Operational Information Note

Automated Mechanical Ventilation Fans

INTRODUCTION

The provision of mechanical fan assisted or natural buoyancy driven ventilation systems in the corridors or stairs of residential buildings, is now becoming commonplace. These systems are generally activated automatically on the detection of smoke in corridors and serve to maintain tenable conditions for occupants where escape is needed or to assist fire-fighting access.

POWERS AND POLICY

Where a smoke control system has activated it is not the responsibility of NYFRS to place the system back into monitoring mode on leaving the premises. All fire detection, monitoring and fire engineered systems must be placed back in operation by an external, responsible and competent person.

Service Policy

- Do not alter the automated status of the smoke control system unless it is clear that the system is having an adverse impact on fire service operations.
- Any manual change in the status of a smoke control system must authorised by the Incident Commander.
- The Incident Commander must assess (based on information from the bridgehead) if the automated venting system is assisting or hindering the firefighting and rescue operations.
- The Incident Commander should seek advice from a Business Fire Safety Manager if they are uncertain.
- The decision to alter the status of a smoke control system must be recorded in the incident decision log.

OPERATIONAL CONSIDERATIONS

Tactical impacts of new system designs

There are several types of automated and mechanical venting systems that may be encountered and could appear confusing to operational crews, as dedicated smoke control alarm panels and smoke shaft/Automatic Opening Vent (AOV) configurations are variable, both in design and appearance. These systems are designed to remove smoke via automated window openings, ceiling mounted vent ducts or wall openings at various heights into smoke shafts located in corridors or adjacent to stair-shafts. AOVs and fans are activated in each case by smoke detection.

There are seven basic types of ventilation system commonly found in residential and commercial buildings:

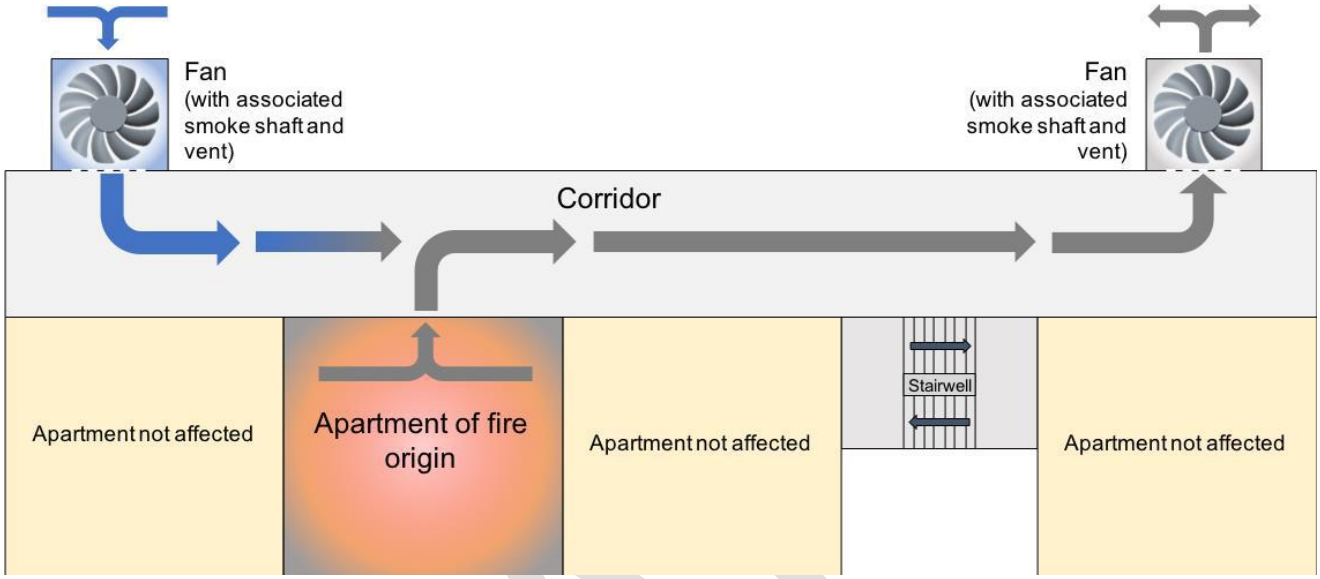
1. Natural - air-flow (buoyancy)
2. Smoke extract - depressurisation (Mechanical)
3. Smoke flushing - forced air movement (Mechanical)
4. Balanced - ‘push – pull’ fans (Mechanical)
5. Pressurisation - usually to protect evacuation and/or firefighting stairs (Mechanical)
6. Car Park
7. Atriums

