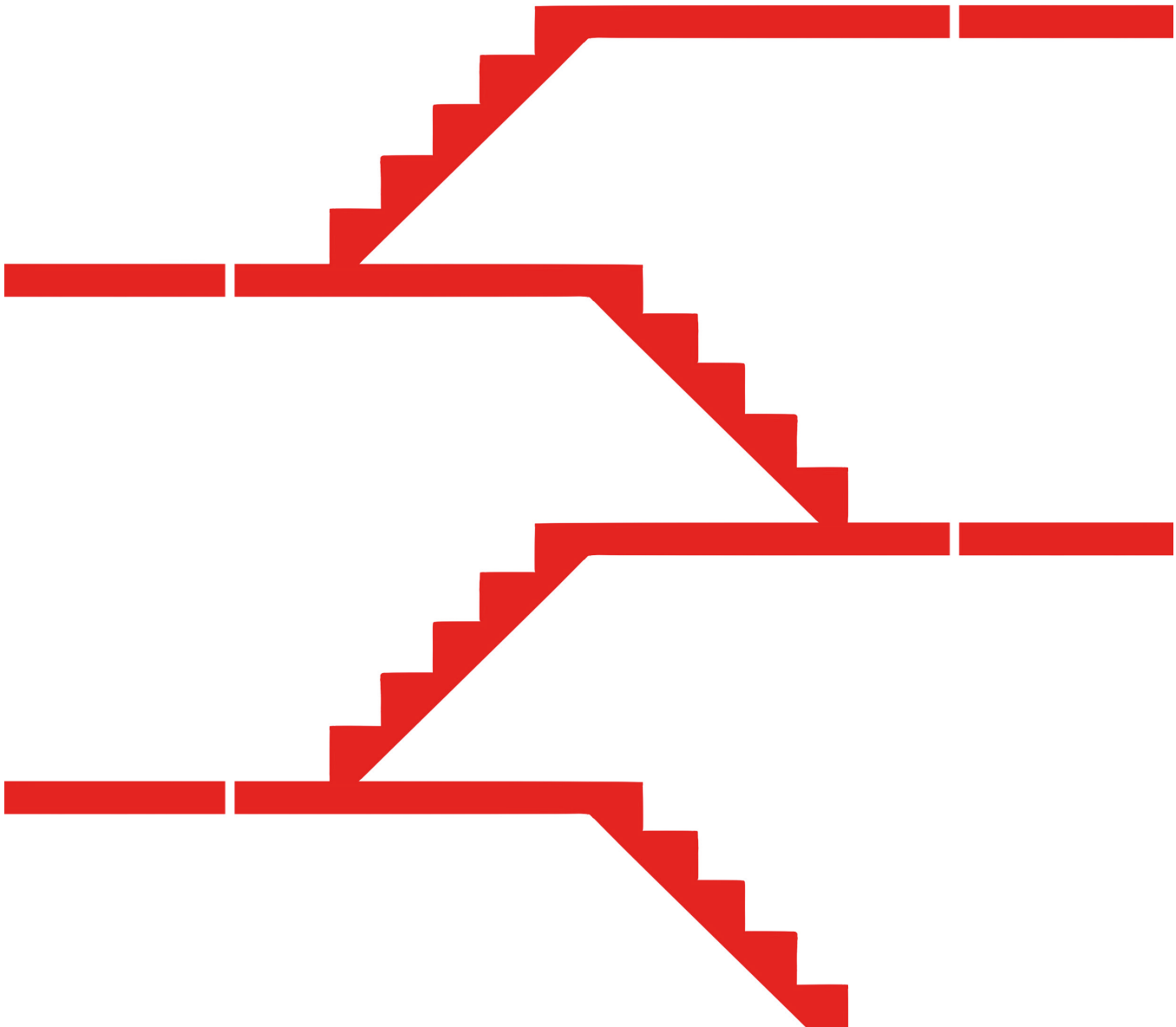
Pocket Guide to Stairwell AOVs

A GUIDE TO UNDERSTANDING AND IMPLEMENTING STAIRWELL AOVs



About Group SCS

Industry experts with more than 25 years of experience

Group SCS is an expert provider of smoke control systems and BEMS, delivering solutions with safety at its core. Our work on thousands of complex UK construction projects and in-depth knowledge of the smoke control industry have paved the way to innovation and given us the expertise required to handle projects of any scope.

