standards given in Annex A, it should be demonstrated that they can achieve a performance equivalent to the acceptable standards as specified in the Code.
8. Clause A1.1.5 of Annex A[8]	**A1.1.5 UK and European standards** BS EN 10025: 2004 — Hot rolled products of non-alloy structural steels - Technical delivery conditions. BS EN 10164: 2004 — Steel products with improved deformation properties perpendicular to the surface of the product - Technical delivery conditions. BS EN 10210-1: 2006 — Hot finished structural hollow sections of non-alloy	**A1.1.5 UK and European standards** BS EN 10025: 2004 — Hot rolled products of non-alloy structural steels - Technical delivery conditions. BS EN 10164: 2004 — Steel products with improved deformation properties perpendicular to the surface of the product - Technical delivery conditions. BS EN 10210-1: 2006 — Hot finished structural hollow sections of non-alloy

[7] Addition of a criterion for using the latest version of the standards listed in Annex A.
[8] Addition of BS EN 10147:2000.

Item	Current version		Amendments	
		and fine grain structural steels. Part 1: Technical delivery requirements.		and fine grain structural steels. Part 1: Technical delivery requirements.
	BS EN 10248-1: 1996	Hot rolled sheet piling of non alloy steels. Part 1: Technical delivery conditions	BS EN 10248-1: 1996	Hot rolled sheet piling of non alloy steels. Part 1: Technical delivery conditions
			BS EN 10147: 2000	Continuous hot dip zinc coated carbon steel sheet of structural quality
9. Clause A1.7.5 of Annex A[9]	**A1.7.5 UK, European and ISO standards**		**A1.7.5 UK, European and ISO standards**	
	BS 5950-7: 1992	Structural use of steelwork in building. Specification for materials and workmanship: cold formed sections	BS 5950-7: 1992	Structural use of steelwork in building. Specification for materials and workmanship: cold formed sections
	BS EN 10149-1: 1996	Specification for hot-rolled flat products made of high yield strength steels for cold forming. Part 1: General delivery conditions	BS EN 10149-1: 1996	Specification for hot-rolled flat products made of high yield strength steels for cold forming. Part 1: General delivery conditions
	BS EN 10149-2: 1996	Specification for hot-rolled flat products made of high yield strength steels for cold forming. Part 2: Delivery	BS EN 10149-2: 1996	Specification for hot-rolled flat products made of high yield strength steels for cold forming. Part 2: Delivery

[9] Addition of BS EN 10268:2006.

Item	Current version		Amendments	
		conditions for thermomechanically rolled steels		conditions for thermomechanically rolled steels
	BS EN 10149-3: 1996	Specification for hot-rolled flat products made of high yield strength steels for cold forming. Part 3: Delivery conditions for normalized or normalized rolled steels	BS EN 10149-3: 1996	Specification for hot-rolled flat products made of high yield strength steels for cold forming. Part 3: Delivery conditions for normalized or normalized rolled steels
	BS EN 10219-1: 2006	Cold formed welded structural hollow sections of non-alloy and fine grain steels. Part 1: Technical delivery requirements	BS EN 10219-1: 2006	Cold formed welded structural hollow sections of non-alloy and fine grain steels. Part 1: Technical delivery requirements
	BS EN 10249-1: 1996	Cold formed sheet piling of non alloy steels. Part 1: Technical delivery conditions	BS EN 10249-1: 1996	Cold formed sheet piling of non alloy steels. Part 1: Technical delivery conditions
			BS EN 10268: 2006	Cold-rolled steel flat products with high yield strength for cold forming – Technical delivery conditions