

Smoke Control Plan Review Checklist

Purpose: A smoke control system is intended to provide a tenable environment for the evacuation or relocation of occupants. However, maintenance of a tenable environment is not required in a mechanical smoke-control zone of FIRE origin utilizing the pressurization method. IBC § 909.1 and IBC § 909.6

General: Construction documents shall include sufficient information and detail to adequately describe the elements of the design necessary for the proper implementation of the smoke control systems. These documents shall be accompanied by sufficient information and analysis to demonstrate compliance. IBC § 909.2

- Plan Readability. The plans shall be easily read having a readable typeface. The plans shall have a vivid contrast or difference in brightness between the light and dark areas.
- The plans shall identify the project by name and street address. Source: Nevada Blue Book.
- The front cover of all plans and calculations shall contain the design professionals' wet seal or stamp with an original signature across the face of the seal or stamp and date below the seal or stamp. Subsequent sheets within the plans may be a reproduction. Source: Nevada Blue Book.
- Smoke Control Analysis IBC § 909.4
 - Type(s) of Smoke Control System(s) Employed
 - Smoke Barrier Construction
 - Pressurization Method
 - Airflow Method
 - Exhaust Method
 - Methods of Operation
 - Other Supporting Systems
 - Methods of Construction
 - Stack Effect Analysis IBC § 909.4.1
 - Temperature Effect Analysis IBC § 909.4.2
 - Wind Effect Analysis IBC § 909.4.3
 - Air-handling systems IBC § 909.4.4
 - Climate IBC § 909.4.5
 - Duration of Operation IBC § 909.4.6
- Design Fire. IBC § 909.9
 - Design fire analysis.
 - Minimum Q of not less than 5,000 Btu/s

- Fuel characteristics, fuel load, effects included by the fire, steady or unsteady fire. IBC § 909.9.1
- Fuel type, fuel spacing, fuel configuration, separation ratio to fuel equivalent radius not less than 4, fuel equivalent radius involving other combustibles if within calculated distance. IBC § 909.9.2
- Design fire heat-release assumptions. IBC § 909.9.3
- Sprinkler effectiveness documented analysis. IBC § 909.9.4
- Non-sprinklered buildings design fire pressure. IBC § 909.6.1

- Smoke Barrier Construction IBC § 909.5
 - Maximum allowable leakage area calculations. IBC § 909.5
 - Definitions:
 - SMOKE BARRIER. A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly, that is designed and constructed to restrict the movement of smoke. 702
 - SMOKE COMPARTMENT. A space within a building enclosed by smoke barriers on all sides, including the top and bottom. 702
 - Smoke Barrier Construction - Opening Protection. IBC § 909.5.2.

- Automatic Closing Device(s) Actuated by Req. Controls
 - Exceptions:
 - Passive System w/ Automatic Closing Device VIA Listed Releasing Smoke Detector IBC § 909.5.2 ex.1
 - Fixed Opening protected w/ Airflow Method IBC § 909.5.2 ex.2
 - Cross Corridor Doors in I-2. IBC § 909.5.2 ex.3
 - Group I-3. IBC § 909.5.2 ex.4
 - Ceilings 14' or more w/ a 20 min Smoke Reservoir IBC § 909.5.2 ex.5
 - Self-closing Passive Smoke Control Systems at Guest rooms, Individual Dwelling Units, Mechanical Rooms, Elevator Machine Rooms, Electrical Rooms, & Others as Req. IBC § 909.5.2.5 ex.6 (as amended)

- Opening Protection IBC Chapter 7
 - Door rating, door label, temperature rise control assemblies when required. IBC § 714.
 - Through penetrations and membrane penetrations. Listing numbers. IBC § 711.
 - Fire dampers, smoke dampers, and combination fire smoke dampers. IBC § 715.

- Pressurization Method IBC § 909.6
 - See Code for Calculation(s) Details
 - Provide smoke control calculations for mechanical equipment sizing. Provide calculations for fan, duct and outlet sizes.