Each system varies in both design and configuration, according to corridor or compartmental layouts. In some cases, the movement of air/smoke may be directed towards the access stairs whilst in others the direction of air/smoke movements will be away from the access stairs (see figure 1)

Figure 1 - Typical Corridor Smoke Ventilation Systems

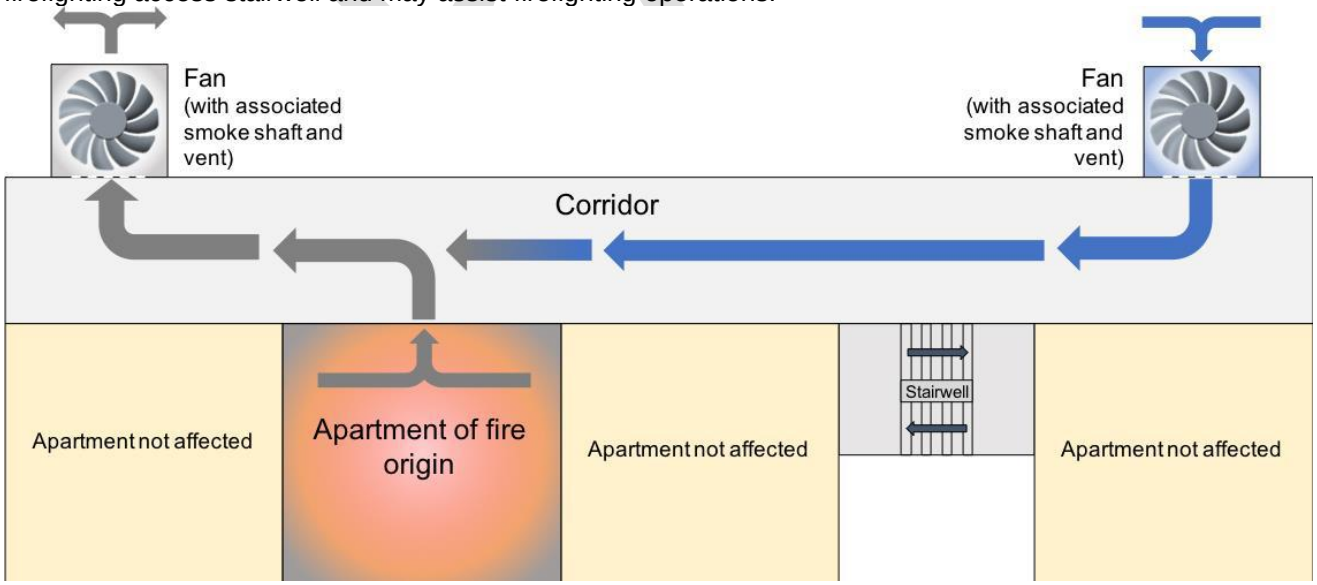
Poorly Configured system example

This is a poorly configured system that may direct air, smoke and heat movements towards the firefighting access stairwell and may also impede firefighting operations.



Correctly configured system example

This is a correct configured system that is designed to direct air, smoke and heat movements away from the firefighting access stairwell and may assist firefighting operations.

