

Horizontal design force on a nonstructural component, applied at its center of mass (ASCE 7-22 Chapter 13)

$$F_p = 0.4 S_{DS} I_p W_p \left(\frac{H_f}{R_\mu} \right) \left(\frac{C_{AR}}{R_{po}} \right) \quad \text{Eq. 13.3-1}$$

$$0.3 S_{DS} I_p W_p \leq F_p \leq 1.6 S_{DS} I_p W_p \quad \text{Eqs. 13.3-2, 13.3-3}$$

Height amplification factor

$$H_f = 1 + a_1 \left(\frac{z}{h} \right) + a_2 \left(\frac{z}{h} \right)^{10}, \quad a_1 = \frac{1}{T_a} \leq 2.5, \quad a_2 = 1 - \left(\frac{0.4}{T_a} \right)^2 \geq 0 \quad \text{Eq. 13.3-4}$$

$$H_f = 1 + 2.5 \left(\frac{z}{h} \right) \quad \text{when } T_a \text{ is not known} \quad \text{Eq. 13.3-5}$$

Structure ductility reduction factor

$$R_\mu = \sqrt{\frac{1.1 R}{I_e \Omega_0}} \geq 1.3 \quad R_\mu = 1.3 \text{ when } R, I_e \text{ or } \Omega_0 \text{ is not known} \quad \text{Eq. 13.3-6}$$

Concurrent vertical force

$$F_v = \pm 0.2 S_{DS} W_p$$

Components at or below grade: $H_f = 1.0$ and $R_\mu = 1.0$. z/h is not taken greater than 1.0.

Vibration-isolated components: design force taken as $2F_p$ when the nominal air gap exceeds 0.25 in (6 mm).

F_p	horizontal seismic design force at the component center of mass
S_{DS}	design spectral response acceleration, short period (g)
I_p	component importance factor, 1.0 or 1.5
W_p	component operating weight
z	height of the component attachment above the base ($z/h \leq 1.0$)
h	average roof height of the structure above the base
H_f	height amplification factor for the floor acceleration
R_μ	structure ductility reduction factor
R, I_e, Ω_0	response modification, importance and overstrength factors of the structure
C_{AR}	component resonance ductility factor (Table 13.5-1 / 13.6-1)
R_{po}	component strength factor (Table 13.5-1 / 13.6-1)
T_a	approximate fundamental period of the supporting structure (s)

Approximate period (Eq. 12.8-8) $T_a = C_t h_n^x$ $h_n =$ structural height

Structure type (Table 12.8-2)	C_t (hn in ft)	C_t (hn in m)	x
Steel moment-resisting frames	0.028	0.0724	0.8
Concrete moment-resisting frames	0.016	0.0466	0.9
Steel eccentrically braced and buckling-restrained braced frames	0.03	0.0731	0.75
All other structural systems	0.02	0.0488	0.75

Moment-frame rows apply when the frames resist 100% of the seismic force and are not enclosed or adjoined by stiffer components.