Group SCS offers a pre-designed suite of customisable solutions that can be applied to a wide range of buildings for the protection of escape routes. The current range includes:

- Smoke shafts
- Automatic opening vents
- Car park ventilation
- Fire and smoke damper control systems
- Fire curtains

What we offer

Smoke Control

Comprehensive packages with innovative open source controls that facilitate integration with our BEMS and fire alarm installations.

BEMS

Cost and energy-efficient systems that integrate various environmental controls such as heating, lighting, ventilation and security through one system.

Modular Solutions

A range of standardised modular smoke control systems that can be self-selected, specified and purchased through a variety of routes.

Window Technology

A wide range of innovative solutions for the automation of windows, roof & skylights for natural, smoke and environmental ventilation.

Training

Group SCS supports a network of trained Approved Installers, who have expert knowledge of our range and benefit from our ongoing support.

Support & Afercare

Our Support and aftercare division provides service and maintenance and ensures that buildings remain safe after handover.

Guide to Stairwell AOVs

Definition

A stairwell ventilator is an automatic opening ventilator which provides at least 1.0m^2 of free area when open. The table below shows the required dimensions, which also feature in the Building Regulations 2010. The installation is always located at the highest point in an evacuation stairwell and can take a number of forms. The most common type of stairwell ventilators are louvred, hatch type, windows and roof windows.

Primary Purpose

The stairwell ventilator usually serves one of two purposes:

- It removes any smoke that gets in the stairwell of small buildings
- More commonly it provides replacement air for a lobby smoke extract system in large buildings

If a fire breaks out, which results in smoke getting into communal lobbies or corridors adjoining the escape stairwell, there needs to be some means of removing smoke from these areas. Solutions to this include the installation of an automatic opening ventilator (AOV) or a natural/mechanical smoke shaft system. As smoke is extracted through such a system, the stairwell ventilator provides replacement air to allow people to escape safely and firefighters to enter the building easily to tackle the fire.

Where are Stairwell AOVs used?

Residential buildings

Stairwell ventilators are commonly used in the stairwells of flats where protecting the common escape routes is of paramount importance. The exact requirements for ventilating such buildings are stipulated in Approved Document B of the Building Regulations 2013. There are two main categories which are considered:

Small single stair buildings

Small single stair buildings are those which have a top floor less than 11m above ground, with no more than three storeys above the ground floor level. The stair does not connect with a covered car park or ancillary accommodation unless via a ventilated lobby. In such buildings, there is no requirement to protect the lobby. A ventilator at the head of the staircase that can be operated remotely from the fire service access level is required

Approved Document B (fire safety) volume 1: Dwellings, 2019 edition incorporating 2020 amendments.

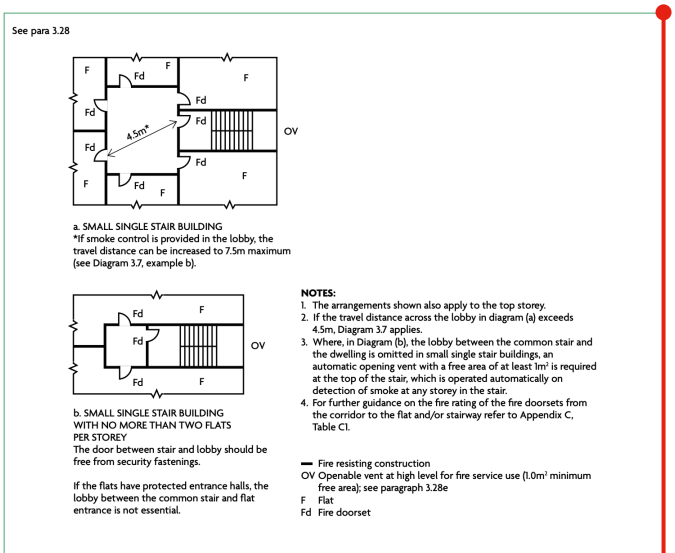


Diagram 3.9 Common escape route in small single stair building

Guide to Stairwell AOVs

Where are Stairwell AOVs used?