- Airflow Method IBC § 909.7
See Code for Calculation(s) Details
- Exhaust Method IBC § 909.8
See Code for Calculation(s) Details
- Equipment suitable for their intended use and probable exposure temperatures IBC § 909.10
- Exhaust fans components rated and manufacturer certified for calculated probable exposure temperature rise. IBC § 909.10.1
- Ducts materials and joints shall be capable of withstanding the calculated probable exposure temperatures and pressures. Ducts shall be supported directly from fire-resistance-rated structural elements of the building by substantial, noncombustible supports. IBC § 909.10.2

Equipment, inlets and outlets. IBC § 909.10.3

- Equipment shall be located so as to not expose uninvolved portions of the building to an additional fire hazard. IBC § 909.10.3
- Outside air inlets shall be located so as to minimize the potential for introducing smoke or flame into the building, IBC § 909.10.3
- Exhaust outlets shall be so located as to minimize reintroduction of smoke into the building and to limit exposure of the building or adjacent buildings to an additional fire hazard. IBC § 909.10.3

Automatic dampers shall be listed. IBC § 909.10.4

- Fire Damper. The operating temperature of a fire damper located in a smoke control system shall be not more than 286°F (141°C). 715.3.1.1(2)
- Smoke Damper.
 - Smoke damper leakage ratings shall not be less than Class II.
 - Elevated temperature ratings shall not be less than 250°F (121°C). 715.3.2
- Combination Fire/Smoke Damper. The operating temperature rating of a combination fire/smoke damper located in a smoke-control system shall be approximately 50°F (10°C) above the maximum smoke control system designed operating temperature, or a maximum temperature of 350°F (177°C). The temperature shall not exceed the UL 555S degradation test temperature rating for a combination fire/smoke damper. 715.3.1.1(3)

Fans. IBC § 909.10.5

- Belt-driven fans shall have 1.5 times the number of belts required for the design duty, with minimum of 2.
- Fans shall be selected for stable performance based on normal temperature and, where applicable, elevated temperature.
- Fan calculations and manufacturer's fan curves.
- Motor shall have a minimum service factor of 1.15.
- Fan support and restraint shall be non-combustible and comply with IBC chapter 16.
- Fan operational speed and capacity (normal and smoke mode).

Power Systems IBC § 909.11

- Two sources of power required. Normal power shall be primary power.
 - Standby source shall be secondary power.
 - Standby power source and transfer switches shall be in a 1-hour room separate from the normal power transformers and switchgear. The room shall be ventilated directly to and from the exterior.
 - Power distribution from the two sources by independent routes.
- Power sources and power surges. Provide conditioners, suppressors and 15-minute UPS where needed. IBC § 909.11.1

Detection and control systems.

- Comply with NFPA 72.
- Comply with UL 864 and UUKL.

Positive confirmation of:

- Actuation.
- Testing.
- Manual override.
- Presence of power downstream of all disconnects.

Weekly preprogrammed test sequence:

- Abnormal conditions report audibly
- Abnormal conditions report visually
- Abnormal conditions printed report

- Wiring shall be in conduit. IBC § 909.12.1

System activation. IBC § 909.12.2

- Mechanical pressurization, airflow or exhaust methods shall have completely automatic controls.
- Passive smoke control may be actuated by listed releasing service spot-type detectors.

Automatic control. IBC § 909.12.3

- Initiated from an appropriately zoned automatic sprinkler system or from an appropriately zoned, total-coverage smoke detection system complying with NFPA 72.
- Control air tubing. IBC § 909.13
- Marking and identification of detection and control systems shall be clearly marked at all junctions, accesses and terminations. IBC § 909.14
- Control diagrams showing all devices in the system, identifying their location and function shall be maintained current at three locations. IBC § 909.15
- Fire-fighter's smoke control panel. IBC § 909.16
 - See the Henderson smoke control panel guide and checklist for more information.
 - Smoke control system fans shall be shown on the panel indicating airflow. IBC § 909.16.1
 - The panel shall provide control capability over the complete system including kitchen hoods. IBC § 909.16.2.
 - Control actions and priorities once issued from the fire-fighter's panel shall not be over-riden from any other means or control point in the building including temperature actuated linkage. IBC § 909.16.3(1)
- System response time shall be initiated immediately. Confirmation of proper operations shall be indicated within 60 seconds. IBC § 909.17
- Smokeproof enclosures shall consist of an enclosed inter exit stairway and a vestibule. IBC § 909.20
- The minimum vestibule dimensions shall not be less than the required width of the corridor leading to the vestibule but not less than 44-inches and have a length of not less than 72-inches. IBC § 909.20.1
- Smokeproof enclosures shall be separated by not less than 2-hour fire resistive rated fire barrier. IBC § 909.20.2.1
- Vestibules shall be separated from the stairs and adjacent spaces by not less than 2-hour fire-resistance-rated fire barrier. IBC § 909.20.2.1
- Doors in a smokeproof enclosure shall be self-closing or automatic-closing via a smoke detector installed at the floor-side entrance to the enclosure. Activation of any enclosure door smoke detector shall close all enclosure doors. IBC § 909.20.2.1

