18.9.1.1 Data Recording

The force-deflection relationship for each cycle of each test shall be recorded.

18.9.1.2 Sequence and Cycles of Testing

For the following test sequences, each damping device shall be subjected to gravity load effects and thermal environments representative of the installed condition. For seismic testing, the displacement in the devices calculated for the maximum considered earthquake ground motions, termed herein as the maximum device displacement, shall be used.

1. Each damping device shall be subjected to the number of cycles expected in the design windstorm, but not less than 2,000 continuous fully reversed cycles of wind load. Wind load shall be at amplitudes expected in the design windstorm and shall be applied at a frequency equal to the inverse of the fundamental period of the structure ($f_1 = 1/T_1$).

EXCEPTION: Damping devices need not be subjected to these tests if they are not subject to wind-induced forces or displacements or if the design wind force is less than the device yield or slip force.

2. Each damping device shall be loaded with five fully reversed, sinusoidal cycles at the maximum earthquake device displacement at a frequency equal to $1/T_{1M}$ as calculated in Section 18.4.2.5. Where the damping device characteristics vary with operating temperature, these tests shall be conducted at a minimum of three temperatures (minimum, ambient, and maximum) that bracket the range of operating temperatures.

EXCEPTION: Damping devices are permitted to be tested by alternative methods provided all of the following conditions are met:

   a. Alternative methods of testing are equivalent to the cyclic testing requirements of this section.
   b. Alternative methods capture the dependence of the damping device response on ambient temperature, frequency of loading, and temperature rise during testing.
   c. Alternative methods are accepted by the registered design professional responsible for the design of the structure.

3. If the force-deformation properties of the damping device at any displacement less than or equal to the maximum device displacement change by more than 15 percent for changes in testing frequency from $1/T_{1M}$ to $2.5/T_1$, then the preceding tests shall also be performed at frequencies equal to $1/T_1$ and $2.5/T_1$.

   If reduced-scale prototypes are used to qualify the rate-dependent properties of damping devices, the reduced-scale prototypes should be of the same type and materials, and manufactured with the same processes and quality control procedures, as full-scale prototypes, and tested at a similitude-scaled frequency that represents the full-scale loading rates.

18.9.1.3 Testing Similar Devices

Damping devices need not be prototype tested provided that both of the following conditions are met:

1. All pertinent testing and other damping device data are made available to and are accepted by the registered design professional responsible for the design of the structure.
2. The registered design professional substantiates the similarity of the damping device to previously tested devices.

18.9.1.4 Determination of Force-Velocity-Displacement Characteristics

The force-velocity-displacement characteristics of a damping device shall be based on the cyclic load and displacement tests of prototype devices specified in the preceding text. Effective stiffness of a damping device shall be calculated for each cycle of deformation using Eq. 17.8-1.

18.9.1.5 Device Adequacy

The performance of a prototype damping device shall be deemed adequate if all of the conditions listed below are satisfied. The 15 percent limits specified in the following text are permitted to be increased by the registered design professional responsible for the design of the structure provided that the increased limit has been demonstrated by analysis not to have a deleterious effect on the response of the structure.

18.9.1.5.1 Displacement-Dependent Damping Devices

The performance of the prototype displacement-dependent damping devices shall be deemed adequate if the following conditions, based on tests specified in Section 18.9.1.2, are satisfied:

1. For Test 1, no signs of damage including leakage, yielding, or breakage.
2. For Tests 2 and 3, the maximum force and minimum force at zero displacement for a damping device for any one cycle does not differ by more