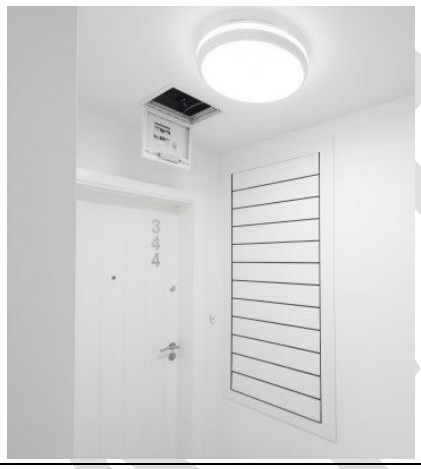


The direction of air flow is important to firefighters and should be assessed during building visits, as well as during firefighting operations. Vents located near the ceiling are extract vents, whilst vents located near the floor are air inlet vents. In some cases, extract wall vents may be at shoulder height and the air inlet may be via an inwards swinging stair door. (See figure 2 for examples of ventilation grilles)

Where hot gases enter the corridor from a developing compartment fire, this directional air movement can be critical to firefighters trying to make headway along a corridor. In each case the Incident Commander must assess if the automated venting system is assisting the firefighting operations.

In all cases the default position should be to allow the system to function as designed. Where smoke and heat is being driven directly at firefighters in the corridor, consideration should be given to operate the systems Firefighter Override to deactivate the system (Note: This effect could also be the result of a wind-driven fire).

Figure 2 - Typical Ventilation Grilles



Car parks and Atrium Spaces

Car Parks

Car parks located at ground, basement or sub-basement levels may use natural ventilation to vent smoke via external walls, or it may be ducted and mechanically extracted to external air.
Some modern ventilation systems in larger car parks use high powered 'impulse' positive pressure air fans at ceiling level which are activated automatically by smoke, to drive heat towards smoke extract points (or ducts). They may be designed for simple post-fire smoke extraction, or in some cases to assist firefighters during firefighting operations.

The direction of air travel must be understood to avoid deployments against air-flows.

Atriums

Atriums may exist as large open ground to roof spaces to provide aesthetic space and light within buildings. These may be vented either naturally by automated or mechanical roof vents.
It is also important to try and understand the intention of any particular ventilation configuration, is it to assist occupants to escape or to assist firefighting access?

Extended Corridor Ventilation Systems

The design requirements for greater liveable floor space is leading to the removal of second stairs in modern residential buildings and the emergence of long undivided corridors, up to 30 metres in some cases (Figure 3). To support extended occupant escape distance beyond 7.5 metres, the provision of fire engineered mechanical venting systems are required to maintain a smoke free route.

These distances to a single point of exit have sometimes caused difficult access for firefighters and delayed evacuation of the fire floor.

Figure 3 - Extended Length Corridor

Extended corridor lengths and the removal of corridor smoke stop doors mean firefighting access and evacuation operations on the fire floor may be severely hampered when the fire compartment is opened.

There is also a serious concern that firefighters could be exposed to severe heat conditions in the corridor if exterior windows fail and the fire becomes wind driven. In such situations the extended distance to a point of safe refuge can be considerable and great care is needed when deploying crews to tackle a developing fire. The exterior wind conditions, the configuration of the venting system (airflow direction) and the provision of safety hose-lines in support of the attack hose-line are all important considerations.

Personnel must aware that opening up of a fire compartment into an extended corridor will have an impact on the pressure within the corridor, resulting in the possibility of the products of combustion be drawn into corridor and potentially into the path of firefighters. The impacts should be fully assessed and the activity must be authorised by the Incident Commander with the appropriate control measures in place before any opening up of the fire compartment takes place.

Note: The prioritisation of local evacuation should be considered

Control Panels and Firefighter Overrides

There is a wide range of smoke control panels and firefighter override controls (Examples shown in Figure 4) installed in buildings. Familiarisation visits of the buildings should include locating the control panels developing and understanding of the working principles of the system, including the vent layout and the intended purpose of the ventilation system.

Firefighter overrides are generally used to close or open an AOV, most often at the top of a stairwell or sometimes in a corridor. However, sometimes they may deactivate a mechanical smoke shaft system or boost the function of the system into firefighting mode, where greater rates of smoke extraction will occur. The Incident Commander must authorise the decision to activate a boost control, deactivating a mechanical system, or to open/close and AOV.

