VASU INFOSEC LTD.

SMOKE CONTROL SYSTEM ARCHITECTURE

Engineering Knowledge Guide

DESIGN • SYSTEM INTEGRATION • TESTING • COMMISSIONING

Purpose

This guide outlines the principal engineering considerations for smoke-control system architecture. It is an illustrative knowledge resource and does not replace project-specific design, approvals or statutory requirements.

Contents

Engineering overview • System architecture • Design philosophy • Smoke-control strategy • Smoke zones • Extraction and make-up air • Fans, ducts and dampers • Pressurization • Fire alarm and BMS interfaces • Cause-and-effect • Installation • Testing and commissioning • Handover

1. Engineering Overview

A smoke control system is an engineered arrangement intended to manage smoke movement during a fire scenario. Its architecture must be derived from the building fire strategy, occupancy and geometry, compartmentation, escape provisions and intended smoke-management objectives.

2. Complete Smoke Control System Architecture

The architecture may include smoke reservoirs or zones, extract paths, make-up air provisions, fans, dampers, shafts, controls, power supplies, sensors and monitoring interfaces. Treat the arrangement as an integrated system with defined operating modes.

3. Design Philosophy

Identify design fire scenarios and the spaces, routes or zones requiring smoke management. Record assumptions, boundaries, operating objectives and dependencies supplied by the fire strategy. Do not infer an undefined design fire or performance criterion.

4. Smoke Control Strategy

Map smoke extraction and replacement-air paths, including openings, ducts, shafts, dampers and discharge locations. Check path continuity and identify potential short-circuiting, recirculation or interference with escape routes.

5. Design Fire & Scenario Assessment

Define fan duties, operating conditions, temperature exposure requirements where specified, pressure losses, control arrangements and maintainability. Support equipment selection with project calculations and manufacturer data.

6. Smoke Zone Identification

Develop a zone-based sequence identifying initiating events, equipment commands, damper positions, status feedback, overrides and reset conditions. Coordinate with fire alarm, HVAC, lift, access-control and emergency-power interfaces as applicable.

7. Smoke Reservoirs & Layer Management

Identify the smoke reservoir or zone arrangement in accordance with the approved fire strategy. Confirm its relationship with extraction points, replacement-air openings and protected escape routes.

8. Smoke Extraction Principles

Establish designated extraction locations, airflow paths, fan interfaces and discharge points in accordance with the approved design.

9. Make-Up Air Strategy

Coordinate replacement-air openings and supply systems to avoid unintended short-circuiting, recirculation or interference with evacuation routes.

10. Smoke Exhaust Ductwork

Coordinate duct routes, dimensions, pressure losses, structural openings, supports, fire performance and maintenance access. Maintain the intended airflow path in accordance with coordinated drawings.

11. Smoke Shafts & Discharge

Coordinate smoke shafts and discharge locations with building geometry, structural openings, equipment access and the approved smoke-management strategy.

12. Smoke Exhaust Fan Selection

Base fan selection on specified airflow, pressure duty, operating conditions, temperature exposure where required, power supply and manufacturer performance data.

13. Fan Duty & Pressure Loss

Determine the required fan operating point from project airflow requirements and calculated system resistance. Consider ductwork, fittings, dampers, shafts and other pressure-loss contributors.

14. Smoke Dampers & Control Devices

Identify damper type, location, actuator, operating position and feedback arrangement from the approved design. Coordinate devices with smoke zones, control panels and fire alarm interfaces.

15. Natural Smoke Ventilation Interfaces

Where natural smoke ventilation is specified, coordinate natural openings, vents, actuators, control signals and replacement-air provisions with the building fire strategy.

16. Mechanical Smoke Ventilation

Define operating modes, fan commands, damper responses, power dependencies and interfaces for each applicable mechanical smoke-ventilation scenario.

17. Staircase & Lobby Pressurization Interface

Coordinate staircase and lobby pressurization with the smoke-management strategy. Verify pressure relationships, airflow requirements, door operation, leakage paths and fan control against approved project criteria.

18. Power Supply & Resilience

Identify normal and emergency power requirements, essential distribution, control supplies and failure indications from the project design basis. Document dependencies.

19. Control Panels & Field Devices

Coordinate control panels, sensors, actuators, field devices and communication interfaces. Verify equipment identification, signal mapping, power dependencies and feedback indications.

20. Fire Alarm Interface

Define initiating signals, output commands, interface modules and monitoring signals for the approved smoke-control sequence. Follow the approved life-safety control philosophy.

21. BMS & Monitoring Interface

Define BMS/IBMS monitoring points, communication architecture, control permissions and failure indications. Life-safety control priorities must follow the approved design.

22. Cause-and-Effect Matrix

Develop a matrix identifying initiating events, equipment commands, damper positions, status feedback, overrides and reset conditions. Obtain approval from responsible design stakeholders.

23. System Zoning & Operating Modes

Define normal, emergency, manual override, maintenance and recovery modes where applicable. Identify affected zones and verify commands and status indications against the approved sequence.

24. Installation & Coordination

Coordinate plant rooms, shafts, duct routes, structural openings, access, discharge points and make-up air paths. Resolve clashes before installation.

25. Access & Maintainability

Provide access for inspection, testing, replacement and maintenance of fans, motors, dampers, actuators, sensors, panels and associated equipment.

26. Testing & Commissioning

Test components and integrated sequences, including fan operation, damper response, status indication, control logic and failure conditions. Record results against approved acceptance criteria.

27. Integrated Scenario Testing

Verify representative scenarios from initiating signal through control logic, fan and damper activation, status feedback and relevant system interfaces. Document test conditions and results.

28. Failure & Recovery

Identify equipment, communication, power and control failures. Verify fault indications and recovery procedures against the approved design. Record deviations and corrective actions.

29. Documentation & Handover

Maintain traceability between approved drawings, equipment schedules, control narratives, cause-and-effect matrices, inspection records, commissioning results, as-built drawings and O&M; manuals.

30. Engineering Objective

Establish smoke-management requirements, define system boundaries, coordinate extraction and replacement-air paths, select suitable equipment, integrate controls, verify sequences and maintain traceable handover records.

Frequently Asked Questions

What is the purpose of Smoke Control System Architecture?

It defines the engineered arrangement used to manage smoke movement during a fire scenario, based on the building fire strategy, occupancy, geometry, compartmentation and escape provisions.

What is the high-level process?

Fire Strategy → Requirements → System Boundary and Interfaces → Equipment Definition → Coordinated Design → Installation → Inspection → Functional and Integrated Verification → Documentation → Handover.

What information should be confirmed before implementation?

Confirm the approved design basis, project inputs, operating conditions, coordinated drawings, interface requirements, manufacturer information and acceptance criteria. Refer ambiguous inputs to the responsible project engineer.

Does this guide establish project compliance or a final design?

No. This is an illustrative engineering knowledge resource, not a verified project record, design approval or compliance certificate. Project-specific requirements and technical decisions must be independently verified.

Engineering Disclaimer

Smoke-control performance criteria, design fires, airflow rates, pressure targets, equipment ratings and acceptance limits must come from the approved project design and applicable requirements. Manufacturer application data and responsible engineering approvals must govern project implementation.

VASU INFOSEC LTD. | Fire & Life Safety | Electronic Security