

# Fire Safety for Impulse (Jet) Fans in Car Parks



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## Review period

This guideline should be reviewed by the doctrine owner come 1 May, 2023.

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# Acknowledgements

None to note.

# Source of authority

Approved by AFAC Council on 30 April, 2018.

# Purpose

The primary objective of this guideline is to provide guidance to building certifiers, engineers, builders and installers when preparing or reviewing a proposal involving impulse (jet) fans in car parks.

# Scope

This guideline details the use and provision of impulse fans within enclosed car park areas. Some guidance is also provided on the interpretation of the requirements of relevant Australian standards with regards to the provision of impulse fans.

# Statement of engagement

This guideline has been prepared by the AFAC Built Environment Technical Group and the AFAC Fire Engineering Network.

# Audience

This guideline should be used by fire service officers when providing advice to building certifiers, engineers, builders and installers.

# Definitions, acronyms and key terms

In this document the following terms have specific meanings.

**Car park:** A building that is used for the parking of motor vehicles other than a private garage or a building used for the servicing of vehicles, other than washing, cleaning or polishing.

**Exhaust air:** Air, removed from an enclosure by mechanical means and discharged to atmosphere.

**Fire alarm signal:** A signal received to initiate fire mode and which may be of a general or a zone-specific nature.

**Fire detection control and indicating equipment (FDCIE):** As defined in AS 1670.1. The FDCIE panel was formerly known as FIP.

**Hot layer:** A horizontal buoyant layer of hot gases contained by a ceiling or roof above it, and characterized by a zone beneath it that is relatively clear of visible smoke.

**Smoke:** A visible suspension of carbon or other particles in air, typically one emitted from a burning substance

**Sprinkler system:** An automatic fire sprinkler system designed and installed in accordance with AS 2118.

**Supply air:** Air introduced into an enclosure by mechanical means.

# Introduction

The primary purpose of a ventilation system in a car park is to address the requirements associated with amenity and air quality, e.g. to prevent and clear the build-up of carbon monoxide generated by motor vehicles. The BCA and Australian standard AS1668.1:2015 confirms that car park ventilation systems are not primarily required for smoke control. However, there are requirements in relation to what the system should do in the event of a fire, which is to automatically switch to full exhaust capacity upon detection of fire, to assist with removing smoke generated by the fire.

The most common form of ventilation for car parks is based upon a traditional ducted ventilation system. The principle of the traditional ducted ventilation system is that the contaminated / polluted air (carbon monoxide) is drawn to the exhaust fans and exhausted from the car park and replaced with fresh air from supply fans and / or replenished naturally through permanent openings in the structure to outside.

Traditional ducted ventilation systems have detailed design and performance specifications set out in the BCA and the Australian standards. These requirements are well understood and accepted as standard practice.

Impulse fans, also known as jet fans, are a form of mechanical ventilation in enclosed car parks. Impulse fans are low profile ceiling mounted fans and provide air at a velocity to provide momentum to produce air movement towards an exhaust point. Impulse fan housings are generally installed directly onto the car park ceiling.

This principle differs from the conventional ducted system in that, while there is some supply for fresh air make up, impulse fans are located in strategic positions within the car park, and usually in the centre of a drive lane, to push air towards the exhaust points. The supply and exhaust points may or may not utilise fans as normally expected with a conventional ducted system.

## Summary of NCC and relevant standard requirements

The 2016 revision of the NCC has been gazetted and as a result the 2015 revisions of AS1668.1 and AS1670.1 are now both referenced standards within the NCC.

The following is a summary of the requirements of the NCC and relevant standards for mechanical ventilation systems, smoke control and impulse fans in car parks.

- F4.11 of the BCA requires an enclosed car park to have mechanical ventilation complying with AS 1668.2-2012.
- AS 1668.2-2012 allows for the provision of impulse fans for movement of air from dead air spaces.
- Table E2.2a also requires car parks that have a mechanical ventilation system in accordance with AS 1668.2-2012 to meet specific requirements of clause 5.5 of AS/NZS 1668.1-2015.

