Designing for Successful Smoke Controls

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About the SCA

The Smoke Control Association (SCA) is an independent body involved in various aspects of smoke control; including design, CFD, manufacturing, install, commissioning, service and maintenance.

Past projects include the publication of guides related to the design of smoke control systems and projects.

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Aim

- Highlight the design considerations that should be adopted early in the project life cycle to help achieve success.

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Challenges for a Successful Smoke Control System

Achieving the customer requirements

Keeping within budgetary constraints

Acceptance by Building Control Authority

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What is Smoke Control?

BS 9999 – Fire safety in the design, management and use of buildings

- **3.107 smoke control**
  technique used to control the movement of smoky gases within a building in order to protect the structure, the contents, the means of escape, or to assist fire-fighting operations

BS 7346-8 Code of practice for planning, design, installation, commissioning and maintenance

- **3.26 smoke control system**
  arrangement of components installed in a building to limit the effects of smoke and heat from a fire

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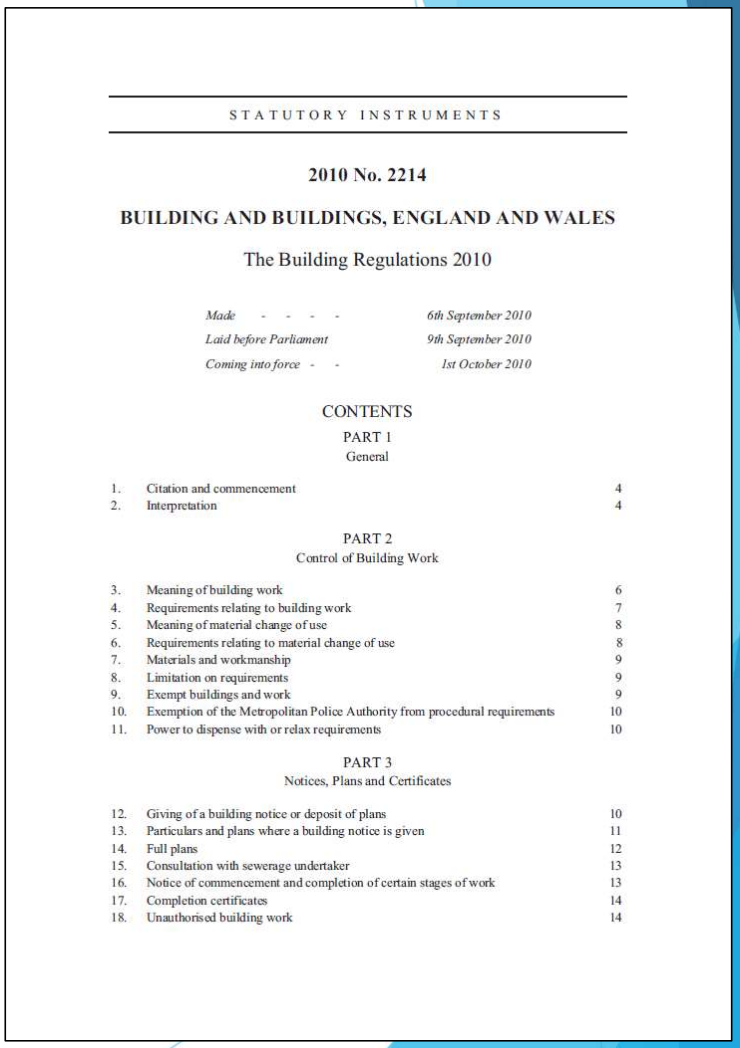
Legal Obligations

The Building Regulations 2010

Requirements relating to building work

4.—(1) Subject to paragraph (2) building work shall be carried out so that—

- (a) it complies with the applicable requirements contained in ***Schedule 1***; and
- (b) in complying with any such requirement there is no failure to comply with any other such requirement.



STATUTORY INSTRUMENTS

2010 No. 2214

BUILDING AND BUILDINGS, ENGLAND AND WALES

The Building Regulations 2010

Made - - - - 6th September 2010
Laid before Parliament 9th September 2010
Coming into force - - 1st October 2010

CONTENTS

PART 1
General

PART 2
Control of Building Work

PART 3
Notices, Plans and Certificates

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The Building Regs - Schedule 1

Schedule 1
Part B Fire Safety

B1. Means of warning and escape

The building shall be **designed** and **constructed** so that there are appropriate provisions for early warning of fire, and **appropriate means of escape in case of fire** from the building to a place of safety outside the building capable of being safely and effectively used at all material times.

B5. Access and facilities for the fire service

(1) The building shall be **designed** and **constructed** so as to provide reasonable facilities **to assist fire fighters** in the protection of life.

