

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

SECTION 230903/283110

SMOKE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplemental Conditions of the Construction Contract and Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS

- A. Submit manufacturer's data on the following:

1.3 STANDARDS

- A. Materials shall comply with the following standards.

1. NFPA 92A Smoke Control Systems
2. NFPA 92B *Smoke Management Systems in Malls, Atria and Large Spaces*
3. NFPA 70 *National Electrical Code*
4. NFPA 72 *National Fire Alarm Code*
5. NFPA 101 *Life Safety Code*
6. IBC
7. Local Code Requirements and Amendments
8. Life Safety Report as prepared by FSC
9. UL 555 *Standard for Safety Fire Dampers*
10. UL 555S *Standard for Safety Leakage Rated Dampers for Use in Smoke Control Systems*
11. UL 864/UUKL

1.4 RELATED WORK

- A. Section 21 13 00 – Fire Suppression Sprinkler Systems
- B. Section 23 34 00 – Fans
- C. Section 23 33 00 – Ductwork Accessories
- D. Section 23 09 00 – Building Automation and Automatic Temperature Control Systems.
- E. Section 23 05 93 – Test Adjust and Balance
- F. Section 28 \_\_\_ – Addressable Fire Alarm System

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PART 2 - PRODUCTS

2.1 DESCRIPTION OF SYSTEM(S)

- A. Provide a fully functioning Smoke Management System. This system shall be fully coordinated with other life-safety within the building.
- B. System shall include the use of both passive (architectural) and mechanical means to remove and prevent the movement of smoke. Mechanical methods include the following:
  - 1. Stairwell pressurization.
  - 2. Zoned smoke exhaust systems.
  - 3. Elevator shaft pressurization systems.
  - 4. Make-up air systems.
- C. The intent of the Smoke Management System is to prevent the flow of smoke into egress areas of the building, and provide a tenable environment in the areas protected for a period of time sufficient to evacuate the building. It should be noted that smoke would exist in these areas.
- D. All components of the Smoke Management System shall be able to operate during a fire event for not less than 20 minutes.

2.2 FIRE FIGHTERS' SMOKE CONTROL STATION (FSCS)

- A. A Fire Fighters' Smoke Control Station (FSCS) shall be provided for full monitoring and manual override and control of all devices associated with the Smoke Management System. The FSCS and all control components shall be UUKL listed.
- B. The FSCS shall have the highest priority of control over all other operational states, including automatic activation of the Smoke Management System. The FSCS shall bypass all other building automation functions and local "hard-wired" controls such as Hand-Off-Auto switches, high-limit status pressure switches, freeze stats and smoke detectors.
- C. The FSCS shall not bypass controls intended to provide for electrical overloads, personal safety when servicing equipment or prevent system damage.
- D. The FSCS shall not bypass duct-mounted smoke detectors on supply air systems.
- E. The FSCS shall include a graphic representation of the building, the smoke zones and the Smoke Management System. Fans, dampers, ductwork and other devices shall be clearly indicated on the FSCS along with direction of airflow.
- F. The status of each component shall be indicated by a pilot light according to the following legend:
  - 1. GREEN - Devices in their NORMAL or OPERATING state.
  - 2. YELLOW - Devices in their TROUBLE or FAULT state.
  - 3. RED - Devices in their OFF or CLOSED state.
- G. The FSCS shall include switches for all devices associated with the Smoke Management System as follows:
  - 1. ON-AUTO-OFF  
Control over each device that can be controlled from other locations or systems.

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2. OPEN-AUTO-CLOSED  
Control over each damper that can be controlled from other locations or systems.
  3. ON-OFF or OPEN-CLOSED  
Control over each device that is solely intended for use in the Smoke Management System.
- H. When a switch is in the AUTO position, other automatic or manual devices shall be allowed to control the Smoke Management device, however once a control function is issued from the FSCS, no other system or device within the building shall countermand this action.
- I. When a switch is in the AUTO position, the device's status shall be indicated (ON, OFF, OPEN, CLOSED) as noted above.
- J. VAV terminal units that are all located within and serve only one Smoke Management zone may be controlled collectively.
- K. A push-to test switch shall be provided to test all pilot lights.
- L. The FSCS shall be labeled in plain English having a font equivalent to 12-point Helvetica bold.
- M. A full-scale color drawing of the FSCS shall be submitted to the Engineer and the local Authority Having Jurisdiction for review and approval.

2.3 ACTIVATION

- A. The Smoke Management System shall be automatically activated by a signal from any of the following devices within the appropriate smoke zone:
1. Area smoke detectors
  2. Duct mounted smoke detectors
  3. Sprinkler water-flow switch
    - a. Sprinkler zones must match smoke zones.
  4. Heat detectors
- B. The Smoke Management System shall also be manually activated and deactivated from the FSCS.
- C. Response Times:
1. The Smoke Management System shall be activated immediately upon receipt of initiation signal (manual or automatic).
    - a. Devices within the system shall be activated and report the desired state or operational mode to the FSCS within the following time line:

1)	Damper closing (start)	15 Seconds
2)	Damper opening (start)	15 Seconds
3)	Completion of damper travel	75 Seconds
4)	Fan energizing (start)	15 Seconds
5)	Fan de-energizing (start)	Immediately
6)	Fan volume modulation	30 Seconds
7)	Fan at desired state	60 Seconds
8)	Pressure control modulation	15 Seconds
9)	Temperature control override	Immediately
10)	Positive indication of status	15 Seconds

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- b. Response times indicated above shall be the same whether the system has been activated manually from the FSCS or automatically from any initiation device.
- c. Components shall be sequenced as necessary to avoid physical damage to components and the system.

