FIRE BEHAVIOUR OF BUILDING MATERIALS AND ASSEMBLIES

FIRE PERFORMANCE REFERENCES IN NATSPEC

This TECHnote provides guidance on the National Construction Code (NCC) classification of the fire behaviour of building materials and assemblies. Classification is generally based on the level of risk associated with different classes of buildings and how they will be used.

MATERIALS – FIRE HAZARD PROPERTIES

Building materials have different properties in relation to smoke, heat and flame. The most important properties in the context of a building are those which will be hazardous to its occupants and adjacent buildings. The *Fire hazard properties* regulated by the NCC are summarised in the following table:

Fire hazard property	NCC description	Cited in NATSPEC worksection
Smoke		
Average specific extinction area	The average obscuration of light by smoke from the product combustion stream, as determined by AS/NZS 3837. A material used as a finish, surface, lining or attachment to a wall or ceiling in a building not fitted with a sprinkler system must have an *average specific extinction area* less than 250 m^2/kg.	
Smoke-Developed Index	The index number for smoke as determined by AS/NZS 1530.3. The index number for materials and assemblies ranges between 2 to 8 in Class 2 to 9 buildings, depending on material and location. For example, for fire-isolated exits: Not more than 2 for materials other than sarking-type materials. Refer BCA (2022) Volume 1 S7C7.	0343, 0385, 0420, 0428, 0429, 0430, 0432, 0434, 0437, 0457, 0471, 0472, 0702, 0713, 0721, 0722, 0724, 0741, 0744, 0745, 0752, 0761, 0762, 0823
Smoke development rate	The development rate for smoke as determined by testing flooring materials in accordance with AS ISO 9239.1. Maximum *smoke development rate* in a building not protected by a sprinkler system: 750 percent-minutes.	
Smoke growth rate index ($SMOGRA_{RC}$)	The index number for smoke used in the regulation of *fire hazard properties* and applied to materials used as a finish, surface, lining or attachment to a wall or ceiling, as determined by AS 5637.1. A material on a wall or ceiling in a building not fitted with a sprinkler system must have a *smoke growth rate index* not more than 100.	
Heat		
Group number (of a material)	The number of one of four groups of materials used in the regulation of *fire hazard properties* and applied to materials used as a finish, surface, lining, or attachment to a wall or ceiling, as determined by AS 5637.1.	0385, 0420, 0428, 0430, 0432, 0434, 0437, 0511, 0520, 0521, 0522, 0527, 0530, 0532, 0533, 0575, 0641, 0642, 0762

Relevant worksections

0182 Fire-stopping
0321 Precast concrete
0322 Tilt-up concrete
0331 Brick and block construction
0332 Stone masonry
0334 Block construction
0335 Brick construction
0343 Tensioned membrane structures
0346 Structural fire protection systems
0381 Structural timber
0385 Cross-laminated timber (CLT)
0420 Roofing - combined
0428 Roofing - insulated panel systems
0429 Roofing - glazed
0430 Cladding - combined
0432 Curtain walls
0433 Stone cladding
0434 Cladding - flat sheets and panels
0437 Cladding - insulated panel systems
0451 Windows and glazed doors
0453 Doors and access panels
0454 Overhead doors
0455 Door hardware
0456 Louvre windows
0457 External screens
0461 Glazing
0463 Glass blockwork
0471 Thermal insulation and pliable membranes
0472 Acoustic insulation
0511 Lining
0520 Partitions - combined
0521 Partitions - demountable
0522 Partitions - framed and lined
0523 Partitions - brick and block
0524 Partitions - glazed
0527 Room dividers
0530 Suspended ceilings - combined
0532 Suspended ceilings - flush lined
0533 Suspended ceilings - ceiling units
0541 Access floors
0575 Tapestries
0641 Applied wall finishes
0642 Wallcoverings
0651 Resilient finishes
0652 Carpets
0654 Multilayered board flooring
0655 Timber flooring
0657 Resin based seamless flooring
0702 Mechanical design and install
0713 Cooling towers
(Continued over)

