

# **SEISMIC QUALIFICATION OF HVDC THYRISTOR VALVES USING FEA MODELLING**

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## **ABSTRACT**

This paper presents an approach of seismic qualification studies of HVDC H400 thyristor valve using Fine Element Analysis (FEA) and shake table testing to evaluate seismic performances in accordance to the Standard of IEEE 693-2005.

The roof-suspended HVDC thyristor valve has been developed by ALSTOM Grid in partnership with China Electric Power Research Institute for the LingBao II Back-to-back HVDC project. The whole valve assembly must be seismically assessed and qualified according to industry standard specified by developers in demonstrating the safe functioning or structural safety when and after subjected to specified earthquake excitations.

Combined FEA modelling and shake table testing techniques have been adopted in the seismic qualification studies, in which the FEA modelling is attempted to stimulate the overall mechanical behaviours including each individual valve modules in terms of structural stresses and displacements by dynamic analysis using ANSYS's response spectrum method. Alongside the FEA modelling, shake table testing of a single H400 module is carried out, which includes the exploratory testing to determine the valve module's structural characteristics including frequencies and modes. The test results are used to verify and refine the FEA model of the H400 module which are then extended to create full model of the roof-suspended valve assembly including inter-tier suspension insulators. Using the FEA model of the full valve assembly with input of the required response spectrum specified according to the IEE Standard 693-2005, the overall structure's response to the specified seismic loads are calculated and assessed in accordance with the standard. Further, the results corresponding to each tier module are extracted in terms of the acceleration response spectrum, and the worst of which are used as excitation input for the shake table test to determine the seismic performance of the valve modules.

The joint approach of the FEA modelling and the shake table testing proved successful to validate and verify the structural design of the HVDC thyristor valve in accordance to the IEE Standard.