Approved Document B 2006 - Single stairways - Residential uses Part 3 Shaft Ventilation

Single Stair E - The shaft vent system

This system allows the same categories of building as described in Part 2 (single stair C and D) but solves the problem where the lobby is not located adjacent to an external wall. Therefore single stair residential buildings can be built without restriction on height (although the BRE research was up to 100 storeys). The theory is that smoke from a fire will vent out of the path of least resistance around the smoke seals of the lobby fire door into the stairway lobby and up an interlinked shaft, rather than smoke log the stairway. Upon detection of smoke in the lobby a vent panel will open between the lobby and the shaft, smoke will then travel up the shaft and out of a ventilator at the top (this is also triggered to open by the detector in the lobby). Essentially for smoke to move efficiently out of a building the smoke needs to be replaced with air coming in to the building under the smoke layer.

The inlet air path is via a 1m² ventilator located at the head of the stairway. Air is drawn down the stair, through the gaps around the stairway door on the fire floor and under the smoke layer in the lobby. This assists the smoke to flow up the shaft. Smoke seals on the door between the stairway and lobby should be omitted as they will allow more inlet air to flow into the lobby (although this is not mentioned in the Approved Document).

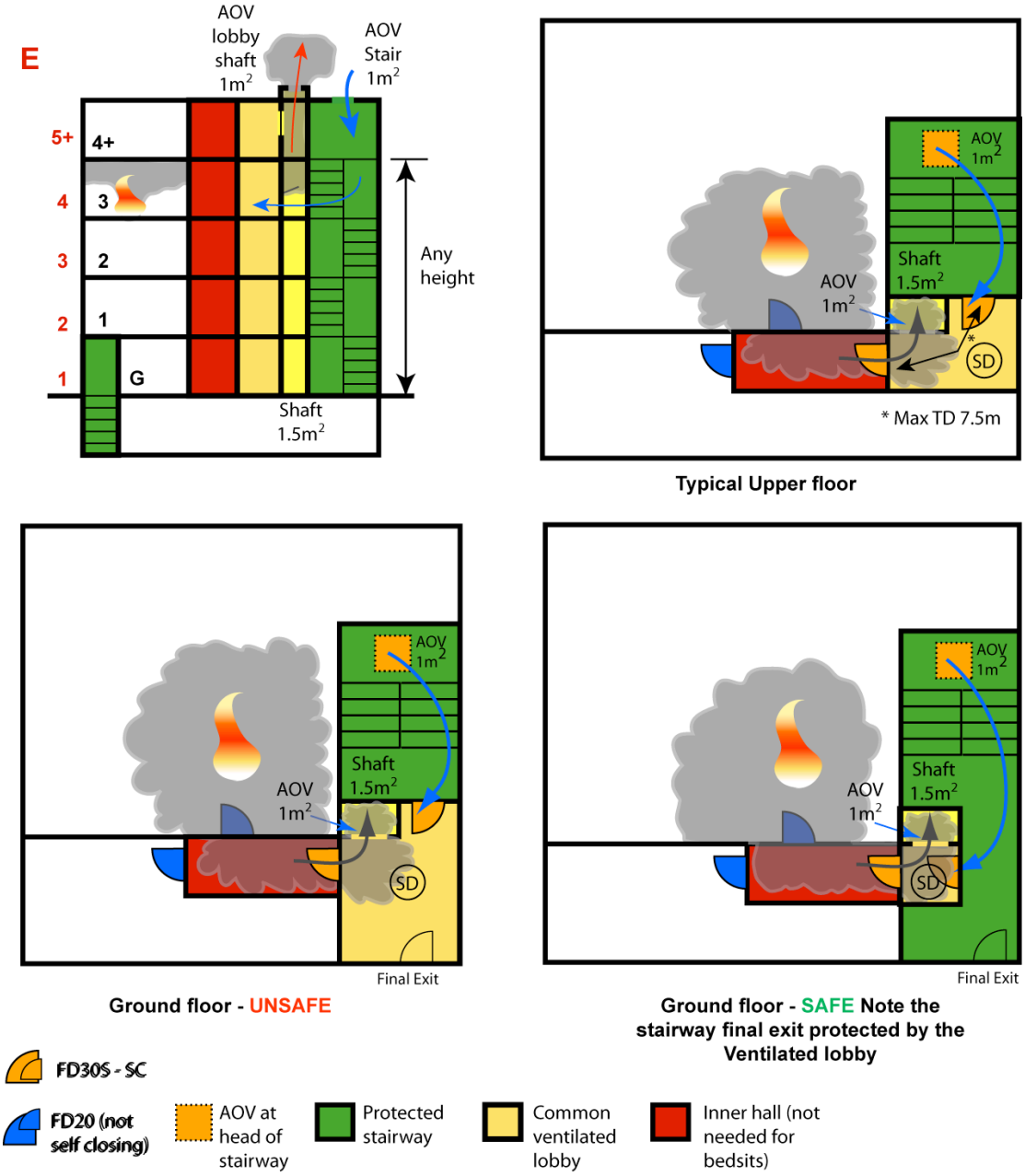
Design considerations:-

Shaft construction

1. The more rectangular the shaft shape the less efficient it will be. The Approved Document recommends the shaft should be at least 0.85m in either width or depth. The area of the shaft should be 1.5m²

2. The shaft should be vertical with no more than 4m at an inclined angle (max 30°) and be of non combustible construction.

3. Nothing should be provided in the shaft which obstructs the air flow, including safety platform grills across the shaft. In theory the reduction in airflow could be considered and the size of the shaft increased accordingly. But there is very little work to draw upon which can be used to assess the situation. A formula does exist for mesh grills from the work of Idelchik [1] but this is limited to certain types of grills and are not those normally used for safety grill floors. Idelchik's work does show that even thin grills will have a significant affect on airflow and cannot be ignored.



