

**IS 1893 (Part 4) : 2015**

be less than 0.20 percent of the concrete area. When two layers of reinforcement are required, the circumferential reinforcement in each face shall not be less than 0.1 percent of the concrete area at the section.

**18.3** The circumferential reinforcement for a distance of 0.2 times diameter of the chimney (from top of the chimney) shall be twice the normal reinforcement.

**18.4** Extra reinforcement shall have to be provided in addition to the reinforcement determined by design at the sides, top, bottom and corners of the openings. The extra reinforcement shall be placed on both faces of the chimney shell as close to the opening as proper spacing of bars shall permit. Unless otherwise specified, all extra reinforcement shall extend past the opening a sufficient distance to develop the full bond strength.

**18.5** At each side of the opening, the additional vertical reinforcement shall have an area at least equal to the established design reinforcement for one-half of the width of the opening.

**18.6** At both the top and bottom of each opening,

additional reinforcement shall be placed having an area at least equal to one-half the established design circumferential reinforcement interrupted by the opening.

One half of this extra reinforcement shall extend completely around the circumference of the chimney, and the other half shall extend beyond the opening to a sufficient distance to develop the bars in bond. The steel shall be placed as close to the opening as practicable, but within a height not to exceed twice the thickness.

**18.7 Deflection Criterion**

The maximum lateral deflection of the top of a stack-like structure under all service conditions, prior to the application of load factors, shall not exceed the limits set forth by the following equation:

$$D_{max} = 0.005 h$$

where

- $D_{max}$  = maximum lateral deflection, and
- $h$  = height of structure above the base.

**ANNEX A**  
(Clause 7.3.2)

**Table 14 Zone Factor Z**

Seismic Zone <sup>1)</sup> Z	II	III	IV	V
	0.10	0.16	0.24	0.36

<sup>1)</sup> These zone factors are for 5 percent damping. For other damping ratios, use multiplying factors as given in Table 15.

**Table 15 Multiplying Factors for Obtaining Values of Zone Factor Z for Other Damping Ratios**

Damping Percent	0	0.5	1.0	2	5	7	10	15	20	25	30
Factors	3.2	1.9	1.6	1.4	1.0	0.9	0.8	0.7	0.6	0.55	0.5