NA to
CYS EN
1993-4-1:2007
(Including
A1:2017 and
AC:2009)

NATIONAL ANNEX TO CYS EN 1993-4-1:2007 (Including AC:2009 and A1:2017)

Eurocode 3: Design of steel structures

Part 4-1: Silos

NATIONAL ANNEX

TO

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CYS EN 1993-4-1:2007+AC:2009+A1:2017

Eurocode 3: Design of steel structures

Part 4-1: Silos

This National Annex has been approved by the Board of Directors of the Cyprus Organisation for Standardisation (CYS) on 14.06.2019.

INTRODUCTION

This National Annex has been prepared by the CYS TC 18 National Standardisation Technical Committee of the Cyprus Organisation for Standardisation. (CYS)

NA 1 SCOPE

This National Annex is to be used together with CYS EN 1993-4-1:2007+AC:2009+A1:2017. Any reference in the rest of this text to CYS EN 1993-4-1:2007 means the above document.

This National Annex gives:

(a) Nationally determined parameters for the following clauses of CYS EN 1993-4-1:2007 where National choice is allowed (see Section NA 2)

- 2.2 (1)
- 2.2 (3)
- 2.9.2.2 (3)
- 3.4 (1)
- 4.1.4 (2) and (4)
- 4.2.2.3 (6)
- 4.3.1 (6) and (8)
- 5.3.2.3 (3)
- 5.3.2.4 (10), (12) and (15)
- 5.3.2.5 (10) and (14)
- 5.3.2.6 (3) and (6)
- 5.3.2.8 (2)
- 5.3.3.5 (1) and (2)
- 5.3.4.3.2 (2)
- 5.3.4.3.3 (2) and (5)
- 5.3.4.3.4 (5)
- 5.3.4.5 (3)
- 5.4.4 (2), (3) and (4)
- 5.4.7 (3)
- 5.5.2 (3)
- 5.6.2 (1) and (2)
- 6.1.2 (4)
- 6.3.2.3 (2) and (4)
- 6.3.2.7 (4)
- 7.3.1 (4)
- 8.3.3 (4)
- 8.4.1 (6)
- 8.4.2 (5)
- 8.5.3 (3)
- 9.5.1 (3) and (4)
- 9.5.2 (5)
- 9.8.2 (1) and (2)
- A.2 (1) and (2)
- A.3.2.1 (6)
- A.3.2.2 (6)
- A.3.2.3 (2)

- A.3.3 (1), (2) and (3)
- A.3.4 (4)

(b) Decisions on the use of the Informative Annexes A, B and C (see Section NA 3)

(c) References to non-contradictory complementary information to assist the user to apply CYS EN 1993-4-1:2007. In this National Annex such information is provided for the following clauses in CYS EN 1993-4-1:2007 (see Section NA 4)

- None

NA 2 NATIONALLY DETERMINED PARAMETERS

NA 2.1 Clause 2.2 (1) Reliability differentiation

No consequence classes for silos are defined.

NA 2.2 Clause 2.2 (3) Reliability differentiation

No information on the consequence classes is provided.

NA 2.3 Clause 2.9.2.2 (3) Partial factors for resistances

Table 2.2 (CYS) provides the numerical values of partial factors γ_{Mi}.

Table 2.2 (CYS): Numerical values for the partial factors for resistance

$\gamma_{M0} = 1{,}00$	$\gamma_{M1} = 1{,}10$	$\gamma_{M2} = 1{,}25$
$\gamma_{M4} = 1{,}00$	$\gamma_{M5} = 1{,}25$	$\gamma_{M6} = 1{,}10$

NA 2.4 Clause 3.4 (1) Special alloy steels

No information is provided on appropriate values of relevant mechanical properties.

NA 2.5 Clause 4.1.4 (2) Allowance for corrosion and abrasion

The value Δt_a is specified as $\Delta t_a = 2$ mm.

NA 2.6 Clause 4.1.4 (4) Allowance for corrosion and abrasion

No appropriate values for corrosion and abrasion losses for particular solids in frictional contact with defined silo wall materials are provided.

NA 2.7 Clause 4.2.2.3 (6) Consequence Class 2

The value of n_{vs} is specified as $n_{vs} = 5$.

NA 2.8 Clause 4.3.1 (6) Modelling of the structural box

The value of n_S is specified as $n_S = 40$.

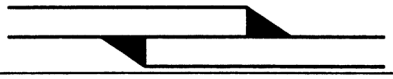
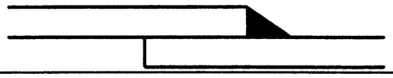
NA 2.9 Clause 4.3.1 (8) Modelling of the structural box

The value of n_{ew} is specified as $n_{ew} = 16$.

