

SPECIFICATION FOR SEISMIC SENSING DEVICES
COMMONLY USED FOR WATER RESERVOIR CONTROL

Developed by

Seismic Protection for Water Systems Ad Hoc Committee

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INTRODUCTION

Background

The purpose of this specification is to provide technical information to specifiers and users of seismic protection devices on the minimum manufacturing and performance requirements for these devices. This specification includes requirements for certification, level of performance, reliability and specifier responsibility. In addition, to recommended cycle and maintenance scheduled, design considerations based on NEMA standards are included

History

The Seismic Protection For Water Systems Ad Hoc Committee was organized in 1998 under the sphere of the AWWA Materials Performance Committee.

The scope of the Committee is to discuss and address all materials used in the industry with special consideration to performance, conduct material performance and specification related forums and/or seminars, address manufacturer and supplier issues and disseminate information to committee members.

The work of the Ad Hoc Committee is conducted by subcommittee. The scope of the Seismic Protection for Water Systems Ad Hoc Committee includes compilation of useable specifications for seismic protection devices as used commonly in the water works industry. The mission statement for the Seismic Protection Water Systems Ad Hoc Committee is: **To develop a**

specification and criteria for protection relating to seismic devices commonly used for water reservoir control.

SPECIAL ISSUES

This is suggested criteria. If any agency, entity or private party chooses to utilize this specification, the devices shall comply with this specification. Any devices not complying with this specification will be substituted by the manufacturer at the approvals of the purchaser.

USE OF THIS SPECIFICATION

The seismic protection for Water Systems Ad Hoc Committee has no responsibility for the suitability or compatibility of the provisions of this specification to any intended application by any user. Each user of this specification is responsible for determining that the specification's provisions are suitable for and compatible with the users intended application.

Section 1 General

Section 1.1 Scope

This specification covers the certification, design consideration, level of performance, reliability, warranty and specifier responsibility requirements for seismic sensing devices commonly used for water reservoir control.

Section 1.1.1 Items Not Covered in this Specification

This specification does not cover the additional specification requirements, materials and procedures that may be required for severe conditions, such as extreme heat, extreme cold and submersion. This specification does not cover additional devices that may be required for functionality, purpose or completion such as valves, actuators, monitors and electronic devices.

Section 1.2 Purpose

The purpose of this specification is to provide purchasers, manufacturers and constructors with the minimum performance requirements for seismic sensing devices, including measurement, certification, calibration, performance, capabilities, reliability, warranty and customer responsibility.

Section 1.3 Application

This specification or sections of this specification can be referenced for purchasing, receiving and installing seismic sensing devices for water systems. This specification can also be used as a guide for installation, reliability, calibration and testing of seismic sensing devices for water systems. The stipulations of this

specification apply where this document has been referenced: and only to seismic sensing devices for water systems control.

Section 2

References

- Pender, Harold and Del Mar, William, Electrical Engineer's Handbook, Fourth Edition.
- Eshbach, Ovid and Souders, Mott, Handbook of Engineering Fundamentals, Third Edition.
- Science News, Vol. 154, July 1998
- Science News, Vol. 153, February 1998
- Science News, Vol. 153, March 1998
- Science News, Vol. 145, June 1994
- Science News, Vol. 146, October 1994

Section 3

Definitions

Calibrate: To determine, check or rectify the graduation of any instrument giving quantitative measurements.

Seismic Sensing Device: A device that measures G-force vector over a specified time period as a resultant of the X, Y and Z axis and initiates a contact closure.

G-force: An increase in velocity due to the acceleration of gravity of approximately 32.2 feet per second per second.

Magnitude: Size; extent; sum of all applied forces

Moderate: Not extreme; of medium quantity; 5.0-5.9 magnitude seismic event.

Resultant: A single vector, often representing a force equivalent to two or more other such vectors, being their vector sum.

SCADA: Supervisory control and data acquisition

Seismic event: Result or outcome caused by an earthquake or vibrations of earth, whether due to natural or artificial causes.

Trigger: A device that initiates or precipitates a reaction series of reactions.

Sinusoidal: Having a magnitude that varies as the sine of an independent variable.

Oscilloscope: A device that depicts on a screen periodic changes in an electric quantity, as voltage or current, using a cathode-ray tube or similar device.

Section 4 Requirements

Section 4.1 Standard of Device Measurement

Section 4.1.1 The seismic sensing device shall measure the resultant force vector of the X, Y and Z axis.

Section 4.1.2 The seismic sensing device shall trigger at 0.3 G-force in a time span of 1.0 second. This force is considered approximately a “**moderate**” seismic event of magnitude greater than or equal to ± 5.0 . Reference Table Nos. 1 and 2.

