SMOKE CONTROL SYSTEMS
Special Inspections and the Issues That Arise

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PRESENTATION OVERVIEW
• Smoke Control Designs
• Smoke Control Special Inspections
• Smoke Control Equipment and Controls
SMOKE CONTROL SYSTEMS

• Why do they exist?
  - Life Safety

• Where are they provided?
  - High-rise buildings
  - Underground buildings
  - Windowless Prisons/Jails
  - Smoke Protected Assembly Seating
  - Atria

TYPES OF SMOKE CONTROL

• Pressurization Method
TYPES OF SMOKE CONTROL

• Smokeproof enclosures
  – Ventilated Vestibules at each stair entrance, or
  – Stairwell Pressurization

• Elevator Pressurization
  – In lieu of elevator lobbies

Images from A Guide To Smoke Control in the 2006 IBC
TYPES OF SMOKE CONTROL

- Air Flow method
  - Use of opposed airflow
  - Often used in combination with exhaust method


SMOKE CONTROL SPECIAL INSPECTIONS

- Special inspections are a means that an AHJ uses to determine code compliance
- Required expertise in Fire Protection Engineering, Mechanical Engineering and certification as an air balancer
- Many jurisdictions require an independent Special Inspector (MA does not)
- Statement of special inspection should be submitted as part of permit documents
SPECIAL INSPECTIONS

- Test plan
  - Outline of testing
  - Description of types of tests
  - Prerequisite states of construction required
    - Duct Leakage testing
    - Damper Inspection
    - Sequence Testing
    - Performance Testing

SPECIAL INSPECTIONS

- Final inspection test report
  - Summary of Results
  - Compilation of inspection reports and any issues that were identified
  - Data Sheets of Equipment
  - Signatures of Inspectors and EOR
SPECIAL INSPECTIONS

- Installation and Component verification
  - Is the right equipment getting installed?
- Equipment Functional Testing
  - Is the equipment working properly?
- Sequence of Operations Testing
  - Are the systems properly integrated?
- System Performance Testing
  - Does the system perform as designed, as required?

EQUIPMENT AND CONTROLS

- Listings
  - Smoke Control listings ≠ Fire Alarm listings
  - UUKL UL 864
- BMS or Fire Alarm

Images from UL 864, Control Units and Accessories for Fire Alarm Systems
CONTROL PRIORITIES
1. Fire Fighters Override Panel
2. Automatic Signal
   - Smoke Detector, Waterflow Switch
3. Manual or Automatic control from other source

CONTROLS – COMMON ISSUES
• VFD Keypad not locked out
• Automatic alarm fails to override “not in auto” VFD
• VFD installed with a Bypass
• Subsequent alarms cannot alter the sequence initiated by the primary alarm.
• Control functions split between systems
  - Electrical and Mechanical specs not harmonized
SPLIT CONTROL FUNCTIONS

- Electrical specifications
  - Fan shuts down on fire alarm

- Mechanical specifications
  - Building Controls tells fan to start

CONTROL FUNCTIONS

- Always use single control system
  (Required by NFPA 92, 2012)
FIRE FIGHTERS OVERRIDE PANEL

• Status Indication for all equipment
  - Red → Closed/Off
  - Green → Open/On
  - Yellow → Fault
  - White → Normal
  - Blue → Duct Detector (Boston)

• Confirmation of Status

Image from Klote, Mike Turnbull, Kashef, Femestia Handbook of Smoke Control Engineering, ASHRAE 2012.

FIRE FIGHTERS OVERRIDE PANEL

• Manual Controls Switches
  - Should be provided for all fans, doors, and windows.
  - Manual control for dampers can often be omitted.

Image from Klote, Mike Turnbull, Kashef, Femestia Handbook of Smoke Control Engineering, ASHRAE 2012.
DUCTS

• Leak tested to 1.5 times the max design pressure

• Leakage not to exceed 5 percent of design flow

FANS – POTENTIAL ISSUES

• 1.5x minimum number of belts
• 1.15 service factor on motor
• Power disconnects not monitored
  – At the VFD
  – At the Fan
FANS – POTENTIAL ISSUES

- Positive status of flow
  - Pressure switch
  - Flow switch
  - CT sensor

VARIABLE FREQUENCY DRIVES (VFD)

- VFDs not protected with 2-hour construction
- VFDs not separated from other mechanical equipment
- Control wiring to and from room containing VFD not protected with 2-hour construction
DAMPERS – POTENTIAL ISSUES

• End switches
• Damper actuator
  – Stroke time limited to 75s or less

DOORS AND WINDOWS – POTENTIAL ISSUES

• Doors and windows are confirmed open before they are.

• Atrium Systems using natural makeup air
  – Provide UPS to powered door operators
POWER SYSTEMS

- Standby power not Emergency power

- Secondary power source or ATS in same room as normal power transformers and switch gears

WEEKLY SELF - TEST

Images from Klote, Mike Turnbull, Koshef, Ferreira Handbook of Smoke Control Engineering, ASHRAE 2012.
WHAT TO WATCH OUT FOR

- Residential buildings containing both stair and elevator pressurization
- Exit discharge doors from pressurized stairs can be a challenge to closed under pressure

QUESTIONS?

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