Buildings over 11m

For buildings with a top floor exceeding 11m, there is a requirement to provide some means of protecting corridors and communal lobbies with access to the escape stairwell in order to control smoke.

This can be done by natural or mechanical means:

- Natural ventilation, either using AOVs directly to the outside or through a shaft up to the roof. A stairwell ventilator will be required with both of these options.
- Although not yet contained within the Building Regulations, mechanical smoke shaft systems are commonly used instead of natural shafts as they occupy less space in the building. These systems also require a stairwell vent for air inlet purposes.

Pressurisation systems, which are an approved mechanical smoke control system, are more complex than the above extract systems and do not require a stairwell ventilator to operate.

Other buildings containing firefighting shafts

Buildings with a top floor more than 18m above fire service access level should contain a designated shaft and appropriate lift for use by firefighters. The table below gives details of the number and location of these shafts.

These require smoke control measures which will include a stairwell ventilator where natural and mechanical extract are employed.

Diagram from Approved Document B (fire safety) volume 2: Buildings other than dwellings, 2019 edition incorporating 2020 amendments.

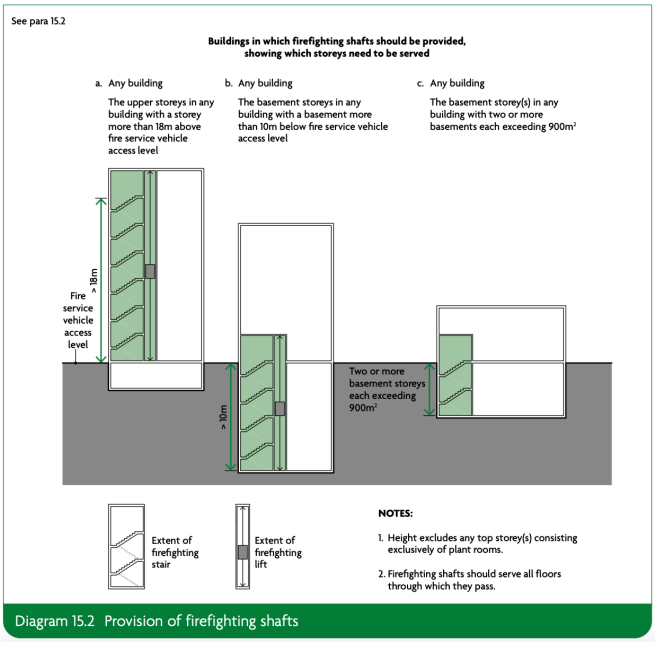


Diagram 15.2 Provision of firefighting shafts

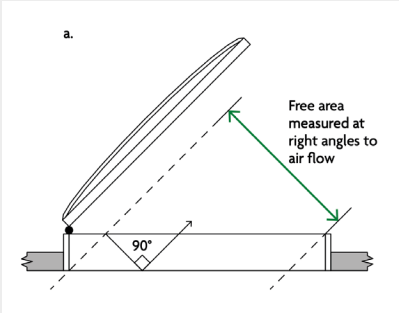
Size/Free Area

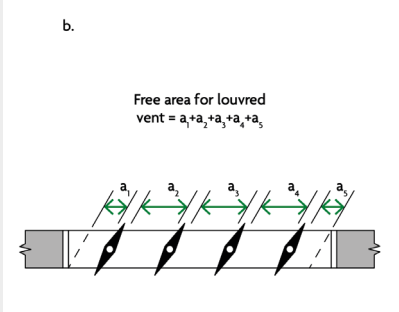
Stairwell ventilators are required to provide a minimum free area of 1.0m² when calculated in accordance with Diagram D7 of Approved Document B Volume 1, 2019 edition (see below).

