

HUBBELL POWER SYSTEMS SEISMIC CAPABILITIES

Hubbell Power Systems is committed to providing enduring products — even in the most demanding environments. We provide multiple product lines suitable for high seismic conditions.

SEISMIC QUALIFICATION LEVELS		
IEEE 693 Seismic Qualification levels	Ground Acceleration gs	Response Acceleration gs
Low	0.1	0.2
Moderate	0.25	0.8
High	0.5	1.6
Performance	1	3.2

AVR 245KV SWITCH

The USCO® AVR 230kV 3000Amp Vertical Break Switch meets the IEEE 693 standards for performance seismic qualifications. After the three open-close configurations required for successful shake table testing, the switch continued to operate flawlessly. Its robust construction, coupled with simple design concepts, provide ease of operation in even the most stressful environments. The AVR group operated air break switch carries a 10 year warranty - the longest in the industry - and is an appropriate, cost-effective choice for substations that reside in a seismic-prone region.



PCORE® AND ELECTRO COMPOSITES™ BUSHINGS

PCORE and Electro Composites adhere to rigorous testing standards and strive to provide the most comprehensive selection of 15kV through 500kV bushings available to address the electric industry's seismic needs. PCORE offers a wide range of products, including 15kV-69kV oil-filled & oil-free PRC® bushings, 25kV-500kV POC® bushings and cost-saving products such as SET-Terminals, Bushing Repair and the patented Quick-Link bushing. Electro Composites offers oil-less SDC® solid dielectric composite bushings rated 15kV through 138kV, for almost all bushing applications such as transformers, circuit breakers, wall/floor and DC applications, including high current Generator Step Up transformer and turbo generator bushings rated up to 21,500A. In addition to bushings, Electro Composites offers custom molded epoxy products and station post insulators for applications up to 34.5kV.



PRC & POC

PCORE conducted the highest performance level time-history shake table tests on both 345kV and 500kV POC Series II bushings. The bushings successfully passed the shake table tests per the requirements in IEEE 693-2018 standard, with the top of the bushings experiencing an acceleration of more than 6g while the bushings were shaken to more than 2g, the highest in the industry. The bushings passed the design tests per IEEE bushing standards C57.19.00 and C57.19.01 after the shake table tests. Based on the success of the shake table tests, PCORE 115kV to 500kV POC Series II bushings are qualified to the highest performance level per IEEE 693-2018 by group qualification. PCORE 15kV to 138kV bushings are qualified by the static pull tests to the high seismic level per IEEE 693-2018.



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SDC®

Electro Composite bushings are qualified to the IEEE 693-2018 per the cantilever bending requirement as qualified by the static pull test since all bushings are rated lower than 161kV. The standard requires the bushing to be able to sustain a bending load equal to twice the weight of the bushing. Thanks to their lighter weight and one-piece condenser body construction, SDC® bushings offer superior performance in seismic conditions. Typically, the basic cantilever bending requirement specified by the IEEE bushing standard exceeds the IEEE 693-2018 requirement.

Qualification Tests for Bushings:

A) TIME HISTORY SHAKE TABLE TEST:

In 2012, PCORE conducted the highest performance level time-history shake table test on its 500kV bushing. During the test, the bushing was shaken at an acceleration of 2.5g (25% higher than the required value) and the top of the bushing experienced an acceleration of more than 8g making PCORE the first porcelain bushing manufacturer in the world to offer a complete bushing line of seismically approved products. The bushing passed the test, which was witnessed and certified by a California-licensed professional engineer. The measured values also meet or exceed the requirement in IEEE 693-2018.

B) STATIC PULL TEST:

PCORE and Electro Composites bushings rated 15kV to 138kV have been tested by a static pull test. For qualification to the IEEE 693-2018 standard, the bushing must at a minimum be capable of sustaining a load equal to twice its weight. In most cases, the specified cantilever bending load required by the IEEE C57.19.01 bushing standard exceeds the seismic standard requirement. In the case when the weight of the bushing results in a higher requirement than the bushing standard, it will be tested to the higher of the two loads. This test is also much more stringent than the requirement for inherently acceptable calculation for 15kV and 25kV bushings.

SURGE ARRESTERS

Hubbell Power Systems qualifies the seismic capability of its surge arresters to Annex K of IEEE 693. All VL and PVI-LP arresters under 35 kV rated voltage are seismically qualified by inherently acceptable criteria. All other Hubbell Power Systems arresters (SVN, SVNH, SVNR, SVNX and MVN) are qualified by shake table testing. To be qualified, a surge arrester must survive the shake table test with no structural damage and remain functional, as demonstrated by successfully passing routine production tests after shake table testing. Routine tests consist of measurement of reference voltage, partial discharge and watts loss, and performance of seal-leak tests. IEEE 693 allows seismic qualification based on the concept of “qualifying equipment by group”. This concept permits products of different voltage ratings, but similar physical structure, to be combined into groups for qualification purposes, with the most seismically vulnerable piece of equipment of each group being analyzed or tested.



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