

Smoke Detector Sensitivity Testing

ISSUE:

CAN/ULC S536-04 "Inspection and Testing of Fire Alarm Systems," the referenced standard for fire alarm system maintenance in the Alberta Fire Code 2006 Division B. Sentence 6.3.1.2.(1), states:

6.3.1.2. Inspection and Testing

- 1) *Fire alarm systems shall be inspected and tested in conformance with CAN/ULC-S536, "Inspection and Testing of Fire Alarm Systems."*

Smoke Detector Sensitivity testing is noted in CAN/ULC S536-04 as an annual requirement in Clause 5.7.4.1.3

"Each smoke detector shall be tested to confirm that it is within its rated operating range using a test method described in Clause 5.7.4.1.6."

While the requirement to conduct such testing has existed and evolved in the ULC S536 standard since the 1986 version such testing has not, until recently, been conducted in most Canadian jurisdictions and has not been a point of enforcement by the Authority Having Jurisdiction in Alberta.

The current practice in Alberta is that this testing is only required where a detector is found to be non-functioning during a properly conducted smoke test. At this time the smoke detector could be cleaned and tested for sensitivity or replaced with a new detector to bring the system back to full functionality as per the most recent verification. This is noted in the "Alberta Fire Alarm System Guide" (editions published in 2002 and 2010).

Questions have been directed to the Chief Fire Administrator as to the discrepancy between the current practice as outlined in the Fire Alarm System Guide and the requirement of Clause 5.7.4.1.3 of ULC S536-04. They include:

- 1) Why would sensitivity testing now be required if it has not been required since 1986?
- 2) Would sensitivity testing provide a greater degree of fire alarm system reliability and functionality than the annual requirements for visual inspection and cleaning and smoke testing prescribed in Clauses 5.7.4.1.1 and 5.7.4.1.2 of the same standard which have been required and enforced since the adoption of the Alberta Fire Code 1997?

BACKGROUND:

The 1986 ULC S536 Standard introduced the requirement for smoke detector sensitivity testing based upon concerns about the reliability of detectors. The issue of life safety devices and system reliability is a major focus of concern, especially in multi-family residential occupancies where, in most cases, smoke detectors will be the most prevalent type of fire alarm initiating device.

The 1982 version of S536 had required “annual testing each component and device for its intended function”. This is the standard referenced in the initial Alberta Fire Code in 1984.

The 1986 version required annual inspection and testing to the manufacturer’s recommendations in addition to testing for “operability and the required sensitivity” and recommending the adoption of a cleaning schedule. This would have applied in Alberta with the adoption of the 1992 Alberta Fire Code.

The 1997 version of ULC S536 mandated visual inspection for cleanliness and cleaning in accordance with the manufacturer’s recommendations. It also required testing of the sensitivity value and directed that detectors which were out of the operating range be cleaned and retested or replaced. This also introduces the specific requirement to test for operation by introducing smoke or simulated smoke to the detector chamber. This version of ULC 536 coincided with the adoption of the Alberta Fire Code 1997.

Part of the reason for a lack of focus on smoke detector sensitivity testing has been that until recent years there were no non-proprietary “smoke detector sensitivity testers” on the market. Fire alarm equipment manufacturers had developed sensitivity testers specific for their models of detectors but it was difficult or impossible for qualified persons (fire alarm technicians or electricians) to obtain these devices unless they were affiliated with a particular manufacturer and even then they would only have access to that manufacturer’s testers and these were not acceptable for testing the equipment made by another company.

This has been addressed in recent years with the development of universal detector sensitivity testing equipment. As ULC S536-04 does not specify a tester which meets a standard, and as there is no Canadian standard for a smoke detector sensitivity tester, these devices, which meet UL 268, could be acceptable for use in Alberta provided they meet the requirements of the electrical regulations adopted under the Safety Codes Act.

Annual sensitivity testing of smoke detectors would be expected to add to the cost of the annual maintenance and testing currently required to be done on every conventional fire alarm system in Alberta as the time needed to test each detector would increase.

It must be noted that newer intelligent, addressable fire alarm systems perform sensitivity tests on all smoke detectors within the system on a continuous basis and that this form of sensitivity testing is acceptable under ULC S536-04. The annual smoke testing is still required for each smoke detector.

