

42 E

INSPECTION, TESTING AND MAINTENANCE OF SMOKE CONTROL SYSTEMS

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42.1 Scope and purpose. The purpose of this standard is to ensure that smoke control systems are operating in accordance with the codes, standards and design under which they were commissioned.

42.2 Where required. All existing buildings or structures with smoke control systems.

Exception: Buildings not required to be provided with smoke control systems under current codes, when an analysis has been performed by a competent licensed design professional that demonstrates the existing building would essentially be compliant with the same code(s) that is acceptable to the Building Official and Fire Marshal.

- Existing systems must be decommissioned as outlined by a report submitted by the design professional described above.
- Permits may be required based on the nature of the work required to decommission the system.

42.3 Compliance. Smoke control and smoke management systems shall comply with the design under which the system was commissioned. Where sufficient documentation is lacking, the owner shall contract with a licensed competent design professional to recreate such documentation in accordance with Number sheet 42C and submitted to the Fire Department for review and approval.

42.4 Routine maintenance and testing. The system must be maintained in accordance with the manufacturer's instructions, system commissioning documentation and IFC sections 909.12, and 909.20.1 - 909.20.5.

42.4.1 Frequency. Operational testing must be completed whenever the system or equipment is altered and on an annual basis for 100% of the building. Performance testing must cover 100% of the building on a 3-year frequency. Performance testing that includes a three year program to test 1/3rd of the buildings each year is acceptable.

42.4.2 Operational Testing. The intent of this testing is to ensure that the system will function as originally designed and commissioned during an emergency. The operational testing involves manipulation of manual override controls and activation of detection devices, fans, and dampers, where provided. The IFC, provides a description of the required testing which must include all smoke control related equipment such as initiating devices, fans, dampers and controls.

42.4.3 Performance Testing. Performance testing includes the measurement of pressure differentials or airflow quantities. Pressure differentials and airflow quantities shall be observed as required for Performance testing. Performance testing shall be performed in accordance with the Special Inspector Test Procedures based on the Detailed Design Report. If these documents are not present, they shall be developed by the SI/SIA for approval in accordance with number sheet 42C.

42.4.4 Records. The routine maintenance and operational program described in IFC Section 909.20 shall be maintained onsite, preferably in the FCC. Periodic testing shall reference these materials.

42.4.4.1 Reverse Chronological Order. The written record described in IFC Section 909.20.2 shall be maintained with the routine maintenance and operational program in reverse chronological order, beginning with the most recent completed report. The record shall minimally include copies of completed BFD Smoke Control System Confidence Test Report forms together with the associated Cover Sheet.

42.4.4.2 Ongoing records of system testing and inspection. Ongoing records of system testing and inspection described in IFC 909.20 shall be maintained onsite, preferably in the FCC as described below:

- Ongoing records shall minimally serve to document the date of each inspection, the focus of each inspection, and the results.
- Elements of the smoke control system found to not conform to the detailed design report or testing program shall be clearly identified as to what the issue is, the date it is discovered, how it was resolved and the date it is resolved (if applicable).

42.4.5 Weekly self-test. Automatic weekly self-tests must be conducted and documented for smoke control systems (IBC 909.12). Such testing must include end-to-end verification. The fire alarm or smoke management panel shall exercise system components once per week and receive positive confirmation that the component operated properly. For fans, the self-test typically involves turning on the fan just long enough to bring them up to speed and receive positive confirmation of airflow. For dampers, the self-test typically involves cycling the damper into both the open and closed positions and receiving positive confirmation of each position via contact switches. The duration of the self-test shall be adequate to allow the system to detect a fault condition in the event an affected system component did not function properly.

42.4.5.1 Self-test failure. During the self-test, should any device malfunction, a “FAULT” indication on the associated equipment on the FSCP is required as part of the IBC 909.12 mandated audible, visual and printed report. A trouble signal shall be transmitted to the fire alarm monitoring agency. The self-test procedure and output shall be printed and maintained in the fire control room and accessible to inspection agencies.

42.4.6 Confidence Test Reports. The BFD Smoke Control Confidence Test Report Cover Sheet and required documents shall be completed and maintained on the premises available for review on request by the Fire Department.

