SIEMENS

SINAMICS drives

Robicon W-Series

Seismic certification

In accordance with the International Building Code (IBC), seismic certification qualifies the Robicon W-Series drives range for installation in essential and critical infrastructure projects in all U.S. states, including California.

Public infrastructure such as municipal water and waste water treatment plants and power generating facilities is an essential part of everyday life, and therefore has special requirements for their installed equipment over and above the more standard expectations of industrial facilities.

Water treatment facilities are often near residential areas where "weak" power supply systems are common in comparison to power suppy systems in industrial areas. As such, it is especially important that power system disturbances such as harmonics generated by variable speed drives are limited to avoid potential damage to nearby residential equipment. It is also important for such facilities to continue operating on emergency generator power in the event of a power failure. In order to insure that all systems operate properly on emergency power, it is common for water treatment facilities to perform monthly emergency operation tests.

The Robicon W-Series range of variable frequency drives was developed to meet these challenges, by effectively addressing and mitigating harmonics.

The Series Clean Power 18-pulse design effectively eliminates harmonics typically caused by variable speed drives and exceeds the most stringent IEEE 519 1992 harmonic distortion requirements for both voltage and current:

- Does not introduce on-line harmonic disturbances
- Provides near-zero harmonic level on power system or generator systems
- Prevents cross-talk with other variable frequency drives
- Eliminates need for time-consuming harmonic analysis
- Avoids costly and inefficient harmonic filters and associated resonance and voltage rise problems

The need for functioning infrastructure does not change in the event of natural disasters such as earthquakes, when access to power, clean water and sanitation continue to be vital elements for society to operate. This issue is addressed by building codes which define the requirements to withstand seismic events and other naturally occurring elements such as wind, snow and ice. Seismic requirements apply not only to the buildings or structures of a facility, but also to non-structural equipment contained therein. This includes the variable frequency drives which control machinery such as pumps and blowers. Seismic certification involves analysis and testing to prove that such equipment will survive and be operational after an earthquake.

THE VMC GROUP
The Power of Together™

SIEMENS

CERTIFICATE OF COMPLIANCE

SEISMIC DESIGN OF NONSTRUCTURAL COMPONENTS AND SYSTEMS

Certification No.

VMA-48153-01C (REVISION 0)

Expiration Date: 04/30/2016

Certification Parameters:

The nonstructural products (mechanical and/or electrical components) listed on this certificate are CERTIFIED[1] FOR SEISMIC APPLICATIONS in accordance with the following building code[2] releases.

IBC 2000, IBC 2003, IBC 2006, IBC 2009, IBC 2012

The following model designations, options, and accessories are included in this certification. Reference report number **VMA-48153-01** as issued by The VMC Group for a complete list of certified models, included accessories/options, and certified installation methods.

Siemens Gen-II Robicon W-Series and Sinamics G120E Variable Frequency Drives

The above referenced equipment is **APPROVED** for seismic application when properly installed,[3] used as intended, and contains a Seismic Certification Label referencing this Certificate of Compliance[4]. As limited by the tabulated values, below grade, grade, and roof-level installations, installations in essential facilities, for life safety applications, and/or of equipment containing hazardous contents are permitted and included in this certification with an Equipment Importance Factor assigned as I_P=1.5.

Certified Seismic Design Levels	
S_{DS} <= 2.11 g	S_{DS} <= 1.32 g
z/h <= 0.0 (Equipment at Grade)	z/h <= 1.0 (Equipment on Roof)
Soil Classes A, B, C, D, Seismic Risk Category 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.	

Certified Seismic Installation Methods	
Directly to non-structural wall	Directly to rigid wall
External isolation to rigid wall	External isolation to non-structural wall
Rigid mounting from unit base to rigid structure	

Shake Test of Active and Energized Components, Non-Active Components, and Equipment Structure:

Qualified by successful seismic shake table testing at the nationally recognized University of California Berkeley Pacific Earthquake Engineering Research Center under the witness of the Certified Seismic Qualification Agency, The VMC Group. Testing was conducted in accordance with ICC-ES AC-156 to envelope the required response spectrum (RRS) of maximum horizontal flexible acceleration (A_{FLEX}) of 2.11 g and a rigid acceleration (A_{RIG}) of 1.58 g. This test level corresponds to an S_{DS} = 2.11 g with a z/h of 0.0. Functionality was verified before and after the shake test.

