SEISMIC CERTIFICATE OF COMPLIANCE

THE VMC GROUP
The Power of Together

SENS®
STORED ENERGY SYSTEMS

Stored Energy Systems, LLC (SENS) has seismically certified its battery charger and best battery selector products[1] in accordance with the following International Building Codes:

IBC – 2000, IBC – 2003, IBC – 2006, IBC - 2009[2]

The following model designations are included in this certification. For a complete list of certified models, options, and installation methods, see report number VMA-44372-105, as issued by The VMC Group.

LC12, LC24, FC12, FC24, FCA12, FCA24, FCA32, NRG12, NRG22, NRG24
BBS-1600, BBS-4800, Q012, Q024, Q048, Q120, Q240

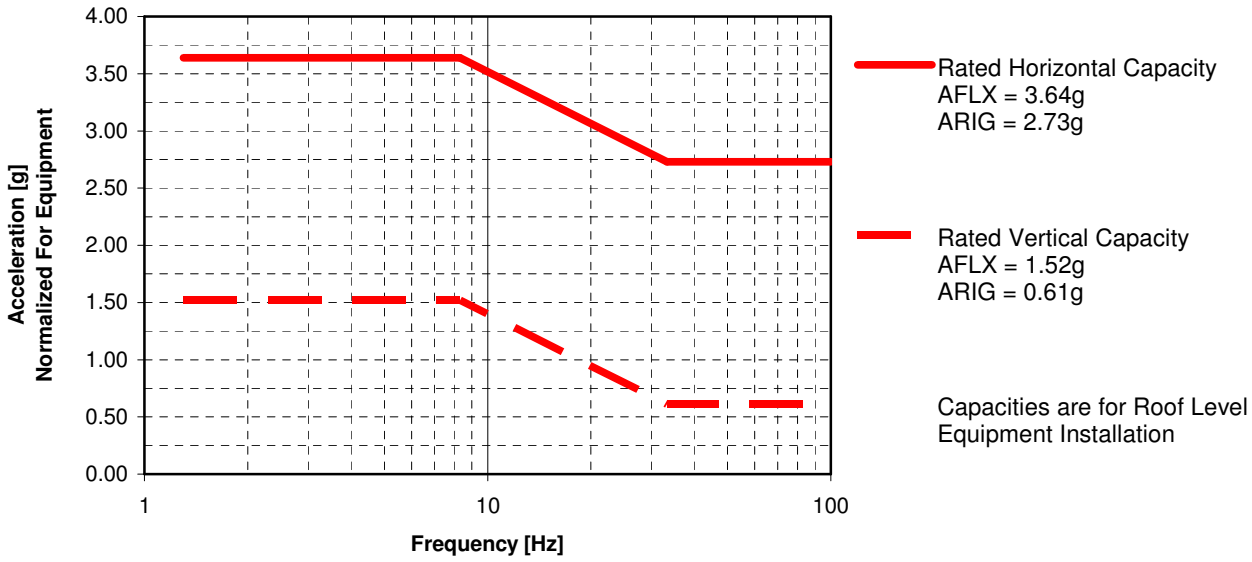
Seismic analysis and shake testing was conducted in accordance with strict adherence to ASCE 7 and ICC-ES AC-156. The basis of this seismic certification is through successful tri-axial shake testing in three orthogonal directions at nationally recognized Clark Dynamic / ANDI Test Laboratory under the witness of and analytical evaluation by the independent approval agency, The VMC Group.[3]

The above referenced equipment is APPROVED for seismic applications when properly installed[4], used as intended, and located in the United States where the Maximum Considered Earthquake Short Period Spectral Response Acceleration, S_s, is less than 342% as determined by the ASCE 7 seismic maps.[5] Below grade, grade, and roof-level installations are permitted and included in this approval. Installation in essential facilities and for life safety applications, both requiring post event functionality, are also included in this approval.

Seismic shake table testing was conducted to a ZPA of 2.73g and a maximum flexible region acceleration of 3.64g. This level corresponds to an S_{ds} value of 2.28g (3.42g S_s for Soil Class D).[5]

For calculations and analysis, the seismic design acceleration was calculated as 1.15g for Allowable Stress Design (ASD) to determine the anchor loads for each group of equipment listed above. The worst-case factors for the building codes listed above are ap=1.0, Rp=2.5, Ip=1.5, Ss=3.42, and z/h=1.0.

Figure 1A Required Response Spectrum of the Tested Equipment



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CERTIFICATE OF COMPLIANCE NOTES

1. All equipment listed herein successfully passed the seismic acceptance criteria for non-structural components and systems as set forth in the ICC AC-156 (2007). The units tested were representative samples of a contingent of models and all remained captive and structurally sound after the seismic shake simulation. The units also remained functionally operational after the simulation testing as functional testing was completed by SENS personnel before and after the seismic simulations.

2. The following building codes are addressed under this certification:

    a) IBC 2000 – referencing ASCE 7-98 and ICC AC-156
    b) IBC 2003 – referencing ASCE 7-02 and ICC AC-156
    c) IBC 2006 – referencing ASCE 7-05 and ICC AC-156
    d) IBC 2009 – referencing ASCE 7-05 and ICC AC-156

3. Seismic qualification testing was conducted in three orthogonal directions on a tri-axis shake table. The test criteria and procedure was defined directly from the International Code Council (ICC) document which outlines seismic testing qualification and acceptance criteria. The test response spectrum (TRS) enveloped the design response spectrum (DRS) containing the zero-period acceleration (ZPA) of 2.73g with a maximum acceleration of 3.64g. The DRS is shown in Figure 1A and corresponds to roof-level installation of equipment. Below grade, grade, and roof-level installations are permitted and included in this certification.

4. Refer to the SENS LC – DIA\00583; FC(A) – DIA\00584; NRG10 – DIA\00585; NRG20 – DIA\00586; Q1 – DIA\00587; Q2 – DIA\00588; BBS-1600 – DIA\00589; BBS-4800 – DIA\00590 drawing for anchor requirements and mounting considerations for seismic applications. Required anchor locations, size, style, and load capacities (tension and shear) are specified on these installation drawings. Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection, wall design, and attachment to non-building structures must be outlined and approved by the Engineer of Record for the project or building. Structural walls, structural floors, and housekeeping pads must also be seismically designed and approved by the project or building Structural Engineer of Record to withstand the seismic anchor loads as defined on the installation drawings. The installing contractor is responsible for the proper installation of all anchors and mounting hardware, observing the mounting requirements detailed in the seismic installation drawings and additionally outlined by the Engineer of Record. Contact your SENS Representative if an application specific Seismic Installation Calculation Package is required.

5. This certification is based on a maximum S_{ds} value of 2.28g. This is obtained from the Maximum Considered Earthquake Short Period Spectral Response Acceleration, S_s, of 300% g for Soil Site Class B with 5% damping. When the site soil properties or final equipment installation location are not known, the soil site coefficient, F_a, defaults to the Soil Site Class D coefficient. Soil Classes A, B, C, D, E, Seismic Use groups I, II, III, IV, and Seismic Design Categories A, B, C, D, E, and F are all covered under this certification, limited by the S_{ds} value stated above. A seismic importance factor, I_p, of 1.5 applies to this certification to include essential facility requirements and life safety applications for post event functionality. Snow load has been neglected due to installations limited to indoor/sheltered applications only.

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