42.4.7 Special Inspector, Special Inspection Agency qualifications. Each building’s smoke control system functions differently. Therefore, the testing plan must be developed by a qualified special inspector (SI) or special inspection agency (SIA) who is familiar with the proper operation of the smoke control system and equipment for the building. The intent of this testing is to ensure that the system will function as designed and commissioned during an emergency, not to challenge the integrity of the system. Periodic testing involves manipulation of FSCP manual override controls; care must be exercised to avoid creating conditions harmful to life or property. The routine maintenance and operational program described in IFC Section 909.20, must be developed by a contractor knowledgeable in these systems.

42.4.8 Reporting. SI/SIA shall complete a Confidence Test Report available onsite within 30 days of completion of the testing or date that a deficiency or non-complying condition, which has not been corrected, was discovered.

42.4.9 Dampers. Dampers controlled by the smoke control system, whether monitored by the FSCP or not, shall be visually inspected and maintained a minimum of every 4 years in accordance with NFPA 90A and the manufacturer's recommendation.

42.5 Special inspector testing. The role of the special inspector is to review the installation for conformance with the approved design approach and code.

42.5.1 Coordination. The Special Inspection Agency must be provided with the approved smoke control Detailed Design Report, the Special Inspection Test Procedures, and the control diagrams.

42.5.2 Written test procedures. The testing shall follow the Special Inspector Test Procedure approved as developed by the design engineer of record.

42.5.3 Deficiencies. The SI/SIA shall give written notice to the owner of any deficient or non-complying smoke control system feature that is discovered and is not corrected prior to the end of the day. All deficient or non-complying aspects shall be corrected.

42.5.4 Life safety. The SI/SIA shall follow the impairment procedures outlined in [Public Information Handout F-39](#) "Impairments" whenever it is determined that a smoke control component or system is inoperable.

42.5.5 Special inspection and acceptance test requirements. Each smoke control system shall be inspected and tested in accordance with IFC 909.3, 909.10 through 909.19, Chapter 8 of NFPA 92, ASHRAE Guideline 1.5, and as described in this section. In particular, the following is a partial list of items that must be tested:

1. Each individual fire alarm initiating device which activates any portion of the smoke control system must be verified to provide all applicable output functions in accordance with IBC 909.18.7. Each detection device must also be tested in accordance with 909.18.1. Where testing would result in the repeated start and stop of large fans, such fans may be disabled or bypassed provided that verification that the proper system output to the fans is transmitted during testing while the FSCP is constantly attended. Proper operation of disabled equipment shall be restored and demonstrated upon receipt of an actual alarm event, or at the conclusion of the testing period, whichever occurs first. It is acceptable to conduct alarm confidence testing in conjunction with this test. Further, the output of the Fire Alarm Controller must be verified but it is not required that the equipment be put through complete functional tests.
2. Power systems shall automatically transfer to full standby power within 10 seconds of failure of the primary power per COB Ordinance.
3. Smoke Barrier construction shall be evaluated in accordance with IBC Section 909.5 requirements.
4. The pressure difference across door (s) shall not exceed a 30-pound force to set the door in motion in accordance with IBC Section 1008.1.2.

5. Pressurized shafts shall have a positive pressure relative to the building, including where a shaft opening exists to a pressurized zone, measured with all stairway doors closed under maximum anticipated stack pressures.

42.6 Special inspector qualifications. The City of Bellevue does not certify or list special inspection agencies (SIA) or special inspectors (SI). The qualifications for special inspector are described below.

Exception: In low-rise buildings equipped with shaft pressurization only smoke control systems may utilize an SI registered with either the Association of Air Balance Council (AABC), National Environmental Balancing Bureau (NEBB), or Testing Adjusting, and Balancing Bureau (TABB) and experienced in engineered smoke control equipment or systems.

42.6.1 Required expertise. Smoke control special inspection qualifications are outlined in IBC Section 909.18.8.2 and 1704.2.1. Both sections indicate that agencies (rarely will a single entity have all of these qualifications as a single special inspector) shall have expertise in mechanical and fire protection engineering and certification as an air balancer. The combination of persons, agencies or firms can vary, but the qualifications must include all of the disciplines prescribed.

42.6.2 Agency requirements. Agencies serving as the SIA must have a Washington State Registered (P.E.) overseeing the special inspection process. The combination of persons, agencies or firms can vary, but the qualifications of the team providing special inspections must include, at a minimum, all of the disciplines prescribed in IBC 909.18.8.2. Individuals conducting the actual testing are not required to be a registered P.E., nor is the P.E. required to be present for all testing. However, the P.E. is required to provide a certificate of compliance in accordance with this document.