The free area of a smoke ventilator should be measured by either of the following.

a. The declared aerodynamic free area in accordance with BS EN 12101-2.

b. The total unobstructed cross-sectional area (geometric free area), measured in the plane where the area is at a minimum and at right angles to the direction of air flow (Diagram D7).





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Product standards and CE marking

The main European standard applying to automatic opening ventilators (AOVs) in general and stairwell ventilators is BS EN 12101-2:2003 Smoke and heat control systems. This part of the European standard describes the test regime that natural smoke and heat exhaust ventilators should be subjected to in order to meet the requirements of CE marking under the Construction Products Regulation EN 305/2011.

Where an actuator is fitted to an existing window or roof window for use as an automatic opening vent (AOV), rather than a purpose-made ventilator, the position regarding CE marking is not so clear cut. Where a vendor wishes to offer a standard solution of a combination of window and actuator then the total solution should be subjected to the same tests as a ventilator.

Where the solution is a one off retrofit of an actuator to a window or rooflight, then strictly speaking it is not a standard product, but an individual design. Because of this it is permissible under the regulations to treat this by assessment rather than testing. Assessments for most common applications are available from reputable window actuator vendors.

Other uses

As well as smoke removal and fresh air replenishment, stairwell ventilators have alternative uses. Other uses include:

Daily ventilation

The stairwell ventilator may be used to evacuate heat or to provide fresh air to a lobby smoke shaft system when it is used for environmental ventilation. This can be achieved by using a ventilator with additional weathered ventilation dampers.

A standard ventilator with an additional rain sensing controller can also be used; it will close the ventilator in bad weather. The rain sensor will usually be a cost-effective solution in installation costs but prevent the use of the ventilator in warm, wet weather. Therefore this may prove to be a false economy.

Daylight

The stairwell ventilator may also be used to provide daylight to an internal stairwell. This is done by selecting a product with either glass or plastic blades or a lid in the case of a hatch. For example, a **glass bladed louvre** or a **polycarbonate hatch vent** are perfect for providing light.

Roof Access

The stairwell ventilator may also be used as a roof access hatch. This will require the opening mechanism to be designed in such a way that it doesn't obstruct access through the hatch.

An addition of manual controls to facilitate the opening and closing both from inside and from the roof can be installed.

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Product types

The most common product types of stairwell ventilators are illustrated below.

Louvred ventilator

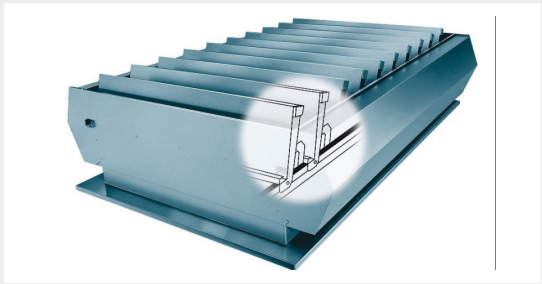
The louvre provides discharge of smoke and fumes through motorised blades along the length of the frame. A choice of blades are available with standard and insulated aluminium, 8mm or 16mm polycarbonate (transparent or opal) and single or double-glazed panels.

It is recommended that insulated blades and frames are used to prevent future condensation problems.

Louvred ventilator with weatherproof ventilation

The louvre provides discharge of smoke and fumes though the motorised blades along the length of the frame. Different styles of blades are available with standard and insulated aluminium, 8mm or 16mm polycarbonate (transparent or opal) and single or double-glazed panels.

These weatherproof ventilators also contain separate 24V, side-mounted daily ventilation louvres to allow fresh air input without opening the whole louvre. This means that daily ventilation can be provided even in wet weather.



Roof hatch

The hatch vent AOV provides discharge of smoke and fumes with an opening angle of 140 degrees. It is available with either a solid aluminium insulated lid or a polycarbonate translucent panel.

