

PROPOSAL 8-43 (2008)

SCOPE: Table 15.4-2, Section 15.6.2 and Commentary to Chapter 15

PROPOSAL FOR CHANGE:

Revise Table 15.4-2 and Section 15.6.2 to Part 1 of the 2008 Provisions:

Cast-in-place concrete silos, stacks, and chimneys having walls continuous to the foundation	15.6.2	3	1.75	3	NL	NL	NL	NL	NL
All other reinforced masonry structures not similar to buildings	14.4.1	3	2	2.5	NL	NL	NL	50	50
All other nonreinforced masonry structures not similar to buildings	14.4.1	1.25	2	1.5	NL	NL	50	50	50
Concrete chimneys and stacks	<u>15.6.2 and ACI 307</u>	<u>2</u>	<u>1.5</u>	<u>1.5</u>	<u>NL</u>	<u>NL</u>	<u>NL</u>	<u>NL</u>	<u>NL</u>
All other steel and reinforced concrete distributed mass cantilever structures not covered herein including stacks, chimneys, silos, and skirt-supported vertical vessels that are not similar to buildings	15.6.2 15.7.10 and 15.7.10.5 a and b.	3	2	2.5	NL	NL	NL	NL	NL

15.6.2 Stacks and Chimneys. Stacks and chimneys are permitted to be either lined or unlined, and shall be constructed from concrete, steel, or masonry. Steel stacks, concrete stacks, steel chimneys, concrete chimneys, and liners shall be designed to resist seismic lateral forces determined from a substantiated analysis using reference documents. Interaction of the stack or chimney with the liners shall be considered. A minimum separation shall be provided between the liner and chimney equal to Cd times the calculated differential lateral drift.

For concrete chimneys in SDC D, E, and F, splices for vertical rebar shall be staggered such that no more than 50% of the bars are spliced at any elevation. Design and detailing of cross-sections in the regions of breachings/openings, where the loss of cross-sectional area is greater than 10%, shall be performed one of the following ways:

- a. For vertical force, shear force, and bending moment demands along the vertical direction, design the affected cross-section using the overstrength factor of 1.5. The region of such overstrength shall extend above and below (except if the opening is at the base) the opening(s) by a distance equal to half of the width of the largest opening in the affected region. Appropriate development length shall be provided beyond the required region of overstrength. The jamb regions around each opening shall be detailed using column tie requirements in Section 7.10 of ACI 318. Such detailing shall extend for a jamb width of a minimum of two times the wall thickness and for a height of the opening height plus twice the wall thickness above and below the opening. The percentage of longitudinal reinforcement in jamb regions shall meet the applicable ACI 318 requirements for columns.
- b. Provided that the cross-sectional moment of inertia in the opening region is at least 70% of the same above and below it, the reduced cross-section may be designed using $R=2$ subject to the following requirements:
 - i. All detailing requirements listed in Item a. above for the overstrength option shall be followed, in addition to the ones listed below.

- 1 ii. Hoop ties in jamb regions shall be detailed as columns of intermediate moment frame
- 2 using the requirements in Chapter 21 of ACI 318. The dimensions for jamb region shall
- 3 be the same as that when the overstrength option is used.
- 4 iii. No construction joints within the opening region plus two times the wall thickness above
- 5 and below the opening.
- 6 iv. Ratio of outer diameter to wall thickness shall not exceed 20 within the opening region.

7
8 **Add to Chapter 23**

9
10 **ACI 307**

11 **Section 15.6.2**

12 **Code Requirements for Reinforced Concrete Chimneys, 2007**

13 **REASON FOR PROPOSAL:**

14 ACI 307-07 (likely to be issued late 2007 or early 2008) prescribes an R value of 2, as opposed
15 to the value of 3 in ASCE 7. Concrete chimneys have low ductility, and their seismic behavior is
16 especially critical in the opening regions due to inherent reduction in strength and loss of
17 confinement for vertical reinforcement in the jamb regions around the openings. Spectacular
18 earthquake-induced chimney failures have occurred in recent history (in Turkey in 1999) and
19 have been attributed to strength/detailing problems (Sozen, et al 2003).

20
21 This proposal will have to be coordinated with the previously passed proposal 8-41.

22 **TS 8 VOTE:**

23 *YES-9 Yes with Reservations-0 No-0 Not Voting-4*