Proposal of amendments on EN 1993-1-3:2006

1. General

This paper includes a brief summary for the decision of amendments on EN 1993-1-3:2006 within CEN/TC250 Subcommittee 3 (SC3) “Steel Structures”.

2. Background for Amendments

3. Summary of Amendments

3.1 Numbering System

Each amendment will be identified using the following numbering system:

AM-1-3-2012-01

- 01 — No. of amendment
- 2012 — Year
- 1-3 — Part of EN 1993
- AM — Amendment

AM-1-3-2013-XX	
Subject	Design by calculation of curved profiles
Clause No./ Subclause No./ Annex	Section 1.1, adding new clause 1.1(7) Section 6, adding new section 6.4
Reason for amendment	Curved profiles are commonly used for roofing and cladding of agricultural and storage buildings. However, the current version EN 1993-1-3 does not cover such products.
Proposed change	(see below)

Add a new clause:

1.1 (7) EN 1993-1-3 covers sheeting profiles which are curved during fabrication by continuous bending or rollforming. Sheeting of which the curvature is created by crushing the inner flanges are not considered. The curved profiles may be used in arch configuration.

Add two new sections:

6.4 Arch made of curved profiled sheeting

(1) If the internal forces and moments are determined using first-order theory, verification must be carried out following the fictitious bar method. Clauses (2) and (3) are applied. The internal forces may be determined using the section property values J_g and A_g of the gross cross section.

(2) In the case of compressive forces the following criterion may be used:

$$\frac{N_{c,Ed}}{N_{c,Rd}} \cdot \left[1 + 0{,}5 \cdot \alpha \cdot \left(1 - \frac{N_{c,Ed}}{N_{c,Rd}}\right)\right] + \frac{M_{c,Ed}}{M_{c,Rd}} \leq 1$$

with:

$N_{c,Ed}$ compressive force,

$N_{c,Rd}$ design resistance for compressive force with respect to overall buckling,

$N_{c,Rd} = \min(\sigma_{cd} * A_{ef} ; 0{,}8\ \sigma_{elg} * A_g) / \gamma_M$

Ideal buckling force: $\sigma_{elg} * A_g = \frac{\pi^2 \cdot E \cdot J_g}{s_k^2}$

Critical buckling stress σ_{cr} according to table xyz

Table xyz: critical buckling stress

α	σ_{cd}/β_S
$\alpha \leq 0{,}30$	1,00
$0{,}30 < \alpha \leq 1{,}85$	$1{,}126 - 0{,}419 \cdot \alpha$
$1{,}85 < \alpha$	$1{,}2/\alpha^2$

$M_{c,Ed}$ bending moment,

$M_{c,Rd}$ design resistance for bending moment,

α slenderness ratio, not limited at 1,00.

$$\alpha = \sqrt{\frac{f_{y,b}}{\sigma_{cr}}} = \frac{s_K}{i_{ef} \cdot \pi} \cdot \sqrt{\frac{f_{y,b}}{E}}$$

with:

σ_{cr} buckling stress in the effective cross section,

s_K buckling length: $s_K = \beta \cdot s$,

β factor defined in figure 1,

s half arc length as showed in figure 1

i_{ef} radius of gyration of the effective cross section: $i_{ef} = \sqrt{I_{eff}/A_{eff}}$

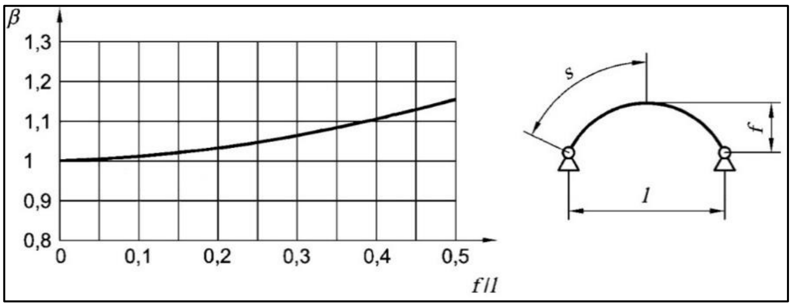

Figure 1.

The loading must be symmetrical along the span.

In case of horizontal displacements of the supports, they must be taken into account to determine $M_{c,Ed}$ and $N_{c,Ed}$, for instance by modelling the supports with horizontal springs.

6.5 Curved profiled sheeting without arch effect

For the design of the bending moment resistance of the curved profiled sheeting it can be considered a reduction factor of 10 % compared to the resistance of the same profile in flat configuration:

$$M_{c,Rd}(curved\ profile) = 0{,}9 \cdot M_{c,Rd}(flat\ profile)$$

Background information	RFCS research project GRISPE:
	DIN 18 807 Part 1 “Trapezoidal steel shheting – General requirements and determination of loadbearing capacity by calculation”, 1987 C. FAUTH (KIT) “Test report – Curved Profiles – Main Part", GRISPE D2.3, 2015 C. FAUTH (KIT) “Test report – Curved Profiles – Annex”, GRISPE D2.3, 2015 R. HOLZ (IFL) “WP2 TEST ANALYSIS AND INTERPRETATION", GRISPE D2.4, 2016 C. FAUTH (KIT) " WP2 Background guidance for EN 1993-1-3 curved profiles", GRISPE D2.6, 2016
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