The latter option can provide daylighting if required. The roof hatch is not usually suitable for environmental ventilation.

Actuated vertical window

It is preferable and more effective for the window to be bottom hung and outward opening. To meet standards it must always provide the required free area as specified in Approved Document B. A range of actuators are available, including chain drives, linear and folding arms. These should be tested and CE marked to EN12101:2.

Actuated roof window

Roof windows are often used for ventilation and may also be used for smoke evacuation subject to compliance with regulations.

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Control Systems

Regardless of the product selected, the control method and components are fairly universal, comprising a power supply unit, manual switches and in some cases smoke detectors.

Power supply unit/ Control panel

A modular unit will most often be used which provides a low voltage (24V) supply to the motor of the stairwell ventilator. The unit will include back-up batteries to ensure it will continue to operate, even if there is a power failure. It will normally have a number of options for interfacing with remote systems and devices including:

- Fire alarm contacts for remote triggering in a small single-stair building
- Smoke detectors where needed, again normally in small single-stair buildings
- Thermostats for day-to-day ventilation
- Manual override switches
- Rain-sensing controls
- BMS or security systems to display system status
- AOVs or smoke shaft systems in lobbies.

Smoke detectors

Smoke detectors should comply with BS5839:1 and can be either an ionisation smoke detector or an optical smoke detector. Smoke detectors have a maximum coverage radius of 7.5m and should be overlapped to ensure there no blind spots.

Rain sensing controls

Wind sensors may also be incorporated into a stairwell ventilation system to prevent ventilators opening in high winds. The sensor should be located at high level - it's often sited on the ventilator for cabling purposes. It is then wired back to the control panel. They are overridden by emergency signals to ensure the ventilator opens regardless of the weather conditions.

Thermostats

Thermostats or temperature sensors can be used to cause the stairwell ventilator to open and close automatically. An upper and lower pre-programmed temperature will determine when the vent is opened. The thermostat should be tamperproof when located in a public area.

Override switches

It is common practice to locate manual switches for firefighters to use at the entry and uppermost levels of a stairwell. These are required to override all other control modes to provide emergency access.

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Wiring

The most commonly used cable for stairwell ventilator power and control is FP200 Plus (*see document Cabling_ and_electric_power_supply_installation1*).

FP PLUS is the 'enhanced', hard skin, dressable fire resistant cable most commonly needed for fire alarm and emergency lighting circuits as defined by BS5839-1:2017 and BS5266-1:2016.

It is approved by third parties BASEC and LPCB in accordance with the requirements of BS5839-1:2017+A2:2008 Clause 26.2 and BS5266-1:2016 Clause 8.2.2b for enhanced fire resisting cables.

Installation guidance

Roof mounting

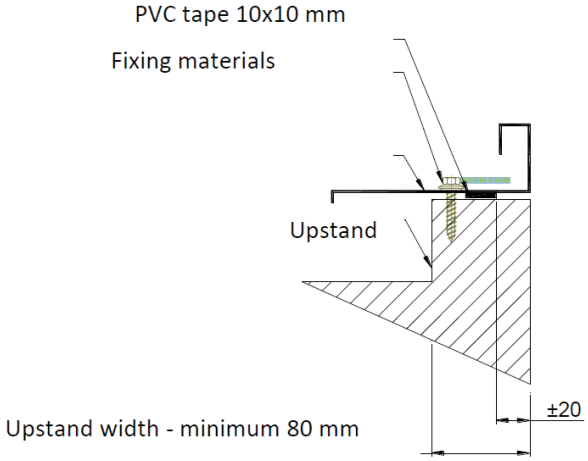
Most stairwell ventilators will be mounted on the roof of the stairwell.

Flat roof

The most common application is installation on a flat roof. The ventilator will either be provided with a roof curb for building into the roof or it will be mounted onto a builder's work upstand.

