

The ultimate solution for maintaining your nationwide generator network

Guide to Generator Set Installation in Areas of Seismic Activity

1.0 Introduction

Several areas of the U.S. are designated as higher areas of seismic activity (see diagram two). System designers have to consider the installation codes applicable to designated areas of seismic activity.

A system designer must consider the behavior of non-structural elements during seismic activity/earth quakes. For reference go to: http://mitigation.eeri.org/files/FEMA74_FieldManual.pdf

2.0 Non-structural Elements

Within commercial buildings, multi-unit housing and government buildings such as schools, there are three categories of components that are effected by high levels of seismic activity.

Architectural: This covers non-structural components built into the structure such as ceilings, windows, doors, panels and lighting

Building Utility Systems: Within this category falls *engine driven generator set systems* because it covers non-structural components that form part of the building including mechanical and electrical equipment, distribution systems, HVAC systems, conduit, roof mounted solar panels, etc.

Furniture: This covers many items such as computers, shelving, communication equipment, etc. *(Continued over)*

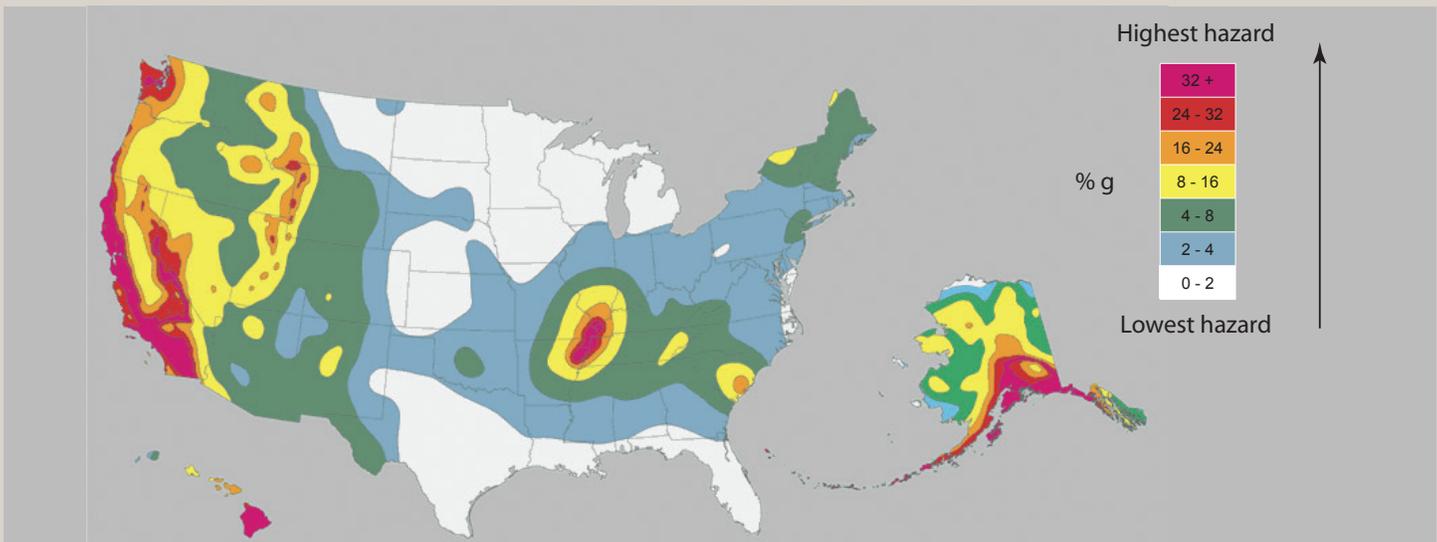


Diagram four - Restraints to prevent upward and lateral movement

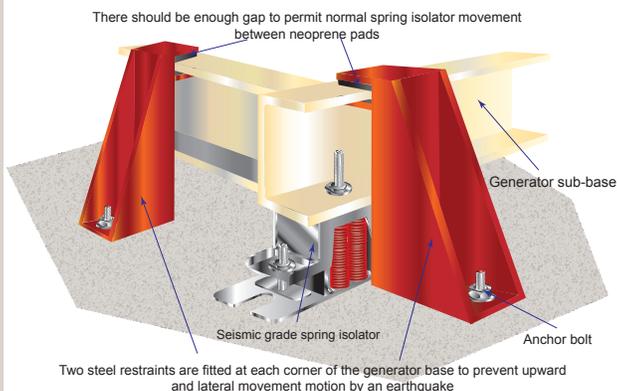


Diagram three - Propane tank installation

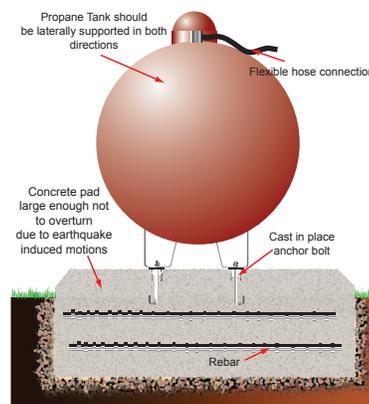
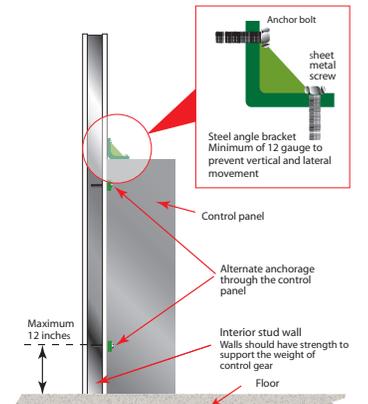
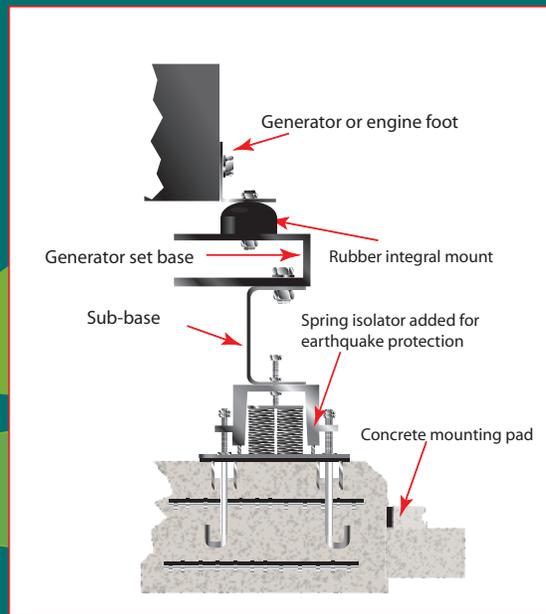
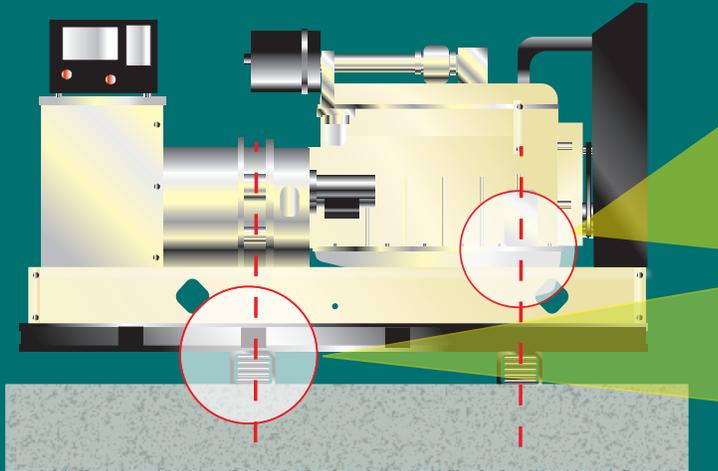


Diagram five - Mounting electrical equipment



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Diagram one - Seismic arrangement for vibration isolators



Some state and local codes require vibration isolators that provide protection for seismic or earthquake ground effects. If the generator set is already fitted with integral neoprene mounts, the addition of spring mounts for earthquake conditions should be as detailed. The spring mounts should equal the integral mounts and be located in the skid rails vertically in line with the existing neoprene isolators.

(Continued from page-one)

3.0 Codes covering generator equipment in seismic areas:

The designer of an electrical system should consult local codes covering the standards for generator set installation and whether there are special considerations due to increased levels of seismic activity.