AS/NZS 1668.1:2015 does not allow jet fans in series, and it incorporates the below specific design requirements where jet fans are installed as part of mechanical ventilation systems.

- Clause 5.5.1(c) outlines a number of installation requirements, including the position of jet fans with respect to sprinkler heads and detectors.
- Clause 5.5.3 prescribed measures for switches to be provided to enable restart and manual control by attending emergency services personnel, e.g. on-auto-off controls and interactions with the fire fan control panel (FFCP) and FDCIE.
- Clause 5.5.5 requires fans to be shut down upon initiation of fire mode or activation of a sprinkler system in the car park.
- Clause 5.5.4 of AS 1668.1:2015 requires that detection for car park ventilation systems and impulse fans comply with the requirements of AS 1670.1-2015.

AS 1670.1-2015 requires the following clauses.

- Clause 7.1 prescribes requirements for smoke detection, initiation and control for car park ventilation systems.
- Clause 7.4 and Table 7.4 summarises smoke control systems that shall be automatically initiated by fire, smoke detectors or suppression systems, included are 'Shutdown systems'.
- Clause 7.5.2.2 requires smoke detection provided to initiate car park ventilation in fire mode to be provided throughout circulation spaces.
- Additional smoke detection measures are prescribed in clause 7.7 for supply air systems associated with car park ventilation.

The 2015 revisions of AS1670.1 and AS1668.1 have provided additional fire safety requirements when impulse fans are provided in carparks and these standards now adequately address previous concerns raised in regards to early shut down of jet fans in a fire. On this basis for buildings that are required to comply with the BCA 2016 a fire safety performance solution is not required.

# AFAC's guideline

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## Single impulse (jet) fans

The installation of a single impulse (jet) fan can be in accordance with the deemed-to-satisfy provisions of the BCA and the requirements of AS1670.1-2015 and AS1668.1-2015.

## Multiple impulse (jet) fans installed in series

Where jets fans are installed in series, a mechanical engineering performance solution will be required. This is outside the referral requirements of most fire services and should be provided to relevant referral authorities. The mechanical engineering performance solution will need to comply with the Performance Requirements of the BCA, according to one or more of the BCA Assessment Methods and be assessed by the certifying authority for the project.

Where impulse fans are proposed in series in enclosed car parks, the design and operation of the system should be discussed with the relevant fire service during the design stages. The review undertaken during the design stages will provide an opportunity for early comment in relation to fire service concerns that may affect fire-fighting operations, e.g. the location of carpark exhaust outlets.

The mechanical engineering performance solution should contain detailed engineering justification to demonstrate that the jet fan system will not have a significant detrimental effect on the safe egress of occupants or operation of the sprinkler system.

Building proposals incorporating the use of jet fans as part of a mechanical ventilation system in a carpark should be supported by a dedicated fire detection system complying with AS 1670.1-2015 is installed to shut down all jet fans in the very early stages of fire development.

Engineering justification as part of the mechanical engineering performance solution to demonstrate that the jet fan system will not have a significant detrimental effect on the safe egress of occupants or operation of the sprinkler system, including (but not limited to):

- identifying the expected impact of the jet fan system on the air flow conditions within the carpark;
- demonstrating that potential smoke movement within the carpark will not impede the occupant egress strategy;
- identifying the expected activation time of the detection system during a fire, when jet fans are operating;

- identifying the expected activation time of the sprinkler system during a fire, when jet fans are not operating; and
- demonstrating that, regardless of fire location, the fire detection system will shut down all jet fans earlier than the anticipated operation of the sprinkler system if no jet fans were operating.

Witness testing (e.g. hot smoke testing) by fire service personnel – at the discretion of the relevant fire service – should demonstrate that impulse fan system specified as part of the mechanical performance solution works as detailed above. The methodology of any testing must be agreed by the relevant fire service prior to undertaking the assessment.

## Supporting discussion

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None to note.