2.4 EQUIPMENT

- A. All devices associated with the Smoke Management System shall be UL listed for their application.
- B. Where applicable, all devices associated with the Smoke Management System shall be designed to withstand temperatures of 250°F.
- C. Dampers:
  - 1. All dampers used in engineered Smoke Management Systems shall be UL listed in accordance with UL 555 *Standard for Safety Fire Dampers* and UL 555S *Standard for Safety Leakage Rated Dampers for use in Smoke Control Systems*.
  - 2. Dampers shall be minimum Class II, rated for 250°F.
- D. Fans: Where applicable, fans shall be designed and certified by the manufacturer to withstand temperatures of 250°F. All fans used in conjunction with the Smoke Management System shall be equipped with 1.5 times (minimum of two) the number of belts required for operation. Fan motors shall have a minimum service factor of 1.15. Fans shall be supported in accordance with the building code, from non-combustible components.
- E. Ductwork: Ductwork shall be constructed and supported in accordance with the Mechanical Code. Ductwork shall be constructed to withstand temperatures of 250°F.
- F. Air Piping Used as Part of Smoke Control Systems: Hard copper tubing, Type L, wrought, copper or brass fittings installed per IBC Section 909.

2.5 ELECTRICAL POWER

- A. All electrical installations shall comply with NFPA 70 *National Electrical Code*
- B. All devices associated with the Smoke Management System requiring electrical power shall be provided with both normal and stand-by power. Transfer to stand-by power shall be automatic and occur within 10 seconds upon loss of normal power.
- C. Devices associated with the Smoke Management System relying upon volatile memory shall be provided with an uninterruptible power source able to provide 15 minutes of power.

2.6 CONTROLS

- A. Wiring: In addition to meeting requirements of the electrical code, all wiring regardless of voltage, in conjunction with the Smoke Management System shall be installed in conduit.
- B. ~~Survivability: When wiring connecting the FSCS to any remote mounted controlling device exceeds 100 feet, the wire shall be installed within a 2-hour rated enclosure in addition to conduit.~~

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C.B. Supervision

1. Provide supervision of all components in association with the Smoke Management System. Supervision shall include positive confirmation of:
  - a. Equipment operation (automatic activation, testing or manual over-ride).
  - b. Presence of power down-stream of disconnect switch(es).
  - c. Fans: Provide proof of airflow through the use of differential pressure sensors.
  - d. Dampers: Provide proof of status through the use of end switches.
2. Supervision of devices shall be indicated at the FSCS.

PART 3 - EXECUTION

3.1 INDEPENDENT INSPECTOR

- A. The Smoke Management System testing shall be carried out by an independent third-party Special Inspection Agency.
- B. The Special inspector shall be a licensed register mechanical engineer in the State of ~~State~~ Minnesota and shall be approved by the Authority Having Jurisdiction for the Smoke Management and Life Safety System.

3.2 TESTING

- A. General: All components of the Smoke Management System shall be individually tested. Testing methodology shall include the following subsets:
  1. Capacity test.(air volume and static pressure)
  2. Functionality test.(equipment operates properly)
  3. Sequence test.(equipment energizes as called for)
- B. All devices shall be tested to demonstrate the correct operating sequence and output reporting under the following modes:
  1. Normal power mode.
  2. Stand-by power mode.
  3. Manual over-ride.
- C. Detection Devices:
  1. All detection devices that are associated with the Smoke Management System shall be individually tested.
  2. The Smoke Management System shall be tested by activating one representative detection device of each within a zone. For example, if a smoke zone is equipped with smoke detectors and water flow switches, only one smoke detector and one water flow switch need be activated within this zone.
- D. Provide test report including the following data:
  1. Date and time of tests.
  2. Test participants, including local Code Authorities, representatives from the Design Team and the Construction Team.
  3. Wind speed, wind direction and outside ambient air temperature.
  4. Actual response times required for system operation.

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5. Verification of correct operating sequences.
6. Fans:
  - a. Examine fans for correct rotation.
  - b. Record airflows.
  - c. Reference Section 23 05 93 – Test Adjust and Balance for testing procedures.
  - d. Provide manufacturer's fan curve(s) and certification detailing compliance with exposure to elevated temperatures as noted above.
7. Ductwork (Including Shafts Utilized for Smoke Evacuation):
  - a. All ductwork shall be leak tested to 1.5 times the maximum design pressure. Leakage shall not exceed 5% of design flow.
  - b. Reference Section 23 05 93 – Test Adjust and Balance for testing procedures.
8. Inlets and outlets:
  - a. Record airflow at all inlets and outlets.
  - b. Reference Section 23 05 93 – Test Adjust and Balance for testing procedures.
9. Dampers: Each damper shall be tested to verify functionality.
10. Pressurization: Measure pressure differential between floors and between stairwell, vestibule and corridor(s).

END OF SECTION