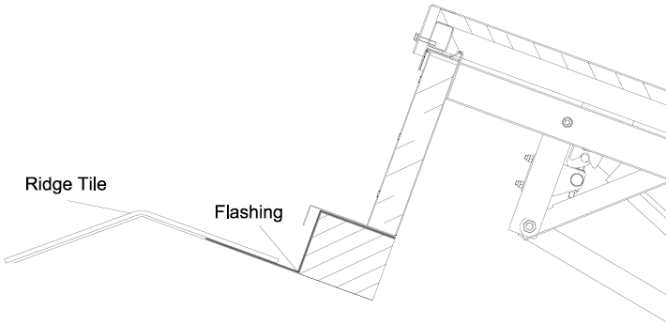
Ideally, roof upstands should have a slight pitch of 3-5 degrees to help prevent rainwater collecting on the ventilator which could be thrown into the building when opened. In specifying the roof upstand dimensions it is important that sufficient tolerance is built in to allow for the weathering membrane and an allowance for expansion.

The internal area should be clear of obstructions e.g. steelwork which could reduce the effective area of ventilation and impede the operation of the ventilator. The flange of the ventilator would have a sufficient turndown to prevent rainwater being blown up inside the ventilator. A sealant may be applied to the top of the upstand as an extra precaution. Fixings should be weatherproof with sealing washers.



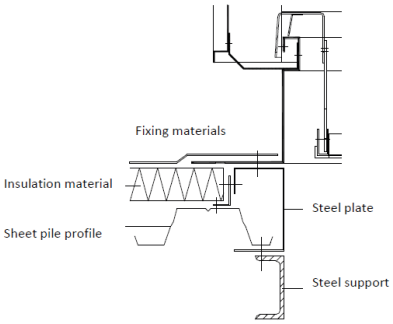
Pitched roof

Louvred ventilators may be satisfactorily installed onto a pitched roof. This type of roof and ventilator is commonly found in large industrial buildings containing fire fighting staircases. They can also be used in small single-stair buildings with slate or tiled roofs. Ideally the ventilator should be positioned at the ridge of the roof with the top flange tucked under the ridge flashing. If the ventilator is down slope from the ridge then it is recommended that the top flange is extended to the ridge with additional panels to ensure a weatherproof seal.



Metal cladding

The simplest method of installing a stairwell ventilator into a pitched metal roof is to use a louvred ventilator with a folded aluminium base. The base will have angled turndowns at the sides and longer flanges at the top and bottom for weathering to the roof cladding.



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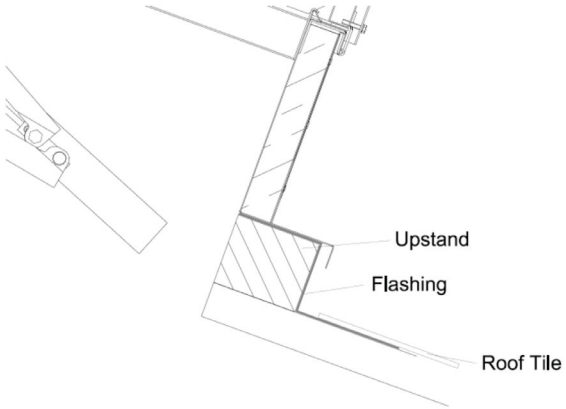
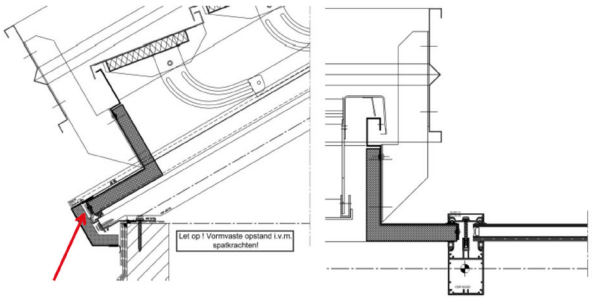
Slate tile

For pitched slate or tiled roof applications, it is possible to provide a ventilator with a flat flange for building into the roof. However, this is often problematic. It is preferable for the roof contractor to provide an upstand curb weathered with a suitable flashing.