Figure 4 – Smoke Control Panel and Fire Fighter Override Controls	
	

OPERATIONAL TACTICS

The main considerations and control measures are as follows:

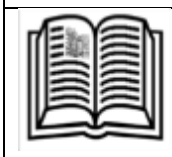
- System types and their operating principles should be located and investigated during building visits.
- Systems should be allowed to function automatically unless they are hindering firefighting approach or rescue operations, any over-ride of the system must be authorised by the Incident Commander.
- Access the main smoke control panel immediately on arrival at a fire and locate local firefighter overrides.
- Analyse the system type and determine the fire location, as well as the automated operation of the system.
- External observers should advise crews of external wind conditions on the fire side of the building prior to opening flat doors into the fire compartment, most particularly where extended corridors exist.

Operating Principles

System Type	Operating Principles	Operational Considerations
Natural air flow (Buoyancy)	AOV opens on smoke detection allowing natural smoke clearance to occur through buoyant air movements via corridor windows, smoke or stair shafts.	This system type could range from a large smoke shaft protecting a firefighting shaft to a corridor window AOV protecting the escape route. In some situations, a corridor smoke shaft arrangement might do the same. Where fire enters the corridor it may head along the flow path created by the vent with high velocity. In older 1960/70 buildings the stairs may have permanently open natural vents at the head of stairs.

Smoke extract (de-pressurisation)	AOV opens on smoke detection allowing mechanical smoke clearance to occur through negative pressures created in protected spaces, usually via corridor smoke shafts, ceiling ducts or basement outlets direct to the exterior.	This system type will normally assist the fire-fighting operation but due to the negative corridor pressure, care should be taken when opening doors leading into grossly under-ventilated conditions, as should normally be the case. Where pre-2014 extract shafts are configured to pull smoke and heat towards the firefighting stair, these may cause problems if fire or very hot smoke has entered the corridor. In these circumstances, consideration by the Incident Commander may lead to an instruction to deactivate the system and avoid the operation of firefighting boost controls. Post 2014 systems should be configured to extract smoke and heat away from the firefighting stair.
Smoke flushing	AOV opens on smoke detection allowing mechanical smoke clearance to occur through negative pressures created in protected spaces, usually via corridor smoke shafts, ceiling ducts or basement outlets direct to the exterior.	This system type will normally assist the fire-fighting operation but due to the negative corridor pressure, care should be taken when opening doors leading into grossly under-ventilated conditions, as should normally be the case. Where pre-2014 extract shafts are configured to pull smoke and heat towards the firefighting stair, these may cause problems if fire or very hot smoke has entered the corridor. In these circumstances, consideration by the Incident Commander may lead to an instruction to deactivate the system and avoid the operation of firefighting boost controls. Post 2014 systems should be configured to extract smoke and heat away from the firefighting stair.
Balanced (push-pull)	AOV opens on smoke detection allowing mechanical smoke clearance to occur through a neutral pressure maintained in the protected space whilst air movement fans work in combination to 'push air in and pull smoke out' of two separate smoke shafts or corridor windows.	This system type appears to support the firefighting phase most effectively, removing smoke whilst controlling temperatures in the gas layers without impacting on fire development.
Pressurisation	Mostly used in stair shafts with an objective of creating a higher positive pressure in the stairs to prevent smoke infiltration from the fire floor. There are normally AOVs and pressure dampers installed to prevent over-pressurisation of protected and adjacent spaces.	Of all system types, the pressurisation of the stairs performed extremely well in support of the firefighting phase during computer simulations. The stairs remain well protected from smoke infiltration and corridor temperatures are generally reduced.

NOG	Relevant National Operational Guidance

	  	Fires in buildings Hazard – Uncontrolled ventilation Control measure - Ventilation systems
	  	Fires and Fire Fighting Hazard – Failure or inappropriate operation fixed installations Control measure - Operate or alter fixed installations
	Other related guidance	
	Fires in buildings - Building Research Establishment supplementary information	

Administration Section and Author Support

This section of the document will not be published and is intended to provide support to the author and assist in the administration and workflow of the document. For assistance in writing this document please contact the FRS Operational Guidance Department.

Document Control

This section is used to monitor and track the changes to the document

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