42.6.3 Individual requirements. Individuals serving as the SI shall be a Washington State Registered (P.E.) Fire Protection, Mechanical, or Electrical Engineer with the qualifications outlined in IBC Section 909.18.8.2. A P.E. with smoke management commissioning experience may serve as the SI to coordinate and verify all components of the smoke-control system within his or her area of expertise. The SI is required to provide a certificate of compliance in accordance with this document.

42.6.4 Allowed to be SI. The P.E. who prepared the rational analysis and Detailed Design Report may serve as the SI.

42.6.5 Exempted from being SI. The vendor, technician, installing contractor or air balancer cannot serve as the SI nor be a subcontractor or affiliate to any of the aforementioned entities.

42.6.6 Air flow and pressure testing. All airflow and pressure testing must be done by an approved Associated Air Balance Council (AABC), National Environmental Balancing Bureau (NEBB), or Testing Adjusting, and Balancing Bureau (TABB) agency. If this company is hired by the installing contractor or responsible for the balancing of the system, the SI must witness all required special inspection testing.

42.7 Certificate of compliance by the special inspector. A certificate of compliance must be provided by the special inspector certifying that the referenced property is in substantial compliance. The certificate shall identify:

- SI/SIA qualifications as required in 42.6
- Company and special inspector that performed the testing
- Name, date and address of the property being tested.
- The following statement must also be included:

“I have reviewed the report and by personal knowledge and on-site observation certify that the smoke control system is in substantial compliance with the approved design documents, and to the best of my understanding complies with requirements of the applicable codes as identified in the smoke control report.”

42.8 Disabling fans. Where Operational or Performance Testing would result in the repeated start and stop of large fans, such fans may be disabled or bypassed provided that verification that the proper system output to the fans is transmitted during testing while the FSCP is constantly attended. Proper operation of disabled equipment shall be restored and demonstrated upon receipt of an actual alarm event, or at the conclusion of the testing period, whichever occurs first.

42.9 Chemical smoke. Testing involving chemical smoke or a tracer gas may be used for tracer test during acceptance testing to visually verify air movement.

42.10 Certificate of compliance by the designer. Upon completion of the commissioning report, IBC Section 909.18.8.3 requires the responsible registered design professional to review the report. When satisfied that the smoke management system has been properly inspected and tested and meets the acceptance criteria, the design professional must affix his or her seal and sign and date the report. They must also include the following statement:

“I have reviewed the report and by personal knowledge and on-site observation certify that the smoke-control system is in substantial compliance with the design intent and to the best of my understanding complies with the requirements of the code.”

42.11 Smoke control acceptance testing documents. The following items must be maintained current onsite, preferably in the FCC for the life of the building: Items one and two must be submitted to and approved by BFD prior to the start of special inspections.

1. Approved control diagrams must be kept accessible in the Fire Control Room for the life of the building and must be updated when changes are made to the building.
2. Plans showing the devices and equipment which make up the smoke control system. This will include control diagrams in accordance with IBC 909.15, all smoke barriers, applicable initiating devices, controllers, fire alarm control panel, fire-fighter's smoke control panel, facility temperature controls, control wiring or tubing, isolation valves, relays, doors, dampers, fans, all supervision devices.
3. Every device must have a distinct identifying address. For purposes of this requirement, BFD will accept the detailed design drawings, provided all of the devices listed above are shown, and no extraneous equipment other than fire alarm devices.
4. A detailed event matrix (each device must be identified by individual address exactly as it is shown on the control diagram plans above);
5. Documents describing the proper operation and maintenance requirements of each component of the smoke control system, including fan curves for the smoke control fans in the building.
6. Maintenance logs and quarterly testing logs.
7. The approved smoke control Detailed Design Report.
8. UUKL panel self-test printouts.
9. The final special inspection report.

42.11.1 Record modifications. Changes as a result of testing, or a change to the system design must be documented in the special inspection report, prepared in accordance with IBC Section 909.18.8.3. Record drawings shall include an accurate depiction of risers, raceway, conduit, all wire runs, cable identification, conduit size, location of junction boxes, terminal boxes, sources of power, devices, sensors, equipment, controlled equipment (motor starters, fans, pumps, valves, dampers, etc.).