Basis of Design for Supports and Attachments to the Building:

For calculations and analysis of the equipment attachment to the building structure, the equivalent static force method was employed using the Seismic Design Acceleration, F_P/W_P,[5] for Load Resistance Factored Design (LRFD) methods. This includes but is not limited to the unit anchoring requirements and external isolation calculations.

Seismic Design Acceleration Equation, $F_P/W_P = 0.4 \times (S_{DS}=1.32\ g) \times (I_P=1.5) \times (a_P/R_P=2.5/2.0) \times (1 + 2(z/h=1.0) = 2.97\ g$

a_P/R_P is representative of the worst-case shake tested condition, as determined from Table 13.6-1 in ASCE/SEI7-05/10.

All states in the continental U.S. have adopted the International Building Code (IBC) as their current building code, although there may be variations in requirements due to the version of the IBC (updated every three years, the current version is 2012), as well as additional local requirements, for example by the California Building Code. Per the IBC, facilities are assigned a Risk Category based upon hazard to human life, as well as the potential of damage to infrastructure having significant economic impact or cause disruption of civilian life.

A Risk Category is designated with roman numerals I to IV, where in the event of failure:

- Category I represents a low hazard or risk
- Category III represents a substantial hazard or risk, and includes for example power generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utilities
- Category IV represents essential facilities for emergency response and emergency shelters as well as public utility facilities required as backup for these, such as water storage and pumping facilities for fire suppression, for example.

Seismic requirements apply not only to the facility structures but also to non-structural equipment such as variable frequency drives. When installed in a facility with Risk Category III or IV they are automatically assigned an Importance Factor of 1.5, indicating that the equipment must not only survive an earthquake without collapsing or toppling over, but be functional afterwards.

The geographic location (eastern, central, western U.S. or California) and the site classification by soil type (Class-A being solid rock, Class-F being liquefiable or loose / soft soil or clay) determine the seismic frequencies and frequency spectra and the amplitude of seismic waves, i.e. the severity and duration of shock waves that are expected.

Seismic certification

Seismic certification involves extensive structural analyses of the design of the enclosed drive, and confirmation by shake table testing.

Certification testing of the Robicon W-Series range was performed by the University of California, Berkeley, Earthquake Simulator Laboratory in accordance with the International Code Council Evaluation Services Acceptance Criteria 156 (ICC—ES-AC 156) “Acceptance Criteria for Seismic Qualification by Shake Table Testing of of Non-Structural Components and Systems” and the American Society of Civil Engineers standard ASCE 7-10. After testing, the drives were powered up and confirmed to be fully operational.

Robicon W-series drives:

- **Certified for installation in all facilities including those classified as essential, across all of the U.S. as detailed in the Certificate of Compliance.**
- **Built upon Robicon field-proven expertise that has reliably served the drives needs of water and wastewater utilities for more than two decades.**

The Robicon W-series range

Siemens builds upon the Robicon legacy of more than 20 years of quality and expertise with the W-Series of low voltage drives developed specifically for the municipal water and wastewater market in the U.S.

Each W-Series drive is custom-configured to meet the particular requirements of each project, based on a broad range of base units, a choice of both clean power and standard front ends, and an extensive selection of standard and custom options. Features that make W-Series drives ideal for public infrastructure projects include:

- Clean Power drives with an 18-pulse front end that provides low harmonics always meeting the requirements of IEEE 519-1992 at the drive input terminals. This is especially important when drives are directly connected to a low-voltage power supply grid shared by other industrial and residential users.
- Compatible with operation on generator supplies and weak power systems. Unlike harmonic filters, Clean Power 18-pulse drives do not present capacitive loads that cause voltage increases at low loads, a frequent cause of problems on weak or emergency supplies.
- Low loss operation especially at partial loads. Alternative technologies that use front ends with active switching devices (IGBTs) have high switching losses at all loads — unavoidable when regenerative operation is required but not desirable on pump and fan drives whose main purpose is energy savings.
- Available seismic certification for use in essential facilities

Performance specifications — Robicon W-series range		
Robicon W120	1 to 200 hp, 460V 1 to 60 hp 75 to 200 hp	Standard 6-pulse enclosed drive Wall-mount enclosure Floor-standing enclosure
Robicon W120CP	50 to 200 hp, 460V	Clean power 18-pulse Floor-standing enclosure
Robicon W150CP	250 to 800 hp, 460V	Clean power 18-pulse Floor-standing enclosure

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