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Flame		
Critical radiant flux	The critical heat flux, at the surface of a specimen at the point where the flame ceases to advance and may subsequently go out as determined by AS ISO 9239.1, required for floor materials and coverings to BCA (2022) Volume 1 Table S7C3, measured in kW/m$^{2.}$	0541, 0651, 0652, 0654, 0655, 0657, 2011
Flammability Index	The flammability index number as determined by AS 1530.2 with values of 0 to 5 for sarking-type materials. Refer BCA S7C7.	0471, 0472, 0702, 0741, 0744, 0745, 0752, 0823
Non-combustible	Not deemed *combustible* as determined by AS 1530.1 when applied to a material or assembly and constructed wholly of materials that are not deemed *combustible* when applied to construction or part of a building.	0182, 0385, 0471, 0472, 0541, 0723, 0731, 0732, 0762, 0781, 0942, 1041, 1051
Spread-of-Flame Index	The index number for spread of flame as determined by AS/NZS 1530.3 with various requirements from 0 to 9.	0343, 0385, 0420, 0428, 0429, 0430, 0432, 0434, 0437, 0457, 0471, 0472, 0702, 0713, 0721, 0722, 0724, 0741, 0744, 0745, 0752, 0761, 0762, 0823

BUILDING ELEMENTS – FIRE-RESISTANCE LEVEL/RATING

The NCC also recognises the relative performance of different forms of construction under fire conditions and measures this in terms of *Fire-Resistance Level (FRL),* which means the grading periods in minutes for the following criteria:

- *Structural adequacy*: The ability to maintain stability and adequate *loadbearing* capacity as determined by AS 1530.4.
- *Integrity*: The ability to resist the passage of flames and hot gases as specified in AS 1530.4.
- *Insulation*: The ability to maintain a temperature on the surface not exposed to the (test) furnace below the limits specified in AS 1530.4.

FRL designations follow the format *structural adequacy* / *integrity* / *insulation*. For example, 60/60/60 means 60 minutes *structural adequacy* and 60 minutes *integrity* and 60 minutes *insulation*. A dash means that there is no requirement for that criterion. For example, 90/-/- means there is no requirement for *integrity* and *insulation* with regard to FRL. -/-/- means there is no requirement for an FRL.

FRL is cited in the following NATSPEC worksections:

0182, 0321, 0322, 0331, 0332, 0334, 0335, 0346, 0381, 0430, 0432, 0433, 0434, 0435, 0437, 0451, 0453, 0454, 0455, 0456, 0461, 0463, 0520, 0521, 0522, 0523, 0524, 0530, 0532, 0533, 0731, 0733, 0741, 0762, 0781, 0882, 0902, 0911, 0921, 0941, 1002, 1082.

Relevant worksections cont.

0721 Packaged air conditioning
0722 Room air conditioners
0723 Evaporative air coolers
0724 Air handling plant - combined
0731 Fans
0732 Air filters
0741 Ductwork
0744 Ductwork insulation
0745 Attenuators and acoustic louvres
0752 Mechanical piping insulation
0761 Refrigeration
0762 Cool rooms
0781 Mechanical electrical
0823 Cold and heated water
0902 Electrical design & install
0911 Cable support and duct systems
0921 Low voltage power systems
0942 Switchboards - custom-built
1041 Gaseous fire suppression systems
1051 Liquid chemical fire suppression systems
2011 Lifts design and install

Relevant standards

AS 1530 series *Methods for fire tests on building materials, components and structures*
Part 1 *Combustibility test for materials.*
Part 2 *Test for flammability of materials.*
Part 3 *Simultaneous determination of ignitability, flame propagation, heat release and smoke release.*
Part 4 *Fire-resistance tests for elements of construction.*

AS/NZS 3837 *Method of test for heat and smoke release rates for materials and products using an oxygen consumption calorimeter.*

AS 5113 *Classification of external walls of buildings based on reaction-to-fire performance.*

AS 5637.1 *Determination of fire hazard properties – Wall and ceiling linings.*
AS ISO 9239.1 *Reaction to fire tests for floor coverings - Determination of the burning behaviour using a radiant heat source.*

BCA (2022) Volume 1 A5G6 *Fire hazard properties.*
BCA (2002) Volume 1 Specification 7 *Fire hazard properties.*