Chapter 18
SEISMIC DESIGN REQUIREMENTS FOR STRUCTURES WITH DAMPING SYSTEMS

18.1 GENERAL

18.1.1 Scope

Every structure with a damping system and every portion thereof shall be designed and constructed in accordance with the requirements of this standard as modified by this section. Where damping devices are used across the isolation interface of a seismically isolated structure, displacements, velocities, and accelerations shall be determined in accordance with Chapter 17.

18.1.2 Definitions

The following definitions apply to the provisions of Chapter 18:

DAMPING DEVICE: A flexible structural element of the damping system that dissipates energy due to relative motion of each end of the device. Damping devices include all pins, bolts, gusset plates, brace extensions, and other components required to connect damping devices to the other elements of the structure. Damping devices may be classified as either displacement-dependent or velocity-dependent, or a combination thereof, and may be configured to act in either a linear or nonlinear manner.

DAMPING SYSTEM: The collection of structural elements that includes all the individual damping devices, all structural elements or bracing required to transfer forces from damping devices to the base of the structure, and the structural elements required to transfer forces from damping devices to the seismic force-resisting system.

DISPLACEMENT-DEPENDENT DAMPING DEVICE: The force response of a displacement-dependent damping device is primarily a function of the relative displacement between each end of the device. The response is substantially independent of the relative velocity between each of the devices and/or the excitation frequency.

VELOCITY-DEPENDENT DAMPING DEVICE: The force-displacement relation for a velocity-dependent damping device is primarily a function of the relative velocity between each end of the device and could also be a function of the relative displacement between each end of the device.

18.1.3 Notation

The following notations apply to the provisions of this chapter:

B_{1D} = numerical coefficient as set forth in Table 18.6-1 for effective damping equal to β_{ml} ($m = 1$) and period of structure equal to T_{1D}

B_{1E} = numerical coefficient as set forth in Table 18.6-1 for the effective damping equal to $\beta_I + \beta_{V1}$ and period equal to T_1

B_{1M} = numerical coefficient as set forth in Table 18.6-1 for effective damping equal to β_{mM} ($m = 1$) and period of structure equal to T_{1M}

B_{mD} = numerical coefficient as set forth in Table 18.6-1 for effective damping equal to β_{ml} and period of structure equal to T_m

B_{mM} = numerical coefficient as set forth in Table 18.6-1 for effective damping equal to β_{mM} and period of structure equal to T_m

B_R = numerical coefficient as set forth in Table 18.6-1 for effective damping equal to β_R and period of structure equal to T_R

B_{V+I} = numerical coefficient as set forth in Table 18.6-1 for effective damping equal to the sum of viscous damping in the fundamental mode of vibration of the structure in the direction of interest, β_{Vm} ($m = 1$), plus inherent damping, β_I, and period of structure equal to T_I

C_{mFD} = force coefficient as set forth in Table 18.7-1

C_{mFV} = force coefficient as set forth in Table 18.7-2

C_{S1} = seismic response coefficient of the fundamental mode of vibration of the structure in the direction of interest, Section 18.4.2.4 or 18.5.2.4 ($m = 1$)

C_{Sm} = seismic response coefficient of the m^{th} mode of vibration of the structure in the direction of interest, Section 18.4.2.4 ($m = 1$) or Section 18.4.2.6 ($m > 1$)

C_{SR} = seismic response coefficient of the residual mode of vibration of the structure in the direction of interest, Section 18.5.2.8

D_{1D} = fundamental mode design displacement at the center rigidity of the roof level of the structure in the direction under consideration, Section 18.5.3.2