NA 2.10 Clause 5.3.2.3 (3) Plastic limit state

The value of j_i for different joint configurations is specified as follows:

Joint efficiency j_i of welded lap joints

Joint type	Sketch	Value of j_i
Double welded lap		$j_1 = 1,0$
Single welded lap		$j_2 = 0,35$

The single welded lap joint should not be used if more than 20 % of the value of $\sigma_{e,Ed}$ in expression 5.4 of EN 1993-4-1:2007 derives from bending moments.

NA 2.11 Clause 5.3.2.4 (10) Buckling under axial compression

The value of ψ_b is specified as ψ_b= 0,40.

NA 2.12 Clause 5.3.2.4 (12) Buckling under axial compression

The values of α_L k_1 and k_2 are specified as follows: α_L= 0,7α; k_1= 0,5 and k_2= 0,25, where α is given by α_o, α_{pe}, α_{pp} as appropriate.

NA 2.13 Clause 5.3.2.4 (15) Buckling under axial compression

The values of $\beta = 1 - 0,95 / [\ 1 + 1,2\ (w_{ok} / t\ )\ ]$, $\eta = 5,4 / [\ 1 + 4,6\ (w_{ok} / t\ )\ ]$ and χ_h = 1,0 are recommended.

NA 2.14 Clause 5.3.2.5 (10) Buckling under external pressure, internal partial vacuum and wind

The value of α_n is specified as α_n= 0,5.

NA 2.15 Clause 5.3.2.5 (14) Buckling under external pressure, internal partial vacuum and wind

The value of k_1 is specified as k_1= 0,1.

NA 2.16 Clause 5.3.2.6 (3) Membrane shear

The value of k_s is specified as k_s= 0,10.

NA 2.17 Clause 5.3.2.6 (6) Membrane shear

The value of α_τ is specified as α_τ= 0,80.

NA 2.18 Clause 5.3.2.8 (2) Fatigue, LS4

The value of N_f is specified as N_f= 10 000.

NA 2.19 Clause 5.3.3.3 Buckling under axial compression

The recommended value for k_s is specified as k_s= 0,50.

NA 2.20 Clause 5.3.3.5 (1) Membrane shear

The value of k_s is specified as k_s= 0,10.

NA 2.21 Clause 5.3.3.5 (2) Membrane shear

The value of k_t is specified as k_t= 4,0.

NA 2.22 Clause 5.3.4.3.2 (2) Unstiffened wall

The value of α_x is specified as α_x= 0,80.

NA 2.23 Clause 5.3.4.3.3 (2) Stiffened wall treated as an orthotropic shell

The value of k_{dx} is specified as k_{dx}= 9,1.

NA 2.24 Clause 5.3.4.3.3 (5) Stiffened wall treated as an orthotropic shell

The value of α_x is specified as α_x= 0,80.

NA 2.25 Clause 5.3.4.3.4 (5) Stiffened wall treated as carrying axial compression only in the stiffeners

The value of k_s is specified as k_s= 6.

NA 2.26 Clause 5.3.4.5 (3) Buckling under external pressure, partial vacuum or wind

The value of $k_{d\theta}$ is specified as $k_{d\theta}$= 7,4.

NA 2.27 Clause 5.4.4 (2) Discretely supported cylindrical shell

The values of $(r/t)_{max}$, k_1, k_2 and k_3 are specified as follows: $(r/t)_{max}$= 400, k_1= 2,0, k_2= 1,0 and k_3= 1,0.

NA 2.28 Clause 5.4.4 (3) Discretely supported cylindrical shell

The value of k_s is specified as k_s= 0,10.

NA 2.29 Clause 5.4.4 (4) Discretely supported cylindrical shell

The value of k_L is specified as k_L= 4,0.

NA 2.30 Clause 5.4.7 (3) Anchorage at the base of a silo

The values for the harmonic coefficients of wind pressure C_m relevant to specific conditions for Class 1 and 2 silos are specified as follows: M= 4; C_1= + 0,25; C_2= + 1,0; C_3= + 0,45 and C_4= - 0,15. For Class 3 silos, the more precise distribution with M= 4 for isolated silos and M= 10 for grouped silos given in Annex C of EN 1993-4-1:2007 are adopted.

NA 2.31 Clause 5.5.2 (3) Rectangular openings

The value of k_{d1} is specified as k_{d1}= 0,02.

NA 2.32 Clause 5.6.2 (1) Deflections

The value of k_{d2} is specified as k_{d2}= 0,02.