E - Single stair unlimited height. Basement connection NOT permitted

AOV 1m² at head of stair and top of lobby shaft
AOV 1m² to lobby vent in to shaft.
Shaft to be 1.5m².

Note the shaft vent system can also be used in single stair category D.

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Ancillary accommodation – See item 3 under Generally at the end of the article.

Ventilators into the lobby vent shaft

4. The ventilators should have a E30Sa rating (this is the new Approved Document description for a 30 minute fire resisting, smoke resisting door; previously FD30S). This means the door or ventilator needs to be tested to BS EN 1634-3 Smoke control doors: 2001. The vent into the shaft is normally a door.

5. The ventilator size is 1m² for a clear opening size.

Outlet ventilator to lobby shaft and head of stairway

6. The ventilator at the head of the shaft and the stairway should achieve a clear area of 1m², and should not appreciably obstruct the vent flow out of the shaft. Diagram C7 is provided in Approved Document B 2006 which shows how the clear area can be measured.

Some types of ventilator are impossible to assess by measurement alone (such as those with a roof and side mounted vents). In such cases the actual air flow can only be assessed by testing the ventilator with actual airflow as described in BS EN 12101-2:2003 – this is normally carried out by the manufacturer of the vent.

7. The doors or ventilators opening into the shaft from the lobbies need to open on the fire floor only, all other ventilators into the shaft should remain closed on all other floors. Therefore whatever mechanism is used to keep the doors or ventilator closed needs to resist the heat of the smoke rising up the shaft (e.g. self closing devices on unlatched smoke shaft ventilator doors). Otherwise the ventilators on other floors will open and spread smoke to the other levels. Essentially this means that such door or ventilator 'furniture' needs to be fire tested to BS 476-22 or BS EN 1634-1:2000.

Outlet locations

8. The outlet of the smoke shaft should:-

a. extend 2.5m above the ceiling of the highest storey, and

b. be raised up at least 500mm above the level of the roof for a horizontal distance of at least 2 m surrounding the lobby shaft outlet and stair inlet vent. This also means the stairway vent should be at least 2m away from the lobby smoke vent on the roof.