DISCUSSION:

The Chief Fire Administrator has enquired throughout North America as to whether any empirical data exists, either from case studies or scientific research, which supports a belief that annual smoke detector sensitivity testing, over and above smoke testing, increases or improves the reliability and functionality of the smoke detectors within a fire alarm system. This has included direct requests to ULC, the Canadian Fire Alarm Association and the National Fire Protection Association.

While data does exist showing that over time the sensitivity of smoke detectors may drift out of range there has been no data presented to date which can be used to validate the premise that annual sensitivity testing of smoke detectors will provide a greater degree of detector reliability and functionality than properly conducted annual smoke testing. Anecdotal evidence suggests that any drift will likely result in the detector becoming more sensitive which creates a concern for nuisance alarms as opposed to reduced sensitivity.

Therefore; is the additional cost of annual sensitivity testing justified with no demonstrated improvement in safety and system reliability?

CONCLUSIONS:

Despite the initial apparent sense that additional types and forms of testing will result in a better result and the emotional argument that not conducting annual sensitivity testing will put Albertans at risk, the scientific support for requiring this additional testing at an annual frequency has not been found.

Annual visual inspection and cleaning of smoke detectors, and proper smoke testing in accordance with manufacturers and testing agent recommendations, would appear to provide a verifiable indication of proper function and reliability of the smoke alarms within a fire alarm system.

This inspection, cleaning and testing is only of value when the testing is completed by trained and qualified persons following proper procedures and fully recording the results of these activities in the full report format described in the appendices of ULC S536-04 "Inspection and Testing of Fire Alarm Systems". These records must remain on site or in a location acceptable to the authority having jurisdiction for a minimum of two years.

Using aerosol "Test" smoke - From a distance of 2 to 4 ft. (.6-1.2m) aim spray for 1-2 seconds at the vents or side of the detector. Alarm will sound within 1 to 10 seconds if the detector is functioning properly. Detectors with delay circuits should be sprayed 1 or 2 additional times to activate the alarm. At no time should the aerosol be used more than 3 times and non-aerosolised liquid must not be allowed to enter the detector. The directions of the test agent's manufacturer will take precedent over these procedures.

It is however reasonable to expect that smoke detectors have a functional life span and that, as critical life safety equipment, they will require additional testing or replacement at a fixed point in their life cycle.

While not explicitly stated by the manufacturer it is reasonable to expect that smoke detectors will have a service life expectancy of ten years. This replacement schedule is consistent with recommendations in the Appendices of CAN/ULC S552-02 "Maintenance and Testing of Smoke Alarms" which strongly recommend that smoke alarms be replaced every ten years. As these devices utilise the same detection principles it seems reasonable to anticipate that they would "age" at a similar rate.

It is anticipated that there are a significant number of smoke detectors on systems currently in service which have exceeded this service life. These detectors cannot continue to remain in place past the end of their service life without additional testing.

All smoke detectors on fire alarm systems within Alberta shall therefore be required to either be replaced within ten years of their manufacture, with a smoke detector listed for use with the fire alarm system and appropriate for the location, or they shall be, from the time they reach ten years and forward, tested for sensitivity in conformance with the methods prescribed in ULC S536-04 on an annual basis.

As noted previously intelligent digital addressable systems may already conduct this testing automatically and this provision will not apply to those systems.

In those instances where smoke detectors are already older than ten years the owner must, within 12 months from the issuance of this Variance, successfully sensitivity test or replace all such detectors.

Where the date of manufacture of an existing smoke detector is unknown, and the manufacturer of the detector is unable to provide clarification, absent any proof of the date of installation, the detector will be deemed to have been in place since the time of the installation of the fire alarm system. When a manufacturer has not produced a model of smoke detector in ten years or more that shall be taken as proof of length of service of the detector.

Records of smoke detector replacement shall be retained for the life of the building or fire alarm system along with the fire alarm verification report(s) as per the Alberta Fire Code 2006.

Where a smoke detector is replaced with a new smoke detector, and the replacement does not have a manufacturing date attached to it by the manufacturer, the qualified person conducting the installation shall ensure that the date of installation is recorded on the detector by means of a permanent marker.

This variance applies throughout the Province of Alberta.