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Approved Document B

- Guidance on each of the technical parts of the regulations
- Guidance for common building situations
- Guidance on potential ways to achieve compliance
- Where followed, a court or inspector will tend to find that there is no breach of the regulations

But…

- Cannot cater for all circumstances, variations and innovations
- Other ways to comply with the requirements than the methods described in an approved document
- Demonstrate that the requirements of the regulations have been complied with

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Other Key Regulations

Other than The Building Regulations 2010,

- CDM Construction Design Management Regulations 2015
- CPR Construction Product Regulations 2013
- RRO The Regulatory Reform (Fire Safety) Order 2005

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Key Design Standards

BS 9999
Fire safety in the design, management & use of **building**

BS 9991
Fire safety in the design, management & use of **residential buildings**

BS 7346-8
Components for smoke control systems – planning, **design**, installation, commissioning & maintenance

BS 7346-7
Components for smoke control systems – functional recommendations & calculation methods for smoke & heat control systems for covered **car parks**

BS EN 12101-13
Smoke and heat control systems - **Pressure differential systems** (PDS). Design and calculation methods, installation, acceptance testing, routine testing and maintenance

BS 8519
Selection & installation of fire resistant **power & control cable systems** for life safety & fire-fighting

BS 7671
Requirements for Electrical Installations. IET **Wiring Regulations**

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Key Product Standards

BS EN 12101-1 Smoke and heat control systems - Specification for smoke barriers

BS EN 12101-2 Smoke and heat control systems - Natural smoke and heat exhaust ventilators

BS EN 12101-3 Smoke and heat control systems - Specification for powered smoke and heat control ventilators (Fans)

BS EN 12101-6 Smoke and heat control systems - Specification for pressure differential systems. Kits

BS EN 12101-7 Smoke and heat control systems - Smoke duct sections

BS EN 12101-8 Smoke and heat control systems - Smoke control dampers

BS ISO 21927-9 Smoke and heat control systems - Specification for control equipment

BS EN 12101-10 Smoke and heat control systems - Specification for power output devices

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Guidance Documents

SCA Guides
https://www.smokecontrol.org.uk/resources

- SCA Guidance on Smoke Control to Common Escape Routes in Apartment Buildings (Flats and Maisonettes)
- Guidance on the Specification of Products and Systems for Smoke Shafts – WP001
- SCA guidance on CFD analysis for Smoke Control design in Buildings
- SCA Guide Vent Systems Loading Bays and Coach parks

SCA Working Groups to produce future guidance documents

Guides from other organisations, include:

- CIBSE
- BSRIA
- IET

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Type of Smoke Control Systems

- **Natural ventilation** (e.g. AOV)
  In accordance with ADB – code compliant solution
- **Natural shaft system**
  In accordance with ADB – code compliant solution
- **Pressure differential system**
  In accordance with performance requirements of BS EN 12101-6, as identified in ADB, a fire engineered solution via calculation of the pressurized spaces, but does not require a CFD
  - **Pressurization** – protected spaces are positively pressurized relative to fire zone e.g. +50 Pa
  - **Depressurization** – fire zone is depressurized relative to the protected spaces, e.g. -50 Pa
- **Mechanical smoke ventilation systems** (e.g. smoke extract)
  Alternative approach to ADB, in accordance with BS 9999 / BS 9991 – fire engineered solution & requires CFD
- **Car park systems**
  In accordance with BS 7346-7, some performance requirements prescribed, others to be justified via fire engineering & requires CFD

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Key steps to success - Fire Strategy

- ✓ Establishes the Fire Safety arrangements of the construction
- ✓ Should clearly identify areas requiring protection
- ✓ When is a system to protect corridors and when is it only protecting stairs
- ✓ Should provide a simple “top level” statement of the intended “cause & effect”
- ✓ Should be agreed by the Authority Having Jurisdiction (AHJ)

- × Should **NOT** specify components or dimensional properties unless to identify limits and constraints within the building
- × This is **NOT** a design of smoke control system
  - ✓ But it is an intention of the design principles!

