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SPECIFICATION C1.1 FIRE-RESISTING CONSTRUCTION

1. SCOPE

This Specification contains requirements for the fire-resisting construction of building elements.

2. GENERAL REQUIREMENTS

.1 EXPOSURE TO FIRE-SOURCE FEATURES

a) A part of a building element is exposed to a fire-source feature if any of the horizontal straight lines between that part and the fire-source feature, or vertical projection of the feature, is not obstructed by another part of the building that:

   (i) has an FRL of not less than 30/–/–

   (ii) is neither transparent nor translucent.

b) A part of a building element is not exposed to a fire-source feature if the fire-source feature is:

   (i) an external wall of another building that stands on the allotment and the part concerned is more than 15 m above the highest part of that external wall; or

   (ii) a side or rear boundary of the allotment and the part concerned is below the level of the finished ground at every relevant part of the boundary concerned.

c) If various distances apply for different parts of a building element:

   (i) the entire element must have the FRL applicable to that part having the least distance between itself and the relevant fire-source feature; or

   (ii) each part of the element must have the FRL applicable according to its individual distance from the relevant fire-source feature, but this provision does not override or permit any exemption from Clause 2.2.

.2 FIRE PROTECTION FOR A SUPPORT OF ANOTHER PART

a) Where a part of a building required to have an FRL depends upon direct vertical or lateral support from another part to maintain its FRL, that supporting part, subject to (b), must:

   (i) have an FRL not less than that required by other provisions of this Specification

   (ii) if located within the same fire compartment as the part it supports have an FRL in respect of structural adequacy the greater of that required:

      A. for the supporting part itself

      B. for the part it supports

   (iii) be non-combustible:

      A. if required by other provisions of this Specification; or

B. if the part it supports is required to be non-combustible.

b) The following building elements need not comply with (a)(ii) and (a)(iii)(B):

(i) An element providing lateral support to an external wall complying with Clause 5.1(b) or C1.11.

(ii) An element providing support within a carpark and complying with Clause 3.9, 4.2 or 5.2.

(iii) A roof providing lateral support in a building:

A. of Type A construction if it complies with Clause 3.5(a), (b) or (d)

B. of Type B and C construction.

(iv) A column providing lateral support to a wall where the column complies with Clause 2.5(a) and (b).

(v) An element providing lateral support to a fire wall or fire-resisting wall, provided the wall is supported on both sides and failure of the element on one side does not affect the fire performance of the wall.

.3 LINTELS

A lintel must have the FRL required for the part of the building in which it is situated, unless it does not contribute to the support of a fire door, fire window or fire shutter, and:

a) it spans an opening in:

(i) a wall of a building containing only one storey; or

(ii) a non-loadbearing wall of a Class 2 or 3 building; or

b) it spans an opening in masonry which is not more than 150 mm thick and:

(i) not more than 3 m wide if the masonry is non-loadbearing; or

(ii) not more than 1.8 m wide if the masonry is loadbearing and part of a solid wall or one of the leaves of a cavity wall.

.4 METHOD OF ATTACHMENT NOT TO REDUCE THE FIRE-RESISTANCE OF BUILDING ELEMENTS

The method of attaching or installing a finish, lining, ancillary element or service installation to the building element must not reduce the fire-resistance of that element to below that required.

.5 GENERAL CONCESSIONS

a) Steel columns — A steel column, other than one in a fire wall or common wall, need not have an FRL in a building that contains:

(i) only 1 storey; or

(ii) 2 storeys in some of its parts and 1 storey only in its remaining parts if the sum of the floor areas of the upper storeys of its 2 storey parts does not exceed the lesser of:

A. 1/8 of the sum of the floor areas of the 1 storey parts; or

B. in the case of a building to which one of the maximum floor areas specified in Table C2.2 is applicable — 1/10 of that area; or

C. in the case of a building to which two or more of the maximum floor areas specified in Table C2.2 is applicable — 1/10 of the lesser of those areas.

b) Timber columns — A timber column may be used in a single storey building if:

(i) in a fire wall or common wall the column has an FRL not less than that listed in the appropriate Table 3, 4 or 5; and

(ii) in any other case where the column is required to have an FRL in accordance with Table 3, 4 or 5, it has an FRL of not less than 30/–/–.

c) Structures on roofs — A non-combustible structure situated on a roof need not comply with the other provisions of this Specification if it only contains:

(i) lift motor equipment; or

(ii) one or more of the following:

A. Hot water or other water tanks.

B. Ventilating ductwork, ventilating fans and their motors.

C. Air-conditioning chillers.

D. Window cleaning equipment.

E. Other service units that are non-combustible and do not contain flammable or combustible liquids or gases.

d) Curtain walls and panel walls — A requirement for an external wall to have an FRL does not apply to a curtain wall or panel wall which is of non-combustible construction and fully protected by automatic external wall-wetting sprinklers.

e) * * * * *

f) Balconies and verandahs — A balcony, verandah or the like and any incorporated supporting part, which is attached to or forms part of a building, need not comply with Tables 3, 4 and 5 if:

(i) it does not form part of the only path of travel to a required exit from the building

(ii) in Type A construction:

A. it is situated not more than 2 storeys above the lowest storey providing direct egress to a road or open space

B. any supporting columns are of non-combustible construction.

.6 MEZZANINE FLOORS: CONCESSION

a) This Clause does not apply to a Class 9b building that is a spectator stand or audience viewing area accommodating more than 100 persons as calculated according to D1.13.

b) A mezzanine and its supports need not have an FRL or be non-combustible provided:

(i) the total floor area of all the mezzanines in the same room does not exceed 1/3 of the floor area of the room or 200 m2, whichever is the lesser; and

(ii) the FRL of each wall and column that supports any other part of the building within 6 m of the mezzanine is increased by the amount listed in Table 2.6.

Table 2.6 Increased FRLs — Construction surrounding mezzanines

Level otherwise *required* for any FRL criterion (mins)	Increase in level to not less than (mins):
30	60
60	90
90	120
120	180
180	240

Note to Table 2.6

Note to Table 2.6: The increase in level applies to each FRL criterion (structural adequacy, integrity or insulation) relevant to the building element concerned.

.7 ENCLOSURE OF SHAFTS

Shafts required to have an FRL must be enclosed at the top and bottom by construction having an FRL not less than that required for the walls of a non-loadbearing shaft in the same building, except that these provisions need not apply to:

a) the top of a shaft extending beyond the roof covering, other than one enclosing a fire-isolated stairway or ramp; or

b) the bottom of a shaft if it is non-combustible and laid directly on the ground.

.8 CARPARKS IN CLASS 2 AND 3 BUILDINGS

a) If a Class 2 building contains not more than 4 storeys of which:

(i) one storey is Class 7 used solely for the purpose of parking motor vehicles or for some other purpose that is ancillary to a Class 2

(ii) the remaining storeys are of Class 2,

the carpark storey is regarded as Class 2 only for the purpose of determining the relevant fire-resisting requirements of this Specification.

b) If a Class 3 building or a building of Class 2 and 3 contains not more than 3 storeys of which:

(i) one storey is Class 7 used solely for the purpose of parking motor vehicles or for some other purpose that is ancillary to the other storeys

(ii) the remaining storeys are of Class 2 or 3,

the carpark storey is regarded as Class 2 or 3 only for the purpose of determining the relevant fire-resisting requirements of this Specification.

.9 RESIDENTIAL CARE BUILDING: CONCESSION

a) In a Class 3 building protected with a sprinkler system complying with Specification E1.5 and used as a residential care building, any FRL criterion prescribed in Tables 3, 4 or 5:

(i) for any floor and any loadbearing wall, may be reduced to 60, except any FRL criterion of 90 for an external wall must be maintained when tested from the outside

(ii) for any non-loadbearing internal wall, need not apply if:

A. it is lined on each side with standard grade plasterboard not less than 13 mm thick or similar non-combustible material

B. it extends:

(aa) to the underside of the floor next above; or

(bb) to the underside of a ceiling lined with standard grade plasterboard not less than 13 mm thick or a material with at least an equivalent level of fire protection; or

(cc) to the underside of a non-combustible roof covering

C. any insulation installed in the cavity of the wall is non-combustible

D. any construction joint, space or the like between the top of the wall and the floor, ceiling or roof is smoke sealed with intumescent putty or other suitable material.

b) The concession described at (a) does not apply to fire-protected timber building elements.

3. TYPE A FIRE-RESISTING CONSTRUCTION

.1 FIRE-RESISTANCE OF BUILDING ELEMENTS

In a building required to be of Type A construction:

a) each building element listed in Table 3 and any beam or column incorporated in it, must have an FRL not less than that listed in the Table for the particular Class of building concerned

b) * * * * *

c) any internal wall required to have an FRL with respect to integrity and insulation must extend to:

(i) the underside of the floor next above; or

(ii) the underside of a roof complying with Table 3; or

(iii) if under Clause 3.5 the roof is not required to comply with Table 3, the underside of the non-combustible roof covering and, except for roof battens with dimensions of 75 mm x 50 mm or less or sarking-type material, must not be crossed by timber or other combustible building elements; or

(iv) a ceiling that is immediately below the roof and has a resistance to the incipient spread of fire to the roof space between the ceiling and the roof of not less than 60 minutes; and

d) a loadbearing internal wall and a loadbearing fire wall (including those that are part of a loadbearing shaft) must be constructed from:

(i) concrete; or

(ii) masonry; or

(iii) fire-protected timber, provided that:

A. the building is:

(aa) a separate building; or

(bb) a part of a building:

(AA) which only occupies part of a storey, and is separated from the remaining part by a fire wall; or

(BB) which is located above or below a part not containing fire-protected timber and the floor between the adjoining parts is provided with an FRL

not less than that prescribed for a fire wall for the lower storey

B. the building has an effective height of not more than 25 m

C. the building has a sprinkler system (other than a FPAA101D or FPAA101H system) throughout complying with Specification E1.5

D. any insulation installed in the cavity of the timber building element required to have an FRL is non-combustible

E. cavity barriers are provided in accordance with Specification C1.13; or

(iv) any combination of (i) to (iii)

e) * * * * *

f) the FRLs specified in Table 3 for an external column apply also to those parts of an internal column that face and are within 1.5 m of a window and are exposed through that window to a fire-source feature.