- Smokeproof enclosure ventilation by natural means. IBC § 909.2.3
- Pressurized smokeproof stair enclosure. IBC § 909.20.5
 - The design pressure shall be 0.05 inch of water gage relative to the vestibule with all stairway doors closed under the maximum anticipated stack pressures. The vestibule with door closed shall have a minimum 0.05-inch of water gage pressure relative to the fire floor.
 - The pressure difference across doors shall not exceed 30 lbs maximum opening force. IBC § 909.20.5.1
- Pressurized smokeproof stair enclosure vestibule door. The door assembly from the building into the vestibule shall be a 20-minute fire door with gaskets (e.g., s-labeled). IBC § 909.20.5.2
- Pressurized smokeproof stair enclosure dampered relief opening. A controlled relief opening capable of discharging a minimum of 2,500 cfm of air at the design pressure difference located at the top of the enclosure. IBC § 909.20.5.3
- The activation of pressurized smokeproof stair enclosure venting equipment shall be by smoke detectors installed at each floor level in an approved location at the entrance to the enclosure. IBC § 909.20.6
- The activation of pressurized smokeproof stair enclosure venting equipment shall be by power failure. IBC § 909.20.6
- Ventilation systems for pressurized smokeproof stair enclosures shall be independent of other ventilation systems. Equipment and ductwork shall be located on the exterior of the building, within the enclosure or separated from the building by a 2-hour barrier. IBC § 909.20.6.1
- Power for ventilation systems serving pressurized smokeproof stair enclosures shall be powered by a standby power system. IBC § 909.20.6.2
- Smoke exhaust systems are required in underground buildings (see 405.5) IBC § 909.21

ACCEPTANCE TESTING

- Acceptance testing for function, sequence, capacity and installed condition. IBC § 909.18
- Smoke or fire detectors that are part of the smoke control system shall be tested in their installed condition. Where applicable, this testing shall include verification of airflow in both minimum and maximum conditions. IBC § 909.18.1
- Ducts that are part of a smoke control system shall be traversed to determine actual air quantities. IBC § 909.18.2
- Ducts shall be leak tested to 1.5 times the maximum design pressure. Measured leakage shall not exceed 5 percent of design flow. 9.9.10.2
- Dampers shall be tested for function in their installed condition. IBC § 909.18.3
- Inlets and outlets shall be read to determine air quantities. IBC § 909.18.4

- Fans shall be examined for correct rotation. Measurements of voltage, amperage, revolutions per minute and belt tension. IBC § 909.18.5
- Motor driven fans shall not be operating beyond their nameplate horsepower as determined from measurement of actual current draw. IBC § 909.10.5
- Power systems. Transfer to full standby power shall be automatic and within 60 seconds of failure of the primary power. IBC § 909.11
- System response time shall be initiated immediately. Confirmation of proper operations shall be indicated within 60 seconds. IBC § 909.17
- Smoke barriers measurement using inclined manometers shall be made of the pressure differences across smoke barriers. Measurements shall be conducted for each possible smoke control condition. IBC § 909.18.6
- Smoke Barrier Construction – Leakage Area. Compliance shall be determined by achieving the minimum air pressure difference across the barrier with the system in the mechanical smoke control mode. Passive smoke control systems shall be tested using the door fan method or other approved method. IBC § 909.5.1
- Devices shall have an approved identifying tag or mark consistent with the approved documentation. Device tags or marks shall indicate the last time they were successfully tested and by whom. IBC § 909.18.9
- Theatrical smoke or tracer gases shall be used during final acceptance testing to visually verify air movement when required. IBC § 909.18.10
- A pressurized smokeproof stair enclosure and vestibule shall achieve a minimum pressure of 0.05 inch of water gage relative the stair to the vestibule and 0.05 inch of water gage relative the vestibule to the fire floor. The pressure difference across door shall not exceed 30 lbs maximum force to begin opening the door. IBC § 909.20.5.1
- Controls. IBC § 909.18.7
 - Each smoke zone shall be put into operation by the actuation of one automatic-initiation device. Subsequent devices in the zone shall be verified to cause the same sequence without operating the fan motors. IBC § 909.18.7
 - Control sequences shall be verified throughout the system, including verification of override from the fire-fighter’s control panel and simulation of standby power conditions. IBC § 909.18.7
- Identification and documentation. IBC § 909.18.9
 - Check charts, drawings and other documents identifying and locating each component of the smoke control system, and describing their proper function and maintenance requirements. IBC § 909.18.9
 - Devices shall have an approved identifying tag or mark on them (consistent with the other required documentation). IBC § 909.18.9