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Key steps to success - QDR & CFD

QDR - Qualitative Design Review

- ✓ Establishes the fire modeling input parameters & acceptance criteria
- ✓ To be approved by Building Control Authority

CFD – Computational Fluid Dynamics

- ✓ Proves the concept for the design
- ✓ Confirms tenability of escape route during means of escape and fire fighting phases.
- ✓ Establishes the performance criteria
- ✓ To be approved by Building Control Authority

- × Should **NOT** specify components or dimensional properties unless to identify limits and constraints within the building
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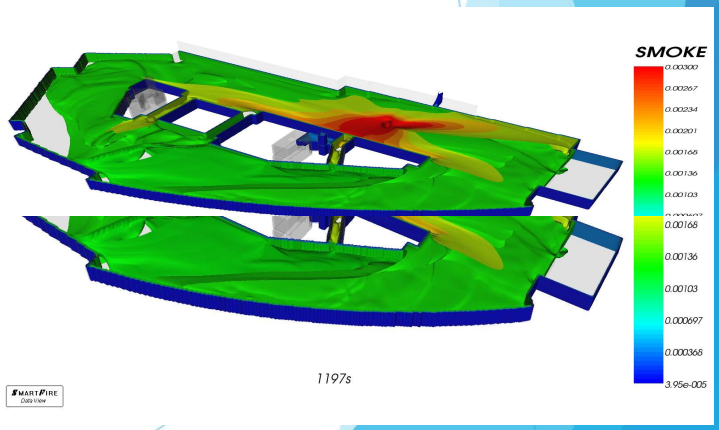

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Key steps to success - Design

- ✓ Consider the requirements of the Fire Strategy
- ✓ Consider the performance criteria of the CFD (MSVS & car parks)
- ✓ Consider the customer M&E specification & requirements
- ✓ Consider the scope of the purchased system
- ✓ Consider the building architectural arrangements
- ✓ Consider requirements of applicable standards
- ✓ Consider methods of activation and controls
- ✓ Consider the requirements of end users & maintainers
- ✓ Consider selection of components
- ✓ Produce design information, drawings specifications, C&E's

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Competence

Competence can be described as the combination of :

- Training
- Skills
- Experience
- Knowledge

that a person has and their ability to apply them to perform a task safely. Other factors, such as **attitude** and **physical ability**, can also affect someone's competence.

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Designer Competence

Challenges:

- Training – No industry training currently available
- Skills – developed via experience and knowledge
- Experience – time served
- Knowledge – from guidance, standards and shared information

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Training

SCA Training Working Group:

- Awareness
- Design
- Installation
- Commissioning & maintenance

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Can you trust your Smoke Control Designer?

Does your organization operate an ISO 9001 management system?

Requirement for supplier assessment:

- Assess your designers!
- Tedious and time consuming
- Is your organization skilled enough to undertake such assessments

Is there a better way?

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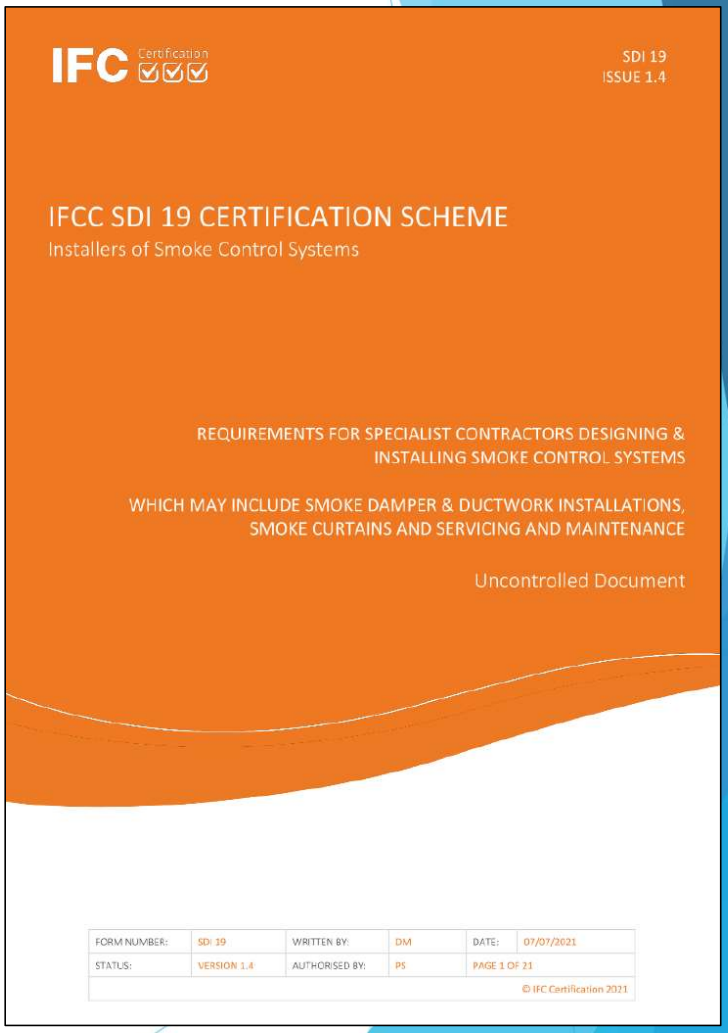
SDI 19 Smoke Control Systems Installer Certification Scheme