Glazing

Ventilators can satisfactorily be built into patent glazing by designing the vent to replace a pane of glass and selecting a flange of the same depth as the glass.



Retro fitting actuators

Stairwell ventilation can be achieved by automatically opening a window within the stairwell.

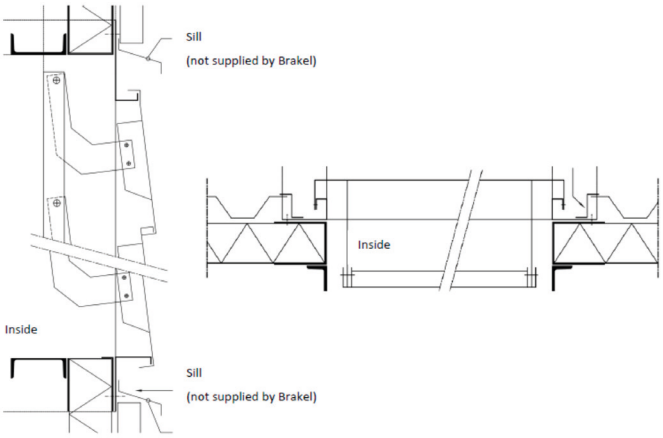
As always this is subject to the minimum free area being achieved when calculated using the method in diagram D of Approved Document B.

It is recommended that bottom hinged outward opening windows are selected for efficient smoke evacuation, however this is not a requirement of ADB. Stairwell ventilators are more commonly used for replacing fresh air in a lobby extract system.

Where orientation is not critical, the control system will be identical to that used for the stairwell ventilator.

Wall mounting

Ventilators can be wall mounted using a similar method to a window installation.



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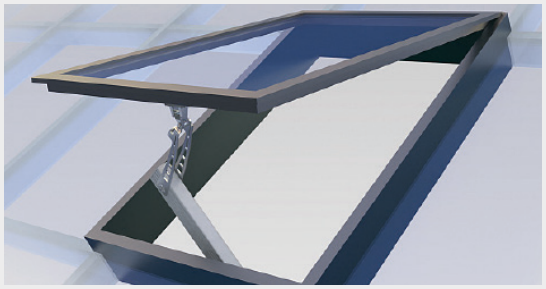
Window Types

Rising sash

It is possible to automate a vertical sash window using linear actuators. The slit actuator from Simon RWA is a neat and unobtrusive solution to such applications.

Top hung outward opening

Most often controlled by a chain actuator, or for larger windows, a folding arm is a reliable option.



Side hung

Once again a chain drive would be suitable subject to being able to deliver the required free area. Otherwise a slit actuator or folding arm may be employed.

Bottom hung

Most often controlled by a chain actuator, or for larger windows, a folding arm is a reliable option.

Guide to Stairwell AOVs

Actuator selection

The best mounting position for the actuator is decided on with reference to clearance and likelihood of tampering. Then the required opening and closing force is calculated (see below) and a suitable product is selected to achieve the correct opening distance.

Calculation of opening force

This calculation is only valid for vertically mounted wall windows.
For other installations a detailed calculation must be done.

F := force of the actuator (N)

S := stroke of the actuator (mm)

H := height of the wing frame (mm) W:= weight of the wing frame (kg)

Required force of the actuator at specified stroke:

$$F = (W / 2) \times (S / H) \times 10 = (W \times S \times 5) / H$$

Maximum possible stroke of the actuator at a given force:

$$S = (2 \times F \times H) / (W \times 10) = (F \times H) / (W \times 5)$$

Fixing

The appropriate brackets for the actuator/window combination are selected and the correct fixings for the window material are used to attach the actuator to the window.

Safety

Force operated windows which are lower than 2.5m above the top edge of the finished floor (even if this only applies to parts of the window) require a risk assessment with regard to the danger of persons being crushed or trapped. Several national and inter- national regulations regulate the protective measures necessary depending upon the type of use of the window. A risk analysis must be carried out.

Window stays

A suitable stay must be fitted to bottom hung windows. The actuator should not be relied upon to restrain the opening sash.

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