Table No. 1

Frequency of Earthquake Occurrence Based on Observations Since 1990

Great	8 and higher	1
Major	7-7.9	18
Strong	6-6.9	120
Moderate	5 – 5.9	800
Light	4 – 4.9	8,200 (estimated)
Minor	3 – 3.9	49,000 (estimated)
Very Minor	Less than 3.0	2-3 about 1,000/day

Mag 1-2 about 8,000/day

Source: U.S. Geological Survey

Table No. 2

Quakes and Their Equivalents

<u>Magnitude</u>	<u>Energy Released</u> (in millions of ergs)	<u>Rough Equivalent</u>
-2	630	100-watt light bulb left on for a week
0	630,000	1-ton car going 25 miles per hour
2	630,000,000	Amount of energy in a lightning bolt
4	630,000,000,000	Seismic wave3s from 1 kiloton of explosives
6	630,000,000,000,000	Hiroshima atomic bomb
8	630,000,000,000,000,000	1980 eruption of Mount St. Helen's largest recorded quake M.9.5, Chile 1960
10	630,000,000,000,000,000,000	Annual U.S. energy consumption

Source: U.S. Geological Survey.

Section 4.1.2.1 The seismic sensing device shall be factory calibratable to trigger between 0.2 G to 0.4 G-force in a time span of 1.0 second within a default setting of 0.3 G force in a time span of 1.0 second if not otherwise specified.

Section 4.2 Device Certification

Section 4.2.1 Testing Device

Section 4.2.1.1 Prior to installation, the device shall be tested by any device producing a sinusoidal motion in a horizontal plane that produces the specified 0.3 G-force \pm 10 percent in a time span of 1.0 second or as specified in Section 4.1.2.1. The manufacturer shall supply an oscilloscope to calibrate the testing device producing the specified G-force in the X, Y and Z vectors.

Section 4.2.1.2 the calibrated testing device shall be started at 75 percent of the specified G-force and increased to reach the specified G-force.

Section 4.2.2 the testing shall be verified at the site of installation or at a site designated by the purchaser.

Section 4.2.3 after testing the device, the device shall be installed in the field as required by the manufacturer. After installation and placement of the device, prior to placing the device into service, the manufacturer an/or its authorized representative shall field verify the correct installation of the device, witnessed by the purchaser.

Section 4.3 Level of Performance

Section 4.3.1 The device shall trigger at 0.3 g-force=10 percent in a timespan of 1.0 second or as specified by purchaser.

Section 4.3.2 The device shall be capable of a 1,000,000 cycle life duration.

Section 4.3.3 The owner shall coordinate with the manufacturer or its authorized representative and verify the device calibration every 3 years.

Section 4.3.4 The device shall be capable of being reset manually and be capable of being reset remotely. The remote resetting capability of the device is not required to be enabled.

Section 4.3.5 The device shall operate to full capabilities at an ambient temperature range of 0° to 40° Celsius. The purchaser/owner may specify higher or lower ranges.

Section 4.3.6 The device shall be able to operate within 100% noncondensing moisture.

Section 4.3.7 The device shall be contained in a NEMA 4X enclosure and constructed of 12 gauge 304 stainless steel.

Section 4.3.8 The device shall have a minimum of two 1.0 amp rated dry contact closures for normally closed operations. The purchaser may specify additional contact closure requirements.

Section 4.3.9 The device shall be rated at 110V 1.0 amp AC and 24 V DC.

Section 4.3.10 The device shall require an on-site manual trigger to activate the seismic sensing device and/or system. The manual trigger shall be secured from vandalism of the system.

Section 4.3.10.1 The device shall allow on-site system check capability. The device shall allow for activating a test cycle either manually or remotely by SCADA. The owner shall test cycle the triggering device a minimum of 1 time over every 6-month period. The owner shall maintain a log of the test date and record the performance of the device.

Section 4.4 System Reliability

Section 4.4.1 The device shall be capable of remaining operational for a minimum of 30 days on dedicated backup power.

Section 4.4.2 The device shall meet or exceed the Bureau of Standards spray test.

Section 4.5 Shop Drawings

Section 4.5.1 The manufacturer shall provide reproducible mechanical wiring diagrams and schematics.

Section 4.5.2 The manufacturer shall provide written recommended installation procedures, operation protocols and complete unit dimensions.

Section 4.5.3 The manufacturer shall provide a minimum of two detailed operation and maintenance manuals and complete material specifications.

Section 4.6 Warranty

Section 4.6.1 The manufacturer shall provide a 2-year warranty on the device, parts and appurtenances with an extended warranty available.

Section 4.6.2 The manufacturer shall guarantee parts availability for the device for a period of 5 years beyond the date of warranty expiration.

Section 4.6.4 The manufacturer shall not be liable for damage to the device caused by the purchaser after the seismic sensing device is accepted as herein stated at the point of delivery by the purchaser.

Section 4.7 Specific Responsibility

Section 4.7.1 The purchaser shall specify and disclose the elevation of the placement of the device to the manufacturer.

Section 4.7.2 The unit shall be mounted to an appropriate available mass on site as determined by the purchaser such as ringwall or tank. the mounting of the seismic sensing device shall be designed to mitigate pendulum effects.

This specification was adopted by the members of the Seismic Protection for Water Systems Ad Hoc Committee for their own use. Use of this specification is at the sole risk of the user: the committee and its members make no representations, guarantees or warranties regarding the efficacy or applicability of the specification.