- An independent certification scheme run by IFC Certification, operated under UKAS accreditation
- The only scheme within UK covering Smoke Control Systems
- Mandatory for all SCA members carrying out works on smoke control systems
- SCA recommends all installers operate under this certification scheme



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Common Challenges

Fire Strategies

- Lack of confirmation of the design objectives
  too many "***what if"*** scenarios left unconfirmed.
- Sometimes don't tell us the key information;
  e.g. what are we protecting within our design?
- Often advise use of items that cannot be product certified
  e.g. use of an external door as an AOV

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Common Challenges continued…

Physical issues

- Smoke shafts wrong size
- Smoke shaft in wrong location
- Doors poorly positioned or wrong orientation
- Poor ductwork arrangements

Construction first, then design?

- Smoke control design commissioned after the building is constructed
  Contrary to Building Regs:
  "B1. *The building shall be **designed** and **constructed*** "

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Common Challenges continued…

Information validity

- Is the information still current?
- Key project documents are often revised, but is the design updated?

Compliance

- Use of uncertified products such as doors as AOV's or fire doors in a smoke shaft
  problems getting BCO approvals

Additional system use

- Required use as day-to-day ventilation
  can cause conflicts between the two functions

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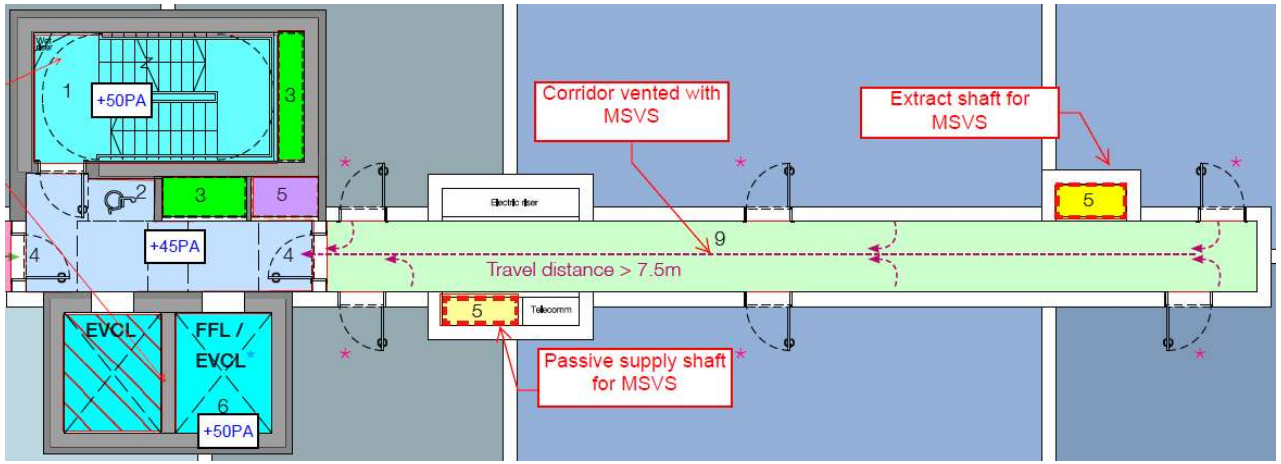
Considerations for the future

BS 9991 update – under review of comments

- Pressurization for all Fire Fighting Stairs (+18m), within single stair buildings



- Requires **Stair**, **Lifts** & **Lobbies** to be pressurized
- Still requires smoke control for each common corridors, similar to current requirements
- Supply air via stairs/lift not acceptable – requires separate source supply
- Significant uplift in plant requirements
- Space issues

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Future considerations

BS 9991 continued…

Or,

- Provide two escape stairs

- Manual controls only for post fire activities

Considerations for other standards

Overlapping standards become potential conflicts

- Can standards committees refrain from duplicating requirements?
  - E.g. Run to destruction "*Variable Speed Drives*", no longer a "thing" (BS 8519:2020)
  - Unless you're designing car parks, where' it's still a thing! (BS 7346-7:2013)

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Designing for Successful Smoke Controls Closing points

- Greater clarity within Fire Strategies will benefit design phase of projects
- Design should proceed construction
- Engage designers early in the process
- Design of smoke control systems is a complex and changing area
- Use SDI 19 certified smoke control providers
- SCA members will help you achieve a compliant and successful system

Good design is crucial to overall success

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Thank you

Any questions?

www.smokecontrol.org.uk

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