

Singapore National Annex to Eurocode 3: Design of steel structures

– Part 1-4: General rules – Supplementary rules for stainless steels

AMENDMENT NO. 1

May 2019

1. Page 5, Contents

Replace the title in NA.3 with “Recommendations on the status and use of annexes”.

2. Page 6, National Foreword, Paragraph 5

Replace “BC 1: 2008” with “BC 1: 2012”.

Add “and Eurocode 3” after “BS 5950”.

3. Page 7, NA.1, Scope, item a)

Add “– 7(1)”, “– A.2(8)” and “– A.3, Table A.4” after 6.2(3).

4. Page 7, NA.2.1, General

Replace “NA.2.8” with “NA.2.9”.

5. Page 8, NA.2.6, Shear buckling resistance

Replace “The value $\eta = 1.00$ should be used when the temperature of steel exceeds 400 °C” with “The value $\eta = 1.00$ should be used when the 0.2% proof strength exceeds 460 MPa and/or the temperature of steel exceeds 400 °C.”

6. Page 8, Addition of a new clause

Add the following new clause NA.2.9 after clause NA.2.8:

NA.2.9 Design assisted by testing [SS EN 1993-1-4:2011+A1:2019, 7(1)]

No further information is given.

7. Page 8, NA.3, Decisions on the status of informative annexes

Replace entire NA.3 with the following:

NA.3 Recommendations on the status and use of annexes

NA.3.1 SS EN 1993-1-4:2011+A1:2019, Annex A.2(8)

A less severe CRF may be used when validated local operating experience of at least 5 years duration demonstrates the suitability of a grade in the adjacent lower CRC. However, the maximum permitted improvement to the CRF is +5.

The performance data should be obtained from a location less than 5 km from the proposed site and, for coastal locations, less than 1 km inland from the proposed site.

Evaluation of the performance shall consider the material grade, quality of surface finish, orientation of the components and exposure to airborne contaminants (particularly chlorides) to ensure these are comparable to the proposed design.

NA.3.2 SS EN 1993-1-4:2011+A1:2019, Annex A, Table A.4

Less frequent cleaning is not permitted.

NA.3.3 SS EN 1993-1-4:2011+A1:2019, Annex B

SS EN 1993-1-4:2011+A1:2019, Annex B maybe used.

Annex B.2 should be extended in the following way:

B.2 Cold working from fabrication

(1) Work hardening caused during fabrication of cold formed structural components may be utilized in the design in the following way:

- a) For austenitic stainless steel sections formed by press braking, an enhanced yield strength f_{ya} may be adopted to account for cold working in 90° section corners where r_i is not greater than 5t.

$$f_{ya} = \frac{f_{yb} \left((A - A_{pb}) + A_{pb} \left(\frac{1.673}{(r_i/t)} \right) \right)}{A}$$

(B.1)

- b) For austenitic cold rolled box sections (RHS and SHS) which have been formed via a circular tube and where $t < 8\text{mm}$ and r_i not greater the 5t, an enhanced yield strength f_{ya} may be adopted to account for cold working in the section faces and an extended corner region.

$$f_{ya} = \frac{(A - A_{cr}) \left(\frac{0.85f_{yb}}{\varepsilon_p - 0.19} \right) + 0.71A_{cr}f_u \left(\left(\frac{0.19}{\varepsilon_p - 0.19} \right) + 1 \right)}{A} \leq f_u$$

(B.2)

where

$$\varepsilon_p \text{ is a strain parameter, defined as } \varepsilon_p = \frac{1}{\left(12.42 \left(\frac{\pi t}{2(b+h)} \right) + 0.83 \right)}$$

A is the gross cross-sectional area of the section.

A_{cr} , is the total corner cross-sectional area for cold rolled box sections including a region of 2t, which extends both sides of each corner. A_{cr} can be obtained with the following expression $A_{cr} = \pi t (2r_i + t) + 16t^2$ and r_i can be assumed to be equal to 2t.

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A_{pb} is the total corner cross-section area for press braked sections which can be calculated as $A_{pb} = \frac{\pi n t}{4}(2r+t)$

f_{yb} , f_u are the yield strength and the ultimate tensile strength of the basic material (i.e. the flat sheet material out of which sections are made by cold forming). f_u should be taken as the minimum value of the range specified in the material standard.

n is the number of 90° corners.

The increase in yield strength due to cold working should not be utilized for sections that are annealed or subject to heat treatment after forming which may produce softening.

- c) For all section types, work hardening may be utilised in the design if the effect of work hardening has been verified by full size tests in accordance with Section 7.
- (2) For design of connections which are not part of the full size testing, nominal strength values should be used.

NA.3.4 SS EN 1993-1-4:2011+A1:2019, Annex C

SS EN 1993-1-4:2011+A1:2019, Annex C may be used.