Fire detection system

9. Approved Document B 2006 Vol. 1 does not appear to give any guidance regarding the standard of smoke detection system to activate the vents. For flats mention is given only of a BS 5839-6:2003 system in item 1.4, however the scope of the BS is applicable only for the internal parts of dwellings or Houses in multiple occupation. Therefore I would suggest the vents should be operated by a more robust system i.e. BS 5839-1:2002 L5 system would be suitable.

Ground floor layout

As previously discussed in this series the ground floor layout needs to be different from the upper floor. The ventilated lobby needs to protect the final exit from the stairway as shown in the diagram on the previous page. This aspect is worth checking at the earliest opportunity as it is common for designers to provide a smoke shaft which at ground floor level ventilates the stairway rather than the lobby protecting the stair! (note the plans labelled UNSAFE and SAFE).

Generally

The usual requirements apply in respect of the following:-

1. Self contained early warning smoke detection provided in each dwelling to BS 5839-6:2004 at least Grade D LD3 standard, with a standby power supplyA higher standard of system and a backup power supply is now a requirement of Approved Document B 2006 (ADB 2006 Vol. 2 - 1.4 and 1.5).
2. Travel distances are complied with (9m in entrance hall – bedsits, HMO's restricted distance in rooms (9m in bedrooms, 18m in other rooms) but no

restriction for any rooms in flats and maisonettes unless bedsits) (ADB 2006 Vol. 2 - 2.13, 2.14 and 2.16).

3. Access to ancillary accommodation is addressed*.

*Approved Document B 2006 Volume 2 suggests that ancillary accomodation cannot open into the stairway or ventilated lobby (paragraph 2.30), however BS 5588: Part 1 does permit a connection with the common escape routes provided it is not on the same floor as residential accommodation (19.1.2) and maintains ventilated lobby separation (14.6.2 c) and d). This code generally states ventilated lobby separation is needed for car parks and 'higher fire risk areas' for multi and single stair situations, but as we are dealing with only single stair situations here it is clearer to say that the 1.5 m² shaft ventilated lobby protection is needed for all connections whether low of high risk ancillary accommodation, but they should not be on the same level as residential uses.

2.40 of Approved Document B 2006 Vol. 2 permits electricity meters in single stairways provided they are enclosed with fire resisting constriction within a secure cupboard. Paragraph 24 of BS 5588: Part 1 covers gas.

Where buildings exceed four storeys, the Approved Document to H 6 (item 1.6) of the Building Regulations recommends that a common refuse chute can be used as a means of refuse disposal. Approved Document B 2006 5.55 recommends refuse chutes and rooms are not located in the stairway or common lobby. However it is unclear from this document how access can be provided to the building, apart from inside an apartment. However BS 5588: Part 1 clarifies this in item 21.2 c) and states the refuse chutes or rooms containing refuse storage can access a common lobby via a further small lobby having a 0.2m² permanent ventilation.

Fire fighting shafts

Where fire fighting shafts are needed for residential buildings, the shaft vent system can be used. Reference should be made to Approved Document B 2006 item 17.13 and 14 and clauses 7 and 8 of BS 5588-5:2004.

Testing

It is important that the shaft vent system is tested to ensure the sequence of operation of vents work correctly, particularly that the vent on the fire floor and head of the shaft and stair open; whilst the shaft vents on the non fire floor remain closed.

Fire safety information

A new Regulation (16B) in the Building Regulations now requires the person carrying out the work to provide fire safety information for the purpose of maintaining fire safety systems under the Regulatory Reform (Fire safety) Order 2005. Therefore information regarding the operation and how to maintain the system should be provided. (ADB 2006 Vol. 2 – 0.12)

References

[1] CIBSE Guide C Flow of fluid in pipes and ducts - page 4-115.

Amendments

2/5/02 – Fire door standards added.