

## 8. **Passive Variable Orifice Damper to Control Excessive Displacement of Seismically Isolated Building** **- Manufacturing Variations in 500kN Class Dampers -**

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Variable Orifice Dampers (VODs) are designed to suppress excessive horizontal displacement during long-period ground motions while otherwise maintaining seismic performance comparable to conventional seismically isolated buildings during moderate to large earthquakes. VODs passively boost the damping coefficient when displacement exceeds a predefined threshold, moderating displacement and maintaining increased damping properties during an earthquake. They also feature regressive characteristics that restore the original damping coefficient following the earthquake.

We confirmed the damping performance of four VODs with a maximum force of 500 kN via dynamic loading tests and evaluated manufacturing variations. We also investigated the regression characteristics of the damping coefficients returning to the original performance after the pre-defined threshold displacement is exceeded, confirming that reproducibility remained within a practical range with no significant problems. We verified that the delay in switching of damping force was less than 0.05 seconds and had minimal impact.

Based on the results of analyses of seismically isolated buildings incorporating the VODs, we concluded that the VODs provide the targeted seismic performance.

**Keywords:** isolated building, passive variable orifice damper, displacement control design, long-period ground motions