NA 2.33 Clause 5.6.2 (2) Deflections

The values of k_{d3} and k_{d4} are specified as follows: k_{d3}= 0,05 and k_{d4}= 20.

NA 2.34 Clause 6.1.2 (4) Hopper wall design

The value of γ_{M0g} is specified as γ_{M0g}= 1,4.

NA 2.35 Clause 6.3.2.3 (2) Rupture at the transition junction

The value of g_{asym} is specified as g_{asym}= 1,2.

NA 2.36 Clause 6.3.2.3 (4) Rupture at the transition junction

The value of k_r is specified as k_r= 0,90.

NA 2.37 Clause 6.3.2.7 (3) Buckling in hoppers

The value of a_{xh} is specified as a_{xh}= 0,30.

NA 2.38 Clause 7.3.1 (4) Shell or unsupported roofs

The value of a_p is specified as a_p= 0,20.

NA 2.39 Clause 8.3.3 (4) Resistance to in-plane buckling

The value of β_{lim} is specified as β_{lim}= 20°.

NA 2.40 Clause 8.4.1 (6) Uniformly supported transition junctions

The values of β_{lim}, k_L and k_R are specified as follows: β_{lim}= 10°; k_L= 10 and k_R= 0,04.

NA 2.41 Clause 8.4.2 (5) Transition junction ring girder

The values of β_{lim}, k_L and k_R are specified as follows: β_{lim}= 10°; k_L= 10 and k_R= 0,04.

NA 2.42 Clause 8.5.3 (3) Base ring

The value of k is specified as k= 0,10.

NA 2.43 Clause 9.5.1 (3) Forces in internal ties due to solids pressure on them

The values of C_{sc} and C_{ss} are specified as follows: C_{sc}= 1,0 and C_{ss}= 1,2.

NA 2.44 Clause 9.5.1 (4) Forces in internal ties due to solids pressure on them

The values of k_{Lf} and k_{Le} are specified as follows: k_{Lf}= 4,0 and k_{Le}= 2,0.

NA 2.45 Clause 9.5.2 (5) Modelling of ties

The value of k_s is specified as k_s= 0,01.

NA 2.46 Clause 9.8.2 (1) Deflections

The values of k_1 and k_2 are specified as follows: k_1= 0,02 and k_2= 10.

NA 2.47 Clause 9.8.2 (2) Deflections

The value of k_3 is specified as k_3= 0,05.

NA 2.48 Clause A.2 (1) Action effect assessment

The value of k_M is specified as k_M= 1,1.

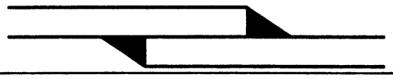
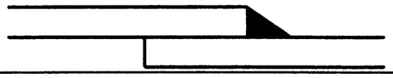
NA 2.49 Clause A.2 (2) Action effect assessment

The value of k_h is specified as k_h= 1,2.

NA 2.50 Clause A.3.2.1 (6) Plastic limit state

The value of j_i for different joint configurations is specified as follows:

Joint efficiency j_i of welded lap joints

Joint type	Sketch	Value of j_i
Double welded lap		$j_1 = 1,0$
Single welded lap		$j_2 = 0,35$

NA 2.51 Clause A.3.2.2 (6) Axial compression

The value of γ_{M1} is specified as γ_{M1}= 1,1.

NA 2.52 Clause A.3.2.3 (2) External pressure, internal partial vacuum and wind

The values of a_n and γ_{M1} are specified as follows: a_n= 0,5 and γ_{M1}= 1,1.

NA 2.53 Clause A.3.3 (1) Conical welded hoppers

The value of γ_{M0g} is specified as γ_{M0g}= 1,4.

NA 2.54 Clause A.3.3 (2) Conical welded hoppers

The value of g_{asym} is specified as g_{asym}= 1,2.

NA 2.55 Clause A.3.3 (3) Conical welded hoppers

The value of k_r is specified as k_r= 0,90.

The value of γ_{M2} is specified as γ_{M2}= 1,25.

NA 2.56 Clause A.3.4 (4) Transition junction

The value of γ_{M0} is specified as γ_{M0}= 1,0.

NA 3 DECISION ON USE OF THE INFORMATIVE ANNEXES

NA 3.1 Annex A

Annex B may be used

NA 3.2 Annex B

Annex C may be used

NA 3.3 Annex C

Annex E may be used

NA 4 REFERENCES TO NON-CONTRADICTORY COMPLEMENTARY INFORMATION

None

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NA to CYS EN 1993-4-1:2007 (Including A1:2017 and AC:2009)

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