The US Geological Survey (USGS) web site can be used to determine the seismicity of a location based on the zip code. It can be found at: <http://eqint.cr.usgs.gov/eq-men/html/zipcode-06.html>

4.0 Earthquake Hazard Mitigation:

The following are recommended good work practices when installing generator sets and associated equipment in areas of high seismic activity. Also consult applicable local codes.

Vibration isolation: When state or local codes specify seismic or earthquake-proof mounts in addition to any neoprene isolators installed between the generator set and the sub-base, spring type isolators should be installed under the generator skid. Vendor should confirm isolators are seismic models.

The quantity of spring isolators used should match that of neoprene mounts and be located in the generator base vertically in line with the existing neoprene isolators. (see diagram one)

Restraints: To prevent upward and lateral earthquake motion, two steel Z's or other restraints on each corner of the base should be installed firmly anchored to the concrete pad. (see diagram four)

Batteries, battery rack restraint: Batteries should be securely attached to the battery rack. Ensure the battery rack is cross-braced in both directions and the rack has anchor bolts securing it to the pad. The concrete pad should be large enough to keep the rack from sliding or tipping.

Diesel fuel and propane tanks: The tank should be securely attached to the supports which should be laterally supported in both directions. Each support is firmly anchored to the pad. (see diagram three)

In many areas, seismic codes specify the propane system has to be fitted with an automatic, earthquake-triggered shut-off valve. Only qualified personnel should make modifications to gas piping.

Fuel lines, water lines and exhaust flues: Local codes will apply but good practice is to attach these with flexible connections that permit movement at the junctions to spring mounted equipment and any structural expansion joints within the building that are required to meet code or design.

Electrical equipment and distribution: The switchgear should be properly anchored to the floor or supported by a wall. The wall should have adequate strength to restrain the switchgear.

All electrical cables or conduits in the event of an earthquake must be able to safely distort at the connections to equipment or where they transfer seismic joints between buildings.

At the bus, ducts and cable conduits should be laterally braced. (see diagram five)



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