Table 3 Type A construction: FRL of building elements

Building element	Class of building — FRL: (in minutes)			
	Structural adequacy/Integrity/Insulation			
	2, 3 or 4 part	5, 7a or 9	6	7b or 8
EXTERNAL WALL (including any column and other building element incorporated within it) or other external building element, where the distance from any fire-source feature to which it is exposed is				
For loadbearing parts				
less than 1.5 m	90/ 90/ 90	120/120/120	180/180/180	240/240/240
1.5 to less than 3 m	90/ 60/ 60	120/ 90/ 90	180/180/120	240/240/180
3 m or more	90/ 60/ 30	120/ 60/ 30	180/120/ 90	240/180/ 90
For non-loadbearing parts				
less than 1.5 m	–/ 90/ 90	–/120/120	–/180/180	–/240/240
1.5 to less than 3 m	–/ 60/ 60	–/ 90/ 90	–/180/120	–/240/180
3 m or more	–/–/–	–/–/–	–/–/–	–/–/–
EXTERNAL COLUMN (not incorporated in an external wall)				
For loadbearing columns	90/–/–	120/–/–	180/–/–	240/–/–
For non-loadbearing columns	–/–/–	–/–/–	–/–/–	–/–/–
COMMON WALLS and FIRE WALLS	90/ 90/ 90	120/120/120	180/180/180	240/240/240
INTERNAL WALLS				
Fire-resisting lift and stair shafts				
Loadbearing	90/ 90/ 90	120/120/120	180/120/120	240/120/120
Non-loadbearing	–/ 90/ 90	–/120/120	–/120/120	–/120/120
Bounding public corridors, public lobbies and the like				
Loadbearing	90/ 90/ 90	120/–/–	180/–/–	240/–/–
Non-loadbearing	–/ 60/ 60	–/–/–	–/–/–	–/–/–
Between or bounding sole-occupancy units				
Loadbearing	90/ 90/ 90	120/–/–	180/–/–	240/–/–
Non-loadbearing	–/ 60/ 60	–/–/–	–/–/–	–/–/–
Ventilating, pipe, garbage, and like shafts not used for the discharge of hot products of combustion				
Loadbearing	90/ 90/ 90	120/ 90/ 90	180/120/120	240/120/120
Non-loadbearing	–/ 90/ 90	–/ 90/ 90	–/120/120	–/120/120
OTHER LOADBEARING INTERNAL WALLS, INTERNAL BEAMS, TRUSSES				
and COLUMNS	90/–/–	120/–/–	180/–/–	240/–/–
FLOORS	90/ 90/ 90	120/120/120	180/180/180	240/240/240
ROOFS	90/ 60/ 30	120/ 60/ 30	180/ 60/ 30	240/ 90/ 60

.2 CONCESSIONS FOR FLOORS

A floor need not comply with Table 3 if:

a) it is laid directly on the ground; or

b) in a Class 2, 3, 5 or 9 building, the space below is not a storey, does not accommodate motor vehicles, is not a storage or work area, and is not used for any other ancillary purpose; or

c) it is a timber stage floor in a Class 9b building laid over a floor having the required FRL and the space below the stage is not used as a dressing room, store room, or the like; or

d) it is within a sole-occupancy unit in a Class 2 or 3 building or Class 4 part of a building; or

e) it is an open-access floor (for the accommodation of electrical and electronic services and the like) above a floor with the required FRL.

.3 FLOOR LOADING OF CLASS 5 AND 9B BUILDINGS: CONCESSION

If a floor in a Class 5 or 9b building is designed for a live load not exceeding 3 kPa:

a) the floor next above (including floor beams) may have an FRL of 90/90/90; or

b) the roof, if that is next above (including roof beams) may have an FRL of 90/60/30.

.4 ROOF SUPERIMPOSED ON CONCRETE SLAB: CONCESSION

A roof superimposed on a concrete slab roof need not comply with Clause 3.1 as to fire-resisting construction if:

a) the superimposed roof and any construction between it and the concrete slab roof are non-combustible throughout

b) the concrete slab roof complies with Table 3.

.5 ROOF: CONCESSION

A roof need not comply with Table 3 if its covering is non-combustible and the building:

a) has a sprinkler system (other than a FPAA101D or FPAA101H system) complying with Specification E1.5 installed throughout; or

b) has a rise in storeys of 3 or less; or

c) is of Class 2 or 3; or

d) has an effective height of not more than 25 m and the ceiling immediately below the roof has a resistance to the incipient spread of fire to the roof space of not less than 60 minutes.

.6 ROOF LIGHTS

If a roof is required to have an FRL or its covering is required to be non-combustible, roof lights or the like installed in that roof must:

a) have an aggregate area of not more than 20% of the roof surface

b) be not less than 3 m from:

(i) any boundary of the allotment other than the boundary with a road or public place

(ii) any part of the building which projects above the roof unless that part has the FRL required of a fire wall and any openings in that part of the wall for 6 m vertically above the roof light or the like are protected in accordance with C3.4

(iii) any roof light or the like in an adjoining sole-occupancy unit if the walls bounding the unit are required to have an FRL

(iv) any roof light or the like in an adjoining fire-separated section of the building

c) if a ceiling with a resistance to the incipient spread of fire is required, be installed in a way that will maintain the level of protection provided by the ceiling to the roof space.

.7 INTERNAL COLUMNS AND WALLS: CONCESSION

For a building with an effective height of not more than 25 m and having a roof without an FRL in accordance with Clause 3.5, in the storey immediately below that roof, internal columns other than those referred to in Clause 3.1(f) and internal walls other than fire walls and shaft walls may have:

a) in a Class 2 or 3 building: FRL 60/60/60; or

b) in a Class 5, 6, 7, 8 or 9 building:

(i) with rise in storeys exceeding 3: FRL 60/60/60; or

(ii) with rise in storeys not exceeding 3: no FRL.

.8 OPEN SPECTATOR STANDS AND INDOOR SPORTS STADIUMS: CONCESSION

In an open spectator stand or indoor sports stadium, the following building elements need not have the FRL specified in Table 3:

a) The roof if it is non-combustible

b) Columns and loadbearing walls supporting only the roof if they are non-combustible

c) Any non-loadbearing part of an external wall less than 3 m:

(i) from any fire-source feature to which it is exposed if it has an FRL of not less than –/60/60 and is non-combustible; or

(ii) from an external wall of another open spectator stand if it is non-combustible.

.9 CARPARKS

a) Notwithstanding Clause 3.1, a carpark may comply with Table 3.9 if it is an open-deck carpark or is protected with a sprinkler system (other than a FPAA101D or FPAA101H system) complying with Specification E1.5 and is:

(i) a separate building; or

(ii) a part of a building:

A. which only occupies part of a storey, and is separated from the remaining part by a fire wall; or

B. which is located above or below another classification, and the floor separating the classifications complies with C2.9; or

C. which is located above another Class 7 part of the building not used for carparking, and the floor separating the parts complies with Table 3 for a Class 7 part other than a carpark; or

D. which is located below another Class 7 part of the building not used for carparking, and the floor separating the parts complies with Table 3.9.

b) For the purposes of this Clause, a carpark:

(i) includes:

A. an administration area associated with the functioning of the carpark

B. where the carpark is sprinklered, is associated with a Class 2 or 3 building and provides carparking for separate sole-occupancy units, each carparking area with an area not greater than 10% of its floor area for purposes ancillary to the sole-occupancy units; but

(ii) excludes:

A. except for (b)(i), any area of another classification, or other part of a Class 7 building not used for carparking

B. a building or part of a building specifically intended for the parking of trucks, buses, vans and the like.

Table 3.9 Requirements for carparks

Building Element			FRL **(not less than)** Structural adequacy/Integrity/Insulation ESA/M **(not greater than)**
Wall			
(a)	external wall		
	(i)	less than 3 m from a fire-source feature to which it is exposed:	
		Loadbearing	60/60/60
		Non-loadbearing	–/60/60
	(ii)	3 m or more from a fire-source feature to which it is exposed	–/–/–
(b)	internal wall		
	(i)	loadbearing, other than one supporting only the roof (not used for carparking)	60/–/–
	(ii)	supporting only the roof (not used for carparking)	–/–/–
	(iii)	non-loadbearing	–/–/–
(c)	fire wall		
	(i)	from the direction used as a carpark	60/60/60
	(ii)	from the direction not used as a carpark	as required by Table 3
Column			
(a)	supporting only the roof (not used for carparking) and 3 m or more from a fire-source feature to which it is exposed		–/–/–
(b)	steel column, other than one covered by (a) and one that does not support a part of a building that is not used as a carpark		60/–/– or 26 m^2/tonne
(c)	any other column not covered by (a) or (b)		60/–/–
Beam			
(a)	steel floor beam in continuous contact with a concrete floor slab		60/–/– or 30 m^2/tonne
(b)	any other beam		60/–/–
Fire-resisting lift and stair shaft **(within the carpark only)**			60/60/60
Floor slab and vehicle ramp			60/60/60
Roof **(not used for carparking)**			–/–/–

Notes to Table 3.9:

1. ESA/M means the ratio of exposed surface area to mass per unit length.

2. Refer to Specification E1.5 for special requirements for a sprinkler system in a carpark complying with Table 3.9 and located within a multi-classified building.

.10 CLASS 2 AND 3 BUILDINGS: CONCESSION

a) In a Class 2 or 3 building with a rise in storeys of not more than 3:

(i) notwithstanding C1.9(a) and (b) and C2.6, timber framing may be used for:

A. external walls

B. common walls

C. the floor framing of lift pits

D. non-loadbearing internal walls which are required to be fire-resisting

E. non-loadbearing shafts, except shafts used for the discharge of hot products of combustion

F. spandrels or horizontal construction provided for the purposes of C2.6

(ii) notwithstanding Clause 3.1(d) of Specification C1.1, for loadbearing internal walls and loadbearing fire walls:

A. timber framing may be used

B. non-combustible materials may be used.

b) A Class 2 or 3 building having a rise in storeys of not more than 4 may have the top three storeys constructed in accordance with (a) provided:

(i) the lowest storey is used solely for the purpose of parking motor vehicles or for some other ancillary purpose

(ii) the lowest storey is constructed of concrete or masonry including the floor between it and the Class 2 or 3 part of the building above

(iii) the lowest storey and the storey above are separated by construction having an FRL of not less than 90/90/90 with no openings or penetrations that would reduce the fire-resisting performance of that construction except that a doorway in that construction may be protected by a –/60/30 self-closing fire door.

c) In a Class 2 or 3 building complying with (a) or (b) and fitted with a sprinkler system (other than a FPAA101D or FPAA101H system) complying with Specification E1.5, any FRL criterion prescribed in Table 3:

(i) for any floor and any loadbearing wall, may be reduced to 60, except any FRL criterion of 90 for an external wall must be maintained when tested from the outside

(ii) for any non-loadbearing internal wall, need not apply if:

A. it is lined on each side with 13 mm standard grade plasterboard or similar non-combustible material

B. it extends:

(aa) to the underside of the floor next above; or

(bb) to the underside of a ceiling with a resistance to the incipient spread of fire of 60 minutes; or

(cc) to the underside of a non-combustible roof covering

C. any insulation installed in the cavity of the wall is non-combustible

D. any construction joint, space or the like between the top of the wall and the floor, ceiling or roof is smoke sealed with intumescent putty or other suitable material

E. any doorway in the wall is protected by a self-closing, tight fitting, solid core door not less than 35 mm thick.

4. TYPE B FIRE-RESISTING CONSTRUCTION

.1 FIRE-RESISTANCE OF BUILDING ELEMENTS

In a building required to be of Type B construction:

a) each building element listed in Table 4, and any beam or column incorporated in it, must have an FRL not less than that listed in the Table for the particular Class of building concerned

b) * * * * *

c) if a stair shaft supports any floor or a structural part of it:

(i) the floor or part must have an FRL of 60/–/– or more; or

(ii) the junction of the stair shaft must be constructed so that the floor or part will be free to sag or fall in a fire without causing structural damage to the shaft

d) any internal wall which is required to have an FRL with respect to integrity and insulation, except a wall that bounds a sole-occupancy unit in the topmost (or only) storey and there is only one unit in that storey, must extend to:

(i) the underside of the floor next above if that floor has an FRL of at least 30/30/30; or

(ii) the underside of a ceiling having a resistance to the incipient spread of fire to the space above itself of not less than 60 minutes; or

(iii) the underside of the roof covering if it is non-combustible and, except for roof battens with dimensions of 75 mm x 50 mm or less or sarking-type material, must not be crossed by timber or other combustible building elements; or

(iv) 450 mm above the roof covering if it is combustible

e) a loadbearing internal wall and a loadbearing fire wall (including those that are part of a loadbearing shaft) must be constructed from:

(i) concrete; or

(ii) masonry; or

(iii) fire-protected timber, provided that:

A. the building is:

(aa) a separate building; or (bb) a part of a building:

(AA) which only occupies part of a storey, and is separated from the remaining part by a fire wall; or (BB) which is located above or below a part not containing fire-protected timber and the floor between the adjoining parts is provided with an FRL not less than that prescribed for a fire wall for the lower storey

B. the building has an effective height of not more than 25 m

C. the building has a sprinkler system (other than a FPAA101D or FPAA101H system) throughout complying with Specification E1.5

D. any insulation installed in the cavity of the timber building element required to have an FRL is non-combustible

E. cavity barriers are provided in accordance with Specification C1.13; or

(iv) any combination of (i) to (iii)

f) * * * * *

g) in a Class 5, 6, 7, 8 or 9 building, in the storey immediately below the roof, internal columns and internal walls other than fire walls and shaft walls, need not comply with Table 4

h) * * * * *

i) in a Class 2 or 3 building, except where within the one sole-occupancy units, or a Class 9a health-care building or a Class 9b building, a floor separating storeys or above a space for the accommodation of motor vehicles or used for storage or any other ancillary purpose, must:

(i) be constructed so that it is at least of the standard achieved by a floor/ceiling system incorporating a ceiling which has a resistance to the incipient spread of fire to the space above itself of not less than 60 minutes; or

(ii) have an FRL of at least 30/30/30; or

(iii) have a fire-protective covering on the underside of the floor, including beams incorporated in it, if the floor is combustible or of metal

j) in a Class 9c building a floor above a space for the accommodation of motor vehicles or used for storage or any other ancillary purpose, and any column supporting the floor must:

(i) be constructed so that it is at least of the standard achieved by a floor/ceiling system incorporating a ceiling which has a resistance to the incipient spread of fire to the space above itself of not less than 60 minutes; or

(ii) have an FRL of at least 30/30/30; or

(iii) have a fire-protective covering on the underside of the floor, including beams incorporated in it, if the floor is combustible or of metal.

Table 4: Type B construction: FRL of building elements

Building element	Class of building—FRL: (in minutes)			
	Structural adequacy/Integrity/Insulation			
	2, 3 or 4 part	5, 7a or 9	6	7b or 8
EXTERNAL WALL (including any column and other building element incorporated within it) or other external building element, where the distance from any fire-source feature to which it is exposed is				
For loadbearing parts				
less than 1.5 m	90/ 90/ 90	120/120/120	180/180/180	240/240/240
1.5 to less than 3 m	90/ 60/ 30	120/ 90/ 60	180/120/ 90	240/180/120
3 to less than 9 m	90/ 30/ 30	120/ 30/ 30	180/ 90/ 60	240/ 90/ 60
9 to less than 18 m	90/ 30/–	120/ 30/–	180/ 60/–	240/ 60/–
18 m or more	–/–/–	–/–/–	–/–/–	–/–/–
For non-loadbearing parts				
less than 1.5 m	–/ 90/ 90	–/120/120	–/180/180	–/240/240
1.5 to less than 3 m	–/ 60/ 30	–/ 90/ 60	–/120/ 90	–/180/120
3 m or more	–/–/–	–/–/–	–/–/–	–/–/–
EXTERNAL COLUMN not incorporated in an external wall, where the distance from any fire-source feature to which it is exposed is				
For loadbearing columns				
less than 18 m	90/–/–	120/–/–	180/–/–	240/–/–
18 m or more	–/–/–	–/–/–	–/–/–	–/–/–
For non-loadbearing columns				
For non-loadbearing columns	–/–/–	–/–/–	–/–/–	–/–/–
COMMON WALLS and FIRE WALLS	90/ 90 / 90	120/120/120	180/180/180	240/240/240
INTERNAL WALLS				
Fire-resisting lift and stair shafts				
Loadbearing	90/ 90/ 90	120/120/120	180/120/120	240/120/120
Fire-resisting stair shafts				
Non-loadbearing	–/ 90/ 90	–/120/120	–/120/120	–/120/120
Bounding public corridors, public lobbies and the like				
Loadbearing	60/ 60/ 60	120/–/–	180/–/–	240/–/–
Non-loadbearing	–/ 60/ 60	–/–/–	–/–/–	–/–/–
Between or bounding sole-occupancy units				
Loadbearing	60/ 60/ 60	120/–/–	180/–/–	240/–/–
Non-loadbearing	–/ 60/ 60	–/–/–	–/–/–	–/–/–
OTHER LOADBEARING INTERNAL WALLS and COLUMNS	60/–/–	120/–/–	180/–/–	240/–/–
ROOFS	–/–/–	–/–/–	–/–/–	–/–/–

.2 CARPARKS

a) Notwithstanding Clause 4.1, a carpark may comply with Table 4.2 if it is an open-deck carpark or is protected with a sprinkler system (other than a FPAA101D or FPAA101H system) complying with Specification E1.5 and is:

(i) a separate building; or

(ii) a part of a building, and if occupying only part of a storey, is separated from the remaining part by a fire wall.

b) For the purposes of this Clause, a carpark:

(i) includes:

A. an administration area associated with the functioning of the carpark

B. where the carpark is sprinklered, is associated with a Class 2 or 3 building and provides carparking for separate sole-occupancy units, each carparking area with an area not greater than 10% of its floor area for purposes ancillary to the sole-occupancy units; but

(ii) excludes:

A. except for (b)(i), any area of another classification, or other part of a Class 7 building not used for carparking

B. a building or part of a building specifically intended for the parking of trucks, buses, vans and the like.

Table 4.2 Requirements for carparks

Building element			FRL **(not less than) Structural adequacy/Integrity/Insulation** ESA/M **(not greater than)**
Wall			
(a)	external wall		
	(i)	less than 3 m from a fire-source feature to which it is exposed:	
		Loadbearing	60/60/60
		Non-loadbearing	–/60/60
	(ii)	3 m or more from a fire-source feature to which it is exposed	–/–/–
(b)	internal wall		
	(i)	loadbearing, other than one supporting only the roof (not used for carparking)	60/–/–
	(ii)	supporting only the roof (not used for carparking)	–/–/–
	(iii)	non-loadbearing	–/–/–
(c)	fire wall		
	(i)	from the direction used as a carpark	60/60/60
	(ii)	from the direction not used as a carpark	as required by Table 4

Building element			FRL **(not less than) Structural adequacy/Integrity/Insulation** ESA/M **(not greater than)**
Column			
(a)	supporting only the roof (not used for carparking) and 3 m or more from a fire-source feature to which it is exposed		–/–/–
(b)	steel column, other than one covered by (a)		60/–/– or 26 m^2/tonne
(c)	any other column not covered by (a) or (b)		60/–/–
Beam			
(a)	less than 3 m from a fire-source feature:		
	(i)	steel floor beam in continuous contact with a concrete floor slab	60/–/– or 30 m^2/tonne
	(ii)	any other beam	60/–/–
(b)	3 m or more from a fire-source feature		–/–/–
Lift shaft			–/–/–
Fire-resisting stair shaft (within the carpark only)			60/60/60
Roof, floor slab and vehicle ramp			–/–/–

Note to Table 4.2:

ESA/M means the ratio of exposed surface area to mass per unit length.

.3 CLASS 2 AND 3 BUILDINGS: CONCESSION

a) In a Class 2 or 3 building with a rise in storeys of not more than 2-

(i) notwithstanding C1.9(a) and (b), timber framing may be used for:

A. external walls

B. common walls

C. the floor framing of lift pits

D. non-loadbearing internal walls which are required to be fire-resisting

E. non-loadbearing shafts, except shafts used for the discharge of hot products of combustion

(ii) notwithstanding Clause 4.1(e) of Specification C1.1, for loadbearing internal walls and loadbearing fire walls:

A. timber framing may be used

B. non-combustible materials may be used.

b) A Class 2 or 3 building having a rise in storeys of not more than 2 may have the top storey constructed in accordance with (a) provided:

(i) the lowest storey is used solely for the purpose of parking motor vehicles or for some other ancillary purpose

(ii) the lowest storey is constructed of concrete or masonry including the floor between it and the Class 2 or 3 part of the building above

(iii) the lowest storey and the storey above are separated by construction having an FRL of not less than 90/90/90 with no openings or penetrations that would reduce the fire-resisting performance of that construction except that a doorway in that construction may be protected by a –/60/30 self-closing fire door.

c) In a Class 2 or 3 building complying with (a) or (b) and fitted with a sprinkler system (other than a FPAA101D or FPAA101H system) complying with Specification E1.5, any FRL criterion prescribed in Table 4:

(i) for any loadbearing wall, may be reduced to 60, except any FRL criterion of 90 for an external wall must be maintained when tested from the outside

(ii) for any non-loadbearing internal wall, need not apply, if:

A. it is lined on both sides with 13 mm standard grade plasterboard or similar non-combustible material

B. it extends:

(aa) to the underside of the floor next above if that floor has an FRL of at least 30/30/30 or is lined on the underside with a fire-protective covering; or

(bb) to the underside of a ceiling with a resistance to the incipient spread of fire of 60 minutes; or

(cc) to the underside of a non-combustible roof covering

C. any insulation installed in the cavity of the wall is non-combustible

D. any construction joints, spaces and the like between the top of the wall and the floor, ceiling or roof is smoke sealed with intumescent putty or other suitable material.

5. TYPE C FIRE-RESISTING CONSTRUCTION

.1 FIRE-RESISTANCE OF BUILDING ELEMENTS

In a building required to be of Type C construction:

a) a building element listed in Table 5 and any beam or column incorporated in it, must have an FRL not less than that listed in the Table for the particular Class of building concerned

b) an external wall that is required by Table 5 to have an FRL need only be tested from the outside to satisfy the requirement

c) a fire wall or an internal wall bounding a sole-occupancy unit or separating adjoining units must comply with Specification C1.8 if it is of lightweight construction and is required to have an FRL

d) in a Class 2 or 3 building, an internal wall which is required by Table 5 to have an FRL must extend:

(i) to the underside of the floor next above if that floor has an FRL of at least 30/30/30 or a fire-protective covering on the underside of the floor; or

(ii) to the underside of a ceiling having a resistance to the incipient spread of fire to the space above itself of not less than 60 minutes; or

(iii) to the underside of the roof covering if it is non-combustible, and except for roof battens with dimensions of 75 mm x 50 mm or less or sarking-type material, must not be crossed by timber or other combustible building elements; or

(iv) 450 mm above the roof covering if it is combustible

e) in a Class 2 or 3 building, except where within the one sole-occupancy unit, or a Class 9a health-care building, or a Class 9b building, a floor separating storeys, or above a space for the accommodation of motor vehicles or used for storage or any other ancillary purpose, and any column supporting the floor, must:

(i) have an FRL of at least 30/30/30; or

(ii) have a fire-protective covering on the underside of the floor including beams incorporated in it and around the column, if the floor or column is combustible or of metal

f) in a Class 9c building a floor above a space for the accommodation of motor vehicles or used for storage or any other ancillary purpose, and any column supporting the floor, must:

(i) have an FRL of at least 30/30/30; or

(ii) have a fire-protective covering on the underside of the floor including beams incorporated in it and around the column, if the floor or column is combustible or of metal.

Table 5 Type C construction: FRL of building elements

Building Element	**Class of building—FRL:** (in minutes)			
	Structural adequacy/Integrity/Insulation			
	2, 3 or 4 part	**5, 7a or 9**	**6**	**7b or 8**
EXTERNAL WALL (including any column and other building element incorporated within it) or other external building element, where the distance from any fire-source feature to which it is exposed is				
Less than 1.5 m	90/ 90/ 90	90/ 90/ 90	90/ 90/ 90	90/ 90/ 90
1.5 to less than 3 m	–/–/–	60/ 60/ 60	60/ 60/ 60	60/ 60/ 60
3 m or more	–/–/–	–/–/–	–/–/–	–/–/–
EXTERNAL COLUMN not incorporated in an external wall, where the distance from any fire-source feature to which it is exposed is				
Less than 1.5 m	90/–/–	90/–/–	90/–/–	90/–/–
1.5 to less than 3 m	–/–/–	60/–/–	60/–/–	60/–/–
3 m or more	–/–/–	–/–/–	–/–/–	–/–/–
COMMON WALLS and FIRE WALLS	90/ 90/ 90	90/ 90/ 90	90/ 90/ 90	90/ 90/ 90

INTERNAL WALLS				
Bounding public corridors, public lobbies and the like	60/ 60/ 60	–/–/–	–/–/–	–/–/–
Between or bounding sole-occupancy units	60/ 60/ 60	–/–/–	–/–/–	–/–/–
Bounding a stair if required to be rated	60/ 60/ 60	60/ 60/ 60	60/ 60/ 60	60/ 60/ 60
ROOFS	–/–/–	–/–/–	–/–/–	–/–/–

.2 CARPARKS

a) Notwithstanding Clause 5.1, a carpark may comply with Table 5.2 if it is an open-deck carpark or is protected with a sprinkler system (other than a FPAA101D or FPAA101H system) complying with Specification E1.5 and is:

(i) a separate building; or

(ii) a part of a building, and if occupying only part of a storey, is separated from the remaining part by a fire wall.

b) For the purposes of this Clause, a carpark:

(i) includes:

A. an administration area associated with the functioning of the carpark

B. where the carpark is sprinklered, is associated with a Class 2 or 3 building and provides carparking for separate sole-occupancy units, each carparking area with an area not greater than 10% of its floor area for purposes ancillary to the sole-occupancy units; but

(ii) excludes:

A. except for (b)(i), any area of another classification, or other part of a Class 7 building not used for carparking

B. a building or part of a building specifically intended for the parking of trucks, buses, vans and the like.

Table 5.2 Requirements for carparks

Building Element				FRL **(not less than) Structural adequacy/Integrity/Insulation** ESA/M **(not greater than)**
Wall				
(a)	external wall			
	(i)	less than 1.5 m from a fire-source feature to which it is exposed:		
			Loadbearing	60/60/60
			Non-loadbearing	–/60/60
	(ii)	1.5 m or more from a fire-source feature to which it is exposed		–/–/–
(b)	internal wall			–/–/–
(c)	fire wall			
	(i)	from the direction used as a carpark		60/60/60
	(ii)	from the direction not used as a carpark		90/90/90
Column				
(a)	steel column less than 1.5 m from a fire-source feature			60/–/– or 26 m^2/tonne
(b)	any other column less than 1.5 m from a fire-source feature			60/–/–
(c)	any other column not covered by (a) or (b)			–/–/–
Beam				
(a)	less than 1.5 m from a fire-source feature			
	(i)	steel floor beam in continuous contact with a concrete floor slab		60/–/– or 30 m^2/tonne
	(ii)	any other beam		60/–/–
(b)	1.5 m or more from a fire-source feature			–/–/–
Roof, floor slab and vehicle ramp				–/–/–

Note to Table 5.2

ESA/M means the ratio of exposed surface area to mass per unit length.

SPECIFICATION C1.8 STRUCTURAL TESTS FOR LIGHTWEIGHT CONSTRUCTION

1. SCOPE

This Specification describes tests to be applied to and criteria to be satisfied by a wall system of lightweight construction.

2. APPLICATION

A wall system need not be tested in accordance with this Specification for static pressure or impact if it is designed and constructed in accordance with the Deemed-to- Satisfy Provisions of Section B to resist the appropriate pressures and impacts defined in this Specification.

3. TESTS

.1 WALLS OF CERTAIN CLASS 9B BUILDINGS

Lightweight construction forming:

a) a wall of a lift shaft and stair shaft

b) an external and internal wall bounding a public corridor, public lobby or the like, including a fire-isolated and non fire-isolated passageway or ramp, in a spectator stand, sports stadium, cinema or theatre, railway or bus station or airport terminal, must be subjected to the following tests and must fulfil the following criteria:

(i) The materials tests of Clause 5(a) and the criteria of Clause 6(a).

(ii) A static test by the imposition of a uniformly distributed load of 1.0 kPa (or its equivalent) in accordance with Clause 5(b) and the damage and deflection criteria of Clauses 6(b) and (c) respectively.

(iii) A dynamic test by the fall of the impact bag through a height of 350 mm in accordance with Clause 5(c) and the damage and deflection criteria of Clauses 6(b) and (d) respectively.

(iv) The surface indentation test of Clause 5(d) and the surface indentation criterion of Clause 6(e).

.2 WALLS OF SHAFTS AND FIRE-ISOLATED EXITS GENERALLY

A wall of lightweight construction that is required to be fire-resisting and which bounds a lift shaft, stair shaft, or service shaft, fire-isolated passageway or fire-isolated ramp must be subjected to the following tests and must fulfil the following criteria:

a) The materials tests of Clause 5(a) and the criteria of Clause 6(a).

b) A static test by the imposition of a uniformly distributed load of 0.35 kPa (or its equivalent) in accordance with Clause 5(b) and the damage and deflection criteria of Clauses 6(b) and (c) respectively.

c) A dynamic test by the fall of the impact bag through a height of 150 mm in accordance with Clause 5(c) and the damage and deflection criteria of Clauses 6(b) and (d) respectively.

d) The surface indentation test of Clause 5(d) and the surface indentation criterion of Clause 6(e).

.3 ADDITIONAL REQUIREMENTS FOR LIFT SHAFTS

a) In addition to the requirements of Clauses 3.1 and 3.2, a wall system for use in a lift shaft that is required to be fire-resisting must be subjected to dynamic test by the imposition of:

   (i) where the lift car speed is 7 m/s or less — 106 cycles of a uniformly distributed load between 0 and 0.2 kPa (or its equivalent); or

   (ii) where the lift car speed is greater than 7 m/s — 106 cycles of a uniformly distributed load between 0 and 0.35 kPa (or its equivalent) in accordance with Clause 5(e) and must fulfil the damage criteria of Clause 6(b).

b) The wall system must be subjected to the static test in accordance with Clause 3.2(b) after the successful conclusion of the dynamic test specified in (a).

.4 WALLS GENERALLY

An external and internal wall of lightweight construction that is required to be fire-resisting, other than one covered by Clauses 3.1, 3.2 or 3.3, must be subjected to the following tests and must fulfil the following criteria:

a) The materials tests of Clause 5(a) and the criteria of Clause 6(a).

b) A static test by the imposition of a uniformly distributed load of 0.25 kPa (or its equivalent) in accordance with Clause 5(b) and the damage and deflection criteria of Clauses 6(b) and (c) respectively.

c) A dynamic test by fall of the impact bag through a height of 100 mm in accordance with Clause 5(c) and the damage and deflection criteria of Clauses 6(b) and (d) respectively.

d) The surface indentation test of Clause 5(d) and the surface indentation criterion of Clause 6(e).

4. TEST SPECIMENS

.1 GENERAL

Testing must be carried out on either:

a) construction in-situ; or

b) a laboratory specimen of the construction.

.2 TESTING IN-SITU

If testing is carried out in-situ, it must be done on that part of the construction least likely, because of the particular combination of the height of the walls, the support conditions and other aspects of the construction, to resist the loads.

.3 TESTING OF SPECIMENS

If a laboratory specimen is tested, the specimen must span only in the direction corresponding to the height of the wall and testing must be done in accordance with either (a) or (b) below:

a) The test specimen:

(i) height (or length, if the specimen is tested horizontally) must be identical with the height between supports in the actual construction

(ii) must be supported at the top and bottom (or at each end if tested horizontally) by components identical with, and in a manner identical with, the actual construction.

b) If the distance between supports of the actual construction is more than 3 m, then a smaller specimen may be tested but:

(i) the distance between supports must be not less than 3 m

(ii) forces, reactions and support conditions must be modelled so as to reproduce the behavior of the actual construction if it were tested in-situ.

5. TEST METHODS

Tests must be carried out in accordance with the following:

a) Material tests — The methods specified for the constituent materials of the construction of the standards adopted by reference in the BCA.

b) For resistance to static pressure — The provisions for testing walls under transverse load in ASTM E72-15, except that:

(i) support conditions must be as specified in Clause 4.3

(ii) equivalent load shall mean the quarter-point load that produces the same deflection or central moment as appropriate

(iii) the timber species nominated in that standard may be substituted with a different species.

c) For resistance to impact — The provisions for testing wall systems in ASTM E695-03, except that:

(i) the point of impact must be set 1.5 m above finished floor level or 1.5 m above the part of the specimen that corresponds to finished floor level

(ii) the impact bag must be not less than 225 mm in diameter and not more than 260 mm in diameter and have a mass of not less than 27.2 or more than 27.3 kg

(iii) the mass must be achieved by putting loose, dry sand into the bag and must be adjusted before each series of impact tests

(iv) where the impact bag and suspension cannot be vertical at the instant of impact on a curved surface or an inclined surface, the height of drop is the net height at the point of impact.

d) For resistance to surface indentation — The test for resistance to surface indentation must be carried out at three points on the surface of an undamaged sample sheet as follows:

(i) A steel ball of 10 mm diameter with a load of 150 N must be placed gently on the surface of the sheet and allowed to remain in position for 5 minutes.

(ii) The ball and load must then be removed and the diameter of each impression of the ball on the surface measured.

e) For resistance of lift shaft construction to repetitive load — As for 5(b) except that:

(i) it is sufficient to test one specimen with the pressure applied from the side of the construction on which the lift will operate

(ii) the load must be applied dynamically at a frequency not less than 1 Hz and not more than 3 Hz

(iii) equivalent load shall mean the quarter-point load that produces the same central moment as the distributed load.

6. CRITERIA FOR COMPLIANCE

The wall system or the specimen of it must fulfil the following criteria:

a) Materials — Materials must comply with the applicable standard adopted by reference in the BCA.

b) Damage — There must be no crack, penetration or permanent surface-deformation to a depth of more than 0.5 mm or any other non-elastic deformation or fastener failure.

c) Deflection — Static pressure — Under static pressure the deflection must not be more than:

(i) 1/240th of the height between supports; or

(ii) for construction other than a lift shaft — 30 mm; or

(iii) for a lift shaft — 20 mm.

d) Deflection — Impact — Under impact the instantaneous deflection must not be more than

(i) 1/120th of the height of the wall between supports; or

(ii) for construction other than a lift shaft — 30 mm; or

(iii) for a lift shaft — 20 mm.

e) Surface indentation — No impression must be more than 5 mm in diameter.

SPECIFICATION C1.10 FIRE HAZARD PROPERTIES

1. SCOPE

This Specification sets out requirements in relation to the fire hazard properties of linings, materials and assemblies in Class 2 to 9 buildings as set out in Table 1.

2. APPLICATION

Linings, materials and assemblies in Class 2 to 9 buildings must comply with the appropriate requirement described in Table 1.

Table 1 Fire hazard property requirements

Lining, Material or Assembly	Requirement
Floor linings and floor coverings	Clause 3
Wall linings and ceiling linings	Clause 4
Air-handling ductwork	Clause 5
Lift cars	Clause 6
In fire control rooms subject to Specification C1.8 and fire isolated exits	Clause 7
In Class 9b buildings used as a theatre, public hall or the like— a) fixed seating in the audience area or auditorium; and b) a proscenium curtain required by Specification H1.3	Clause 7
Escalators, moving walkways and non-required non-fire-isolated stairways or pedestrian ramps subject to Specification D1.12	Clause 7
Sarking-type material	Clause 7
Attachments to internal floors, walls and ceilings	Clause 7
Other materials including insulation	Clause 7

3. FLOOR LININGS AND FLOOR COVERINGS

A floor lining or floor covering must have:

a) a critical radiant flux not less than that listed in Table 2

b) in a building not protected by a sprinkler system (other than a FPAA101D or FPAA101H system) complying with Specification E1.5, a maximum smoke development rate of 750 percent-minutes

c) a group number complying with Clause 6(b), for any portion of the floor covering that is continued more than 150 mm up a wall.

Table 2 Critical radiant flux (CHF in kW/m$^{2)}$ of floor linings and floor coverings

Class Of Building	**Building Not Fitted With A Sprinkler System (Other Than A FPAA101D Or FPAA101H System) Complying With** Specification E1.5	**Building Fitted With A Sprinkler System (Other Than A FPAA101D Or FPAA101H System) Complying With** Specification E1.5	**Fire-Isolated** Exits **And Fire Control Rooms**
Class 2, 3, 5, 6, 7, 8 or 9b, excluding— (i) Class 3 accommodation for the aged; and (ii) Class 9b as specified below	2.2 kW/m^2	1.2 kW/m^2	2.2 kW/m^2
Class 3 Accommodation for the aged	4.5 kW/m^2	2.2 kW/m^2	4.5 kW/m^2
Class 9a	4.5 kW/m^2	2.2 kW/m^2	4.5 kW/m^2
Class 9a Areas other than patient care areas	2.2 kW/m^2	1.2 kW/m^2	4.5 kW/m^2
Class 9b auditorium or audience seating area used mainly for indoor swimming or ice skating	1.2 kW/m^2	1.2 kW/m^2	2.2 kW/m^2
Class 9b auditorium or audience seating area used mainly for— other sports or multi-purpose functions.	2.2 kW/m^2	1.2 kW/m^2	2.2 kW/m^2
Class 9c resident use areas.	N/A	2.2 kW/m^2	4.5 kW/m^2
Class 9c Areas other than	N/A	1.2 kW/m^2	4.5 kW/m^2

4. WALL AND CEILING LININGS

a) A wall or ceiling lining system must comply with the group number specified in Table 3 and for buildings not fitted with a sprinkler system (other than a FPAA101D or FPAA101H system) complying with Specification E1.5 have:

   i. a smoke growth rate index not more than 100; or

   ii. an average specific extinction area less than 250 m2/kg.

b) A group number of a wall or ceiling lining and the smoke growth rate index or average specific extinction area must be determined in accordance with AS 5637.1.

Table 3 Wall and ceiling lining materials (material groups permitted)

Class Of Building	Fire-Isolated Exits And Fire Control Rooms	Public Corridors	Specific Areas	Other Areas
Class 2 or 3, Unsprinklered Excluding accommodation for the aged, people with disabilities, and children	Walls: 1 Ceilings: 1	Walls: 1, 2 Ceilings: 1, 2	Walls: 1, 2, 3 Ceilings: 1, 2, 3	Walls: 1, 2, 3 Ceilings: 1, 2, 3
Class 2 or 3, Sprinklered Excluding accommodation for the aged, people with disabilities, and children	Walls: 1 Ceilings: 1	Walls: 1, 2, 3 Ceilings: 1, 2, 3	Walls: 1, 2, 3 Ceilings: 1, 2, 3	Walls: 1, 2, 3 Ceilings: 1, 2, 3
Class 3 or 9a, Unsprinklered Accommodation for the aged, people with a disability, children and health-care buildings	Walls: 1 Ceilings: 1	Walls: 1 Ceilings: 1	Walls: 1, 2 Ceilings: 1, 2	Walls: 1, 2, 3 Ceilings: 1, 2, 3
Class 3 or 9a, Sprinklered Accommodation for the aged, people with a disability, children and health-care buildings	Walls: 1 Ceilings: 1	Walls: 1, 2 Ceilings: 1, 2	Walls: 1, 2, 3 Ceilings: 1, 2, 3	Walls: 1, 2, 3 Ceilings: 1, 2, 3
Class 5, 6, 7, 8 or 9b schools, Unsprinklered	Walls: 1 Ceilings: 1	Walls: 1, 2 Ceilings: 1, 2	Walls: 1, 2, 3 Ceilings: 1, 2	Walls: 1, 2, 3 Ceilings: 1, 2, 3
Class 5, 6, 7, 8 or 9b schools, Sprinklered	Walls: 1 Ceilings: 1	Walls: 1, 2, 3 Ceilings: 1, 2, 3	Walls: 1, 2, 3 Ceilings: 1, 2, 3	Walls: 1, 2, 3 Ceilings: 1 ,2, 3
Class 9b other than schools, Unsprinklered	Walls: 1	Walls: 1	Walls: 1, 2	Walls: 1, 2, 3

	Ceilings: 1	Ceilings: 1	Ceilings: 1, 2	Ceilings: 1, 2, 3
Class 9b other than schools, Sprinklered	Walls: 1 Ceilings: 1	Walls: 1, 2 Ceilings: 1, 2	Walls: 1, 2, 3 Ceilings: 1, 2, 3	Walls: 1, 2, 3 Ceilings: 1, 2, 3
Class 9c, Sprinklered	Walls: 1 Ceilings: 1	Walls: 1, 2 Ceilings: 1, 2	Walls: 1, 2, 3 Ceilings: 1, 2, 3	Walls: 1, 2, 3 Ceilings: 1, 2, 3

Notes to Table 3:

1. "Sprinklered" means a building fitted with a sprinkler system (other than a FPAA101D or FPAA101H system) complying with Specification E1.5.

2. "Specific areas" means within:

a) for Class 2 and 3 buildings, a sole-occupancy unit

b) for Class 5 buildings, open plan offices with a minimum floor dimension/floor to ceiling height ratio > 5

c) for Class 6 buildings, shops or other building with a minimum floor dimension/floor to ceiling height ratio > 5

d) for Class 9a health-care buildings, patient care areas

e) for Class 9b theatres and halls, etc, an auditorium; and f☐for Class 9b schools, a classroom

f) for Class 9c buildings, resident use area.

5. AIR-HANDLING DUCTWORK

Rigid and flexible ductwork in a Class 2 to 9 building must comply with the fire hazard properties set out in AS 4254.1 and AS 4254.2.

6. LIFT CARS

Materials used as:

a) floor linings and floor coverings must have a critical radiant flux not less than 2.2

b) wall and ceiling linings must be a Group 1 material or a Group 2 material in accordance with AS 5637.1.

7. OTHER MATERIALS

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Materials and assemblies in a Class 2 to 9 building not included in Clauses 3, 4, 5 or 6 must not exceed the indices set out in Table 4.

Table 4 Other materials

Material or assembly location	Flammability Index	Spread-of-Flame Index	Smoke-Developed Index
Fire control rooms subject to Specification E1.8 and fire-isolated exits , other than a Sarking-type material used in a ceiling or used as an attachment or part of an attachment to a building element. Note 1	N/A	0	2
Class 9b buildings used as a theatre, public hall or the like: Any part of fixed seating in the audience area or auditorium.	N/A	0	5
Class 9b buildings used as a theatre, public hall or the like: A proscenium curtain required by Specification H1.3.	N/A	0	3
Escalators, moving walkways or non-required non-fire-isolated stairways or pedestrian ramps subject to Specification D1.12.	N/A	0	5
Sarking-type material: In a fire control room subject to Specification E1.8 or a fire-isolated exit or fire control room used in the form of an exposed wall or ceiling.	0	N/A	N/A
Sarking-type material: In other locations. Note 2	5	N/A	N/A
Other materials or locations and insulation materials other than Sarking-type materials. Notes 2 and 3	N/A	9	8 if the **Spread-of-Flame Index** is more than 5

Notes to Table 4:

1. In a fire control room or fire-isolated stairway, a material used as an attachment or part of an attachment to a building element must, if combustible, be attached directly to a non-combustible substrate and not exceed 1 mm finished thickness.

2. A material, other than one located within a fire-isolated exit or fire control room, may be covered on all faces by concrete or masonry not less than 50 mm thick, as an alternative to meeting the specified indices.

3. In the case of a composite member or assembly, the member or assembly must be constructed so that when assembled as proposed in a building:

a) any material which does not comply with this Table is protected on all sides and edges from exposure to the air

b) the member or assembly, when tested in accordance with Schedule 6, has a Spread-of-Flame Index and a Smoke-Developed Index not exceeding those prescribed in this Table

c) the member or assembly retains the protection in position so that it prevents ignition of the material and continues to screen it from access to free air for a period of not less than 10 minutes.

SPECIFICATION C1.11 PERFORMANCE OF EXTERNAL WALLS IN FIRE

1. SCOPE

This Specification contains measures to minimise, in the event of fire, the likelihood of external walls covered by Clause 2 collapsing outwards as complete panels and the likelihood of panels separating from supporting members.

2. APPLICATION

This Specification applies to buildings having a rise in storeys of not more than 2 with concrete external walls that could collapse as complete panels (e.g. tilt-up and precast concrete) which:

a) consist of either single or multiple panels attached by steel connections to lateral supporting members

b) depend on those connections to resist outward movement of the panels relative to the supporting members

c) have height to thickness ratio not greater than 50.

3. GENERAL REQUIREMENTS FOR EXTERNAL WALL PANELS

a) Cast-in inserts and fixings must be anchored into the panel with welded bars or be fixed to the panel reinforcement.

b) Cast-in inserts for top connections and fixings acting together must be able to resist an ultimate load of two times the larger of the forces required to develop:

(i) the ultimate bending moment capacity of the panel at its base, or

(ii) the overturning moment at the base of the panel arising from an outwards lateral displacement at the top of the panel equal to one tenth of the panel height.

c) Top connections of the panel exposed to fire, such as clips and drilled-in inserts, acting together must be able to resist an ultimate load of six times the larger of the forces required to develop the moment specified in (b)(i) or (ii).

Note.

The increased forces specified by use of the multiplier of two or six in (b) and (c) above are to take account of the lower strength of the connections and members at the higher than ambient temperatures expected in a fire.

d) Lateral supporting members and their connections must be designed to resist the connection forces specified in (b) and (c) and in the case of an eaves tie member the force in the member

must be determined assuming that it deforms in a manner compatible with the lateral displacement of the wall panels, and that it acts in tension only.

e) External wall panels that span vertically must have at least two upper connections per panel to the supporting member, except that where a number of panels are designed to act as one unit, (e.g. tongue and groove hollow-core panels), only two upper connections are required for each unit.

f) External wall panels that span horizontally between columns must have at least two connections at each column.

g) Connections providing lateral support to a panel must be designed to remain engaged to the supported panel both before and during a fire.

4. ADDITIONAL REQUIREMENTS FOR VERTICALLY SPANNING EXTERNAL WALL PANELS ADJACENT TO COLUMNS

a) Where vertically spanning external wall panels are located adjacent to columns, connections to the panels must be located and/or detailed to minimise forces that may develop between the panels and columns arising from the restraint of differential displacement.

b) The requirements of (a) are satisfied by:

(i) detailing the connections and/or the supporting member to sustain a relative outward displacement of (d) between the panels and columns at the connection height where d(m) is calculated as:

A. the square of the connection height (m) divided by one hundred and twenty-five, when the connection height is less than 5 m; or
B. the connection height (m) divided by twenty-five, when the connection height (m) is greater than or equal to 5 m; or

(ii) in situations where an eaves tie member is used to provide lateral support to external wall panels, the tie member is connected to the panels no closer than a distance (s) from the column where s(m) is taken as one quarter of the panel height (m).

SPECIFICATION C1.13 CAVITY BARRIERS FOR FIRE-PROTECTED TIMBER

1. SCOPE

This Specification sets out requirements for cavity barriers in fire-protected timber construction.

2. REQUIREMENTS

a) Cavity barriers must be provided in the following locations where fire-protected timber is used in any of the listed elements:

   (i) At concealed cavities adjacent to junctions between fire-resisting floor/ceiling assemblies and fire-resisting walls.

   (ii) At concealed cavities adjacent to junctions between fire-resisting floor/ceiling assemblies and fire-resisting or non-combustible external walls.

   (iii) At concealed cavities adjacent to junctions between fire-resisting walls and fire-resisting or non-combustible external walls.

   (iv) Around the perimeter of door and window openings in fire-resisting construction.

b) Cavity barriers must be installed so they are tight fitting and are able to withstand thermal expansion and structural movement without the loss of seal against fire and smoke.

c) In addition to cavity barriers required by Clause 2(a), horizontal and vertical cavity barriers are to be provided to wall cavities within, around or adjacent to fire- protected timber elements as follows:

   (i) Horizontal cavity barriers — at not more than 5 m centres.

   (ii) Vertical cavity barriers — at not more than 10 m centres.

d) Cavity barriers must:

   (i) achieve the performance specified in Table 1 based on the highest FRL of the elements they are mounted within or seal against; or

   (ii) consist of:

      A. timber with the minimum thickness specified in Table 1; or
      B. polythene-sleeved mineral wool or mineral wool slabs or strips placed under compression to achieve the minimum thickness specified in Table 1.

e) Cavity barriers provided around openings may be formed by the window or door frame if:

(i) the frame is constructed of steel or timber with the minimum thickness specified in Table 1 for timber

(ii) the frame is tightly fitted to rigid construction and mechanically fixed in position.

f) The FRL of cavity barriers in fire-protected timber construction must be determined in accordance with Schedule 5 applying the criteria for control joint systems specified in Section 10 of AS 1530.4 with the cavity barrier system fitted within an opening between timber members exposed directly to the furnace heating conditions.

g) Notwithstanding anything to the contrary in Schedule 5 Fire Resistance of Building Elements or AS 1530.4, the test results from (f) may be used when the fire-protected timber is constructed from timber having a nominal density at least equal to the tested timber.

Table 1 Cavity barrier requirements

System Required FRL	–/60/60 or –/90/90	–/120/120, –/180/180 or –/240/240
Cavity barrier required FRL	–/45/45	–/60/60
Timber, required minimum thickness	45 mm	60 mm
Mineral wool, required minimum thickness	45 mm	60 mm

Note to Table 1:

Minimum thicknesses are to be measured in the direction of heat flow.

SPECIFICATION C1.13A FIRE-PROTECTED TIMBER

1. SCOPE

This Specification contains requirements for fire-protected timber and procedures for determining the time at which the temperature at the interface between the protection system and the timber is exceeded.

2. REQUIREMENTS

.1 GENERAL REQUIREMENTS

a) Fire-protected timber must:

(i) utilise a non-combustible fire-protective covering fixed in accordance with the system requirements to achieve an FRL not less than that required for the building element

(ii) have a non-combustible fire-protective covering fixed in accordance with system requirements:

A. to achieve a resistance to the incipient spread of fire of not less than 45 minutes when tested in accordance with:

(aa) for horizontal elements: Section 4 of AS 1530.4

(bb) for other elements: the relevant test procedures from Section 4 of AS 1530.4 applied to the element lining; or

B. which consists of not less than 2 layers of 13 mm thick, fire-protective grade plasterboard.

b) For the purposes of (a), the non-combustible fire-protective covering provided under (a)(ii) may form all or part of the non-combustible fire-protective covering provided under (a)(i).

.2 MASSIVE TIMBER

a) Fire-protected timber, where the timber is massive timber, need not comply with Clause 2.1 if the fire-protected timber:

(i) utilises a non-combustible fire-protective covering fixed in accordance with system requirements to achieve an FRL not less than that required for the building element

(ii) has a non-combustible fire-protective covering fixed in accordance with system requirements:

A. so as the temperature at the interface between the protection system and the timber does not exceed 300°C during a fire resistance test performed in accordance with Clause 3 for the application and periods listed in Table 1; or
B. not less than that specified by Table 1

(iii) has either:

A. any cavity:

(aa) between the surface of the timber and the fire-protective covering; or

(bb) between timber elements within the fire-protective covering, filled with non-combustible insulation; or

B. no cavity:

(aa) between the surface of the timber and the fire-protective covering; or

(bb) between timber members within the fire-protective covering.

b) For the purposes of (a), the non-combustible fire-protective covering provided under (a)(ii) may form all or part of the non-combustible fire-protective covering provided under (a)(i).

Table 1 Interface temperature and minimum fire protective grade plasterboard thickness

Application	Time – without timber interface exceeding 300°C (mins)	Minimum thickness of fire-grade plasterboard (mm)
Inside a fire-isolated stairway or lift shaft	20	13
External walls within 1 m of an allotment boundary or 2 m of a building on the same allotment	45	2 x 13
All other applications	30	16

3. DETERMINATION OF TIME THE TIMBER INTERFACE TEMPERATURE EXCEEDS 300°C FOR TIMBER AT LEAST 75 MM THICK

Determination of time the timber interface temperature exceeds 300°C for timber at least 75 mm thick

.1 FORM OF TEST

a) Tests must be carried out in accordance with the Standard Fire Test, or an equivalent or more severe test, on the timber element with the proposed non-combustible coverings fixed in a

representative manner, with the time the timber interface temperatures exceeded 300°C confirmed in a report from an Accredited Testing Laboratory.

b) If a fire protection system incorporates joints, the test specimens must incorporate representative joints.

c) Interface temperatures must be measured over the following features by a minimum of two thermocouples:

(i) At joint positions in the protection systems.

(ii) At least 200 mm from any joint.

(iii) At service penetrations.

(iv) At any other locations where, in the opinion of the Accredited Testing Laboratory, the interface temperature may be higher than the above positions.

d) The temperatures must be measured in accordance with Appendix C1 and Section 2 of AS 1530.4 as appropriate.

.2 SMALLER SPECIMEN PERMITTED

An Accredited Testing Laboratory may carry out the test specified in Clause 3.1 at pilot scale provided:

a) a specimen (which must be not less than 1000 mm x 1000 mm) adequately represents the proposed construction in the building

b) the fire resistance of the specimen has already been determined in a full scale test performed in accordance with AS 1530.4 to demonstrate adequate retention of the fire protection system in conjunction with the timber elements being protected

c) the results of the test do not apply to construction larger than limits defined by the Accredited Testing Laboratory conducting the pilot examination.

.3 ACCEPTANCE CRITERIA

The time the timber interface temperature exceeds 300°C must be taken as the minimum time any of the thermocouples specified in Clause 3.1 exceeded 300°C.

SPECIFICATION C2.5 SMOKE-PROOF WALLS IN HEALTH-CARE AND RESIDENTIAL CARE BUILDINGS

1. SCOPE

This Specification sets out requirements for the construction of smoke-proof walls in Class 9a health-care buildings and Class 9c buildings. Smoke-proof walls required to have an FRL are to be in accordance with requirements for roof cladding in Section B1.3 Cyclone and Flooding Protection.

2. CLASS 9A HEALTH-CARE BUILDINGS

Smoke-proof walls required by C2.5 in Class 9a health-care buildings must comply with the following:

a) Be non-combustible and extend to the underside of:

(i) the floor above; or

(ii) a non-combustible roof covering; or

(iii) a ceiling having a resistance to the incipient spread of fire to the space above itself of not less than 60 minutes.

b) Not incorporate any glazed areas unless the glass is safety glass as defined in AS 1288.

c) Only have doorways which are fitted with smoke doors complying with Specification C3.4.

d) Have all openings around penetrations and the junctions of the smoke-proof wall and the remainder of the building stopped with non-combustible material to prevent the free passage of smoke.

e) Incorporate smoke dampers where air-handling ducts penetrate the wall unless the duct forms part of a smoke hazard management system required to continue air movement through the duct during a fire.

3. CLASS 9C BUILDINGS

Smoke-proof walls in Class 9c buildings must comply with the following:

a) The wall may be lined on one side only.

b) Linings on the wall must be non-combustible and extend to the underside of:

(i) the floor above; or

(ii) a non-combustible roof covering; or

(iii) a flush plasterboard ceiling lined with 13 mm standard grade plasterboard or a fire-protective covering, with all penetrations sealed against the free passage of smoke.

c) If plasterboard is used in the lining on a wall, it must be a minimum of 13 mm standard grade plasterboard.

d) Not incorporate any glazed areas unless the glass is safety glass as defined in AS 1288.

e) Only have doorways which are fitted with smoke doors complying with Specification C3.4.

f) Have all openings around penetrations and the junctions of the smoke-proof wall and the remainder of the building stopped with non-combustible material to prevent the free passage of smoke.

g) Incorporate smoke dampers where air-handling ducts penetrate the wall unless the duct forms part of a smoke hazard management system required to continue air movement through the duct during a fire.

4. DOORWAYS IN SMOKE-PROOF WALLS

A door required to be smoke-proof by Section C or D of the FNBC or this Specification or have an FRL, other than one that serves a fire compartment provided with a zone pressurisation system in accordance with AS 1668.1, must provide a smoke reservoir by not extending within 400 mm of the underside of:

a) a roof covering; or

b) the floor above; or

c) an imperforate false ceiling that will prevent the free passage of smoke.

SPECIFICATION C3.4 FIRE DOORS, SMOKE DOORS, FIRE WINDOWS AND SHUTTERS

1. SCOPE

This Specification sets out requirements for the construction of fire doors, smoke doors, fire windows and fire shutters.

2. FIRE DOORS

A required fire door must:

a) comply with AS 1905.1

b) not fail by radiation through any glazed part during the period specified for integrity in the required FRL.

3. SMOKE DOORS

.1 GENERAL REQUIREMENTS

Smoke doors must be constructed so that smoke will not pass from one side of the doorway to the other and, if they are glazed, there is minimal danger of a person being injured by accidentally walking into them.

.2 CONSTRUCTION DEEMED-TO-SATISFY

A smoke door of one or two leaves satisfies Clause 3.1 if it is constructed as follows:

a) The leaves are side-hung to swing:

(i) in the direction of egress; or

(ii) in both directions.

b) The leaves are solid-core and at least 35 mm thick, or are capable of resisting smoke at 200°C for 30 minutes.

c) The leaves are fitted with smoke seals.

d)

(i) The leaves are normally in the closed position; or

(ii)

A. The leaves are closed automatically with the automatic closing operation initiated by smoke detectors, installed in accordance with the relevant provisions of AS 1670.1, located on each side of the doorway not more than 1.5 m horizontal distance from the doorway
B. in the event of power failure to the door, the leaves fail-safe in the closed position.

e) The leaves return to the fully closed position after each manual opening.

f) Any glazing incorporated in the door complies with AS 1288.

g) If a glazed panel is capable of being mistaken for an unobstructed exit, the presence of the glass must be identified by an opaque mid-height band, mid-rail, crash- bar or other opaque construction.

4. FIRE SHUTTERS

A required fire shutter must:

a) be a shutter that:

(i) is identical with a tested prototype that has achieved the required FRL

(ii) is installed in the same manner and in an opening that is not larger than the tested prototype

(iii) did not have a rise in average temperature on the side remote from the furnace of more than 140 K during the first 30 minutes of the test; or

b) be a steel shutter complying with AS 1905.2 if a metallic fire shutter is not prohibited in Section C Fire Protection

5. FIRE WINDOWS

A required fire window must be:

a) identical in construction with a prototype that has achieved the required FRL

b) installed in the same manner and in an opening that is not larger than the tested prototype.

SPECIFICATION C3.15 PENETRATION OF WALLS, FLOORS AND CEILINGS BY SERVICES

1. SCOPE

This Specification prescribes materials and methods of installation for services that penetrate walls, floors and ceilings required to have an FRL.

2. APPLICATION

a) This Specification applies to installations permitted under the Deemed-to-Satisfy Provisions of the BCA as alternatives to systems that have been demonstrated by test to fulfil the requirements of C3.D13 Openings for Service Installations in the FNBC.

b) This Specification does not apply to installations in ceilings required to have a resistance to the incipient spread of fire nor to the installation of piping that contains or is intended to contain a flammable liquid or gas.

3. METAL PIPE SYSTEMS

a) A pipe system comprised entirely of metal (excluding pipe seals or the like) that is not normally filled with liquid must not be located within 100 mm, for a distance of 2 m from the penetration, of any combustible building element or a position where combustible material may be located, and must be constructed of:

(i) copper alloy or stainless steel with a wall thickness of at least 1 mm; or

(ii) cast iron or steel (other than stainless steel) with a wall thickness of at least 2 mm.

b) An opening for a pipe system comprised entirely of metal (excluding pipe seals or the like) must:

(i) be neatly formed, cut or drilled

(ii) be no closer than 200 mm to any other service penetration

(iii) accommodate only one pipe.

c) A pipe system comprised entirely of metal (excluding pipe seals or the like) must be wrapped but must not be lagged or enclosed in thermal insulation over the length of its penetration of a wall, floor or ceiling unless the lagging or thermal insulation fulfils the requirements of Clause 7.

d) The gap between a metal pipe and the wall, floor or ceiling it penetrates must be fire-stopped in accordance with Clause 7.

4. PIPES PENETRATING SANITARY COMPARTMENTS

If a pipe of metal or UPVC penetrates the floor of a sanitary compartment in accordance with C3.D13:

a) the opening must be neatly formed and no larger than is necessary to accommodate the pipe or fitting; and

b) the gap between pipe and floor must be fire-stopped in accordance with Clause 7.

5. WIRES AND CABLES

If a wire or cable or cluster of wires or cables penetrates a floor, wall or ceiling:

a) the opening must be neatly formed, cut or drilled and no closer than 50 mm to any other service

b) the opening must be no larger in cross-sectional area than:

(i) 2000 mm^2 if only a single cable is accommodated and the gap between cable and wall, floor or ceiling is no wider than 15 mm; or

(ii) 500 mm^2 in any other case

c) the gap between the service and the wall, floor or ceiling must be fire-stopped in accordance with Clause 7.

6. ELECTRICAL SWITCHES AND OUTLETS

If an electrical switch, outlet, socket or the like is accommodated in an opening or recess in a wall, floor or ceiling:

a) the opening or recess must not:

(i) be located opposite any point within 300 mm horizontally or 600 mm vertically of any opening or recess on the opposite side of the wall; or

(ii) extend beyond half the thickness of the wall

b) the gap between the service and the wall, floor or ceiling must be fire-stopped in accordance with Clause 7.

7. FIRE-STOPPING

a) Material: The material used for the fire-stopping of service penetrations must be concrete, high-temperature mineral fibre, high-temperature ceramic fibre or other material that does not flow at a temperature below 1120°C when tested in accordance with ISO 540, and must have:

(i) demonstrated in a system tested in accordance with C3.15(a) that it does not impair the fire-resisting performance of the building element in which it is installed; or

(ii) demonstrated in a test in accordance with (e) that it does not impair the fire-resisting performance of the test slab.

b) Installation: Fire-stopping material must be packed into the gap between the service and wall, floor or ceiling in a manner, and compressed to the same degree, as adopted for testing under Clause 7(a)(i) or (ii).

c) Hollow construction: If a pipe penetrates a hollow wall (such as a stud wall, a cavity wall or a wall of hollow blockwork) or a hollow floor/ceiling system, the cavity must be so framed and packed with fire-stopping material that is:

(i) installed in accordance with Clause 7(b) to a thickness of 25 mm all round the service for the full length of the penetration

(ii) restrained, independently of the service, from moving or parting from the surfaces of the service and of the wall, floor or ceiling.

d) Recesses: If an electrical switch, socket, outlet or the like is accommodated in a recess in a hollow wall or hollow floor/ceiling system:

(i) the cavity immediately behind the service must be framed and packed with fire-stopping material in accordance with Clause 7(c); or

(ii) the back and sides of the service must be protected with refractory lining board identical with and to the same thickness as that in which the service is installed.

e) Test: The test to demonstrate compliance of a fire-stopping material with this Specification must be conducted as follows:

(i) The test specimen must comprise a concrete slab not less than 1 m square and not more than 100 mm thick, and appropriately reinforced if necessary for structural adequacy during manufacture, transport and testing.

(ii) The slab must have a hole 50 mm in diameter through the centre and the hole must be packed with the fire-stopping material.

(iii) The slab must be conditioned in accordance with AS 1530.4.

(iv) Two thermocouples complying with AS 1530.4 must be attached to the upper surface of the packing each about 5 mm from its centre.

(v) The slab must be tested on flat generally in accordance with Section 10 of AS 1530.4 and must achieve an FRL of 60/60/60 or as otherwise required.

SPECIFICATION E1.2 FIRE MAINS AND WATER SUPPLY SERVICES

1. SCOPE

This specification refers to fire mains and water supply services for fire-fighting equipment in buildings.

2. GENERAL REQUIREMENTS

A fire main must:

a) Be capable of supplying water at the flow rates and pressures necessary for the satisfactory operation of the required fire-fighting equipment;

b) Not incorporate plastic pipes above ground; and

c) Not be used for other than fire-fighting purposes, except a fire main serving only hose reels may be connected to a metered supply if:

(i) The required flow rate and pressure can be maintained at the most hydraulically disadvantage hose reel;

(ii) That water meter and street supply to the allotment have a nominal diameter of not less than 32 mm;

(iii) Water supply pipework reticulation arrangements comply with figure 2 or a similar arrangement; and

(iv) Any system valve which can isolate flow in the fire main is secured in the open position by a padlocked metal strap.

In buildings with a sprinkler system with a dual supply to Class A of NZS 4541 the water supply to any wet riser main system and/or hose reels may be taken from one of those supplies provided the rates of flow and pressures are adequate for both or all three purposes.

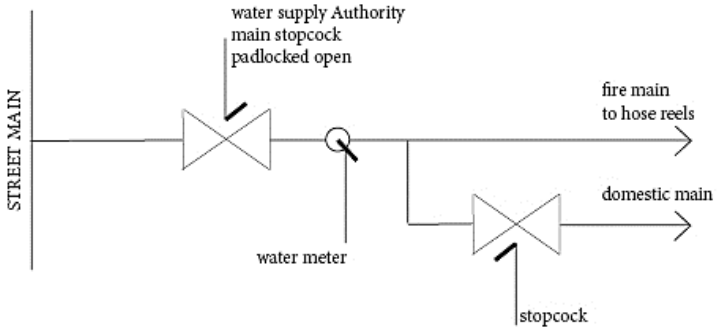


Figure 2: Water Supply Reticulation: Combined Services

3. WATER SUPPLIES FOR SPRINKLER SYSTEMS

All water supplies for sprinkler systems must satisfy the requirements of NZS 4541. Further:

d) A Class C single supply system must comprise:

(i) A street main which may be boosted by a diesel fire pump unit;

(ii) On-site storage or any source allowed by the Standard; or

(iii) A combined supply from two street mains which individually are inadequate; and

e) A Class A dual supply system must include:

(i) A street main which may be boosted by a diesel fire pump or, any other primary source; and

(ii) A separate on-site storage or other source allowed by the Standard, with an independent electric or diesel fire pump.

4. FIRE PUMP ENCLOSURES

Fire pumps must be located in a room or enclosure which has a FRL of not less than 60/60/30 and is:

(i) Within the building; or

(ii) External but not within 6 m of the building and any fire-source feature.

5. BOOSTER AND CHARGED DRY RISER MAIN CONNECTIONS AND CABINETS

a) Each fire brigade booster connection and the fire service inlet connection for a charged dry riser main system must be in locked cabinets accessible only to the fire service. If the system is fitted with a pressure gauge, the gauge must comply with AS 1349, and have a full scale reading of not less than 25% more than the pressure to which the system has been hydrostatically tested.

b) Cabinets may be located:

(i) At the external wall of a building if they are within sight of the main entrance and for Class 6,7,8 or 9b buildings, separated from the building by construction having a FRL of not less than 60/60/30 for not less than 2 m each side of and above the top of the cabinet;

(ii) Remote from the building if they are at the boundary of the allotment, within sight of the main entrance to the building, adjacent to the principal vehicular access to the allotment and located not less than 10 m from the external wall of any building; or

(iii) In any other suitable position.

A permanent fade and water-resistant plan, equal to photo-engraved anodized aluminum, must be displayed in a prominent position within the cabinet, showing the following information:

(i) The layout of the building and adjacent streets;

(ii) The layout of the fire hydrant system reticulation, with supply authority street mains and size, location of street and allotment hydrants, fire hose reels, booster connections, street and allotment isolating and non-return valves, pumps and tanks;

(iii) The operational discharge pressure and pressure at zero flow of any pump installed in the system;

(iv) The capacity of any tank connected to the system;

(v) The height of the highest hydrant outlet above the lowest booster inlet connection; and

(vi) The year of installation of the system.

b) Suitable provision must be made for the drainage of water from within a booster or charged dry riser main system cabinet.

SPECIFICATION E1.5 FIRE SPRINKLER SYSTEMS

1. SCOPE

This Specification sets out requirements for the design and installation of fire sprinkler systems.

2. APPLICATION OF AUTOMATIC FIRE SPRINKLER STANDARDS

Subject to this Specification, an automatic fire sprinkler system must comply with:

a) for all building classifications: AS 2118.1; or

b) for a Class 2 or 3 building with an effective height of not more than 25 m and a rise in storeys of 4 or more: Specification E1.5a and the relevant provisions of this Specification as applicable; or

c) for Class 5, 6, 7, 8, 9a (other than a residential care building) or 9b parts of a building with an effective height not more than 25 m, which also contains Class 2 or 3 parts: a sprinkler system in accordance with Specification E1.5a as for a Class 2 or 3 building and the relevant provisions of this Specification except:

(i) a FPAA101D sprinkler system cannot be used where the Class 5, 6, 7, 8, 9a (other than a residential care building) or 9b parts:

A. contain more than 2 storeys; or
B. are more than 25% of the total floor area of the building; or
C. are located above the fourth storey; and

(ii) a FPAA101D or FPAA101H sprinkler system cannot be used where the Class 7a part (other than an open-deck carpark) accommodates more than 40 vehicles; or

d) for a combined sprinkler and fire hydrant system: AS 2118.6; or

e) for a Class 9a health-care building used as a residential care building: AS 2118.4 as applicable; or

f) for a Class 2, 3 or 9c building: AS 2118.4 as applicable.

3. SEPARATION OF SPRINKLERED AND NON-SPRINKLERED AREAS

Where a part of a building is not protected with sprinklers, the sprinklered and non-sprinklered parts must be fire-separated with a wall or floor which must:

a) comply with any specific requirement of the Deemed-to-Satisfy Provisions of Section C Fire Protection, or

b) where there is no specific requirement, comply with the relevant part of AS 2118, FPAA101D or FPAA101H.

4. PROTECTION OF OPENINGS

Any openings, including those for service penetrations, in construction separating sprinklered and non-sprinklered parts of a building, including the construction separating the areas nominated for omitted protection in AS 2118.1, must be protected in accordance with the Deemed-to-Satisfy Provisions of Section C Fire Protection.

5. FAST RESPONSE SPRINKLERS

Fast response sprinklers may be installed only if they are suitable for the type of application proposed and it is demonstrated that the sprinkler system is designed to accommodate their use.

6. SPRINKLER VALVE ENCLOSURES

a) Sprinkler alarm valves must be located in a secure room or enclosure which has direct egress to a road or open space.

b) All sprinkler valve rooms and enclosures must be secured with a system suitable for use by the fire brigade.

7. WATER SUPPLY

a) A required sprinkler system must be provided with at least one water supply.

b) A required sprinkler system in a building greater than 25 m in effective height must be provided with dual water supply except that a secondary water supply storage capacity of 25,000 litres may be used if:

(i) the storage tank is located at the topmost storey of the building

(ii) the building occupancy is classified as no more hazardous than Ordinary Hazard 2 (OH2) under AS 2118.1

(iii) an operational fire brigade service is available to attend a building fire.

8. BUILDING OCCUPANT WARNING SYSTEM

A required sprinkler system, except a FPAA101D sprinkler system, must be connected to and activate a building occupant warning system complying with Clause 7 of Specification E2.2a.

9. CONNECTION TO OTHER SYSTEMS

Where a smoke hazard management system is installed and is actuated by smoke detectors, the sprinkler system must, wherever practicable, be arranged to also activate the smoke hazard management system.

10. ANTI-TAMPER DEVICES

a) Where a sprinkler system is installed:

   (i) over any stage area in a theatre, public hall or the like, visual and audible status indication of sprinkler valves must be provided at the location normally used by the stage manager; or

   (ii) in a space housing lift electrical and control equipment (including machine rooms, secondary floors and sheave rooms), any valves provided to control sprinklers in these spaces must be located adjacent to the space.

b) Any valves provided to control sprinklers required by (a) must be fitted with anti-tamper monitoring devices connected to a monitoring panel.

11. SPRINKLER SYSTEMS IN CARPARKS

A sprinkler system protecting a carpark complying with Table 3.9 of Specification C1.1 in a multi-classified building must:

a) be independent of the sprinkler system protecting any part of the building not used as a carpark; or

b) if forming part of a sprinkler system protecting a part of the building not used as a carpark, be designed such that the section protecting the non-carpark part can be isolated without interrupting the water supply or otherwise affecting the effective operation of the section protecting the carpark.

12. RESIDENTIAL CARE BUILDINGS

In addition to the provisions of AS 2118.4, a sprinkler system in:

a) a Class 3 building used as a residential care building; or

b) a Class 9a health-care building used as a residential care building; or

c) a Class 9c building, must:

   i. be provided with a monitored main stop valve in accordance with AS 2118.1

ii. be permanently connected with a direct data link or other approved monitoring system to a fire station or fire station dispatch centre.

13. SPRINKLER SYSTEMS IN LIFT INSTALLATIONS

a) Where sprinklers are installed in a space housing lift electrical and control equipment, including machine rooms, secondary floors and sheave rooms, sprinklers in these spaces must:

(i) have heads protected from accidental damage by way of a guard that will not impair the performance of the head

(ii) be capable of being isolated and drained, either separately or collectively, without isolating any other sprinklers within the building.

b) Valves provided to control sprinklers referred to in (a) must be installed in accordance with Clause 10(b).

SPECIFICATION E1.5A CLASS 2 AND 3 BUILDINGS NOT MORE THAN 25 M IN EFFECTIVE HEIGHT

1. SCOPE AND APPLICATION

This Specification sets out requirements for the design and installation of fire sprinkler systems, and concessions for Class 2 and 3 buildings not more than 25 m in effective height with a rise in storeys of 4 or more. The Deemed-to-Satisfy Provisions of this specification take precedence where there is a difference to the Deemed- to-Satisfy Provisions of Sections C, D and E.

2. SYSTEM REQUIREMENTS

Vic Spec E1.5a 2(a)

a) A required automatic fire sprinkler system installed in a Class 2 or 3 building with an effective height of not more than 25 m and a rise in storeys of 4 or more must comply with:

   (i) AS 2118.1; or

   (ii) AS 2118.4, as applicable; or

   (iii) FPAA101D, except for residential care buildings; or

   (iv) FPAA101H, except for residential care buildings.

b) A Class 2 or 3 building not more than 25 m in effective height with a rise in storeys of 4 or more provided with an automatic fire sprinkler system under Clause 2(a)(i) or 2(a)(ii) may be constructed in accordance with Clause 3(a), as applicable, provided:

   (i) the automatic fire sprinkler system is permanently connected to a fire alarm monitoring system connected to a fire station or fire station dispatch centre in accordance with Specification E2.2d if:

      A. the system has more than 100 sprinkler heads; or
      B. in the case of a residential care building, the building will accommodate more than 32 residents

   (ii) the automatic fire sprinkler system is fitted with sprinklers complying with clauses 4.4, 4.5 and 5.5.2 of AS 2118.4 in bedrooms

   (iii) an automatic smoke detection and alarm system is installed in accordance with Specification E2.2a except that it need not be connected to a fire alarm monitoring system connected to a fire station or fire station dispatch centre, and in the case of a residential care building it must be installed in accordance with:

      A. Specification E2.2a Clause 4; or
      B. both:

(aa) Specification E2.2a Clause 3, provided Specification E2.2a Clause 3(a)(ii) is applied as if the building was not protected with a sprinkler system

(bb) Specification E2.2d

(iv) in a residential care building, the automatic smoke detection and alarm system and the automatic fire sprinkler system are connected to a local fire indicator panel provided in accordance with Specification E2.2d

(v) fire orders are provided in a Class 3 building in accordance with G4.9 as for a building in an alpine area.

3. PERMITTED CONCESSIONS

a) The following concessions are permitted for Class 2 and 3 buildings provided with a required automatic fire sprinkler system in accordance with Clause 2(a)(i) or 2(a)(ii):

(i) The FRL for self-closing fire doors, as required by C3.8 and C3.11, may be reduced to not less than -/30/30.

(ii) The FRL for:

A. all non-loadbearing internal walls and shafts constructed of fire-protected timber, as required by Specification C1.1 to have FRLs greater than -/60/60, may be reduced to -/60/60 and service penetrations through non-loadbearing internal walls and shafts constructed of fire-protected timber, as required by C3.15, may be reduced to not less than -/60/15

B. all other non-loadbearing internal walls, as required by Specification C1.1, may be reduced to -/45/45 and the FRL for service penetrations through internal non-loadbearing walls and shafts, as required by C3.15, may be reduced to -/45/15.

(iii) The FRL for fire-isolated stairways enclosed with non-loadbearing construction, as required by D1.3, may be reduced to -/45/45.

(iv) Except in a residential care building, the maximum distance of travel, as required by D1.4(a)(i)(A), may be increased from 6 m to 12 m.

(v) The maximum distance of travel from a single exit serving the storey at the level of egress to a road or open space, as required by D1.4(a)(i)(B), may be increased from 20 m to 30 m.

(vi) The maximum distance between alternative exits, as required by D1.5(c)(i), may be increased from 45 m to 60 m.

(vii) Internal fire hydrants in accordance with E1.3 are not required where:

A. the building is served by external fire hydrants that provide compliant coverage installed in accordance with E1.3, except that in a residential care

building the nozzle at the end of the length of hose need only reach the entry door of any sole-occupancy unit to be considered as covering the area within the sole-occupancy unit; or

B. a dry fire hydrant system that otherwise complies with AS 2419.1 is installed in the building and:

(aa) each fire hydrant head is located in accordance with E1.3 and fitted with a blank end cap or plug; and

(bb) the pipework is installed in accordance with E1.3 (as for a required fire main) except that it need not be connected to a water supply; and

(cc) a hydrant booster inlet connection is provided in accordance with E1.3; and

(dd) an external street or feed hydrant capable of providing the required system flow is located within 60 m of the hydrant booster connection.

(viii) An emergency warning and intercom system need not be provided in a residential care building in accordance with E4.9 if a warning system with an override public address facility is installed in accordance with Specification E2.2d.

b) The following concessions are permitted for Class 2 and 3 buildings provided with a required automatic fire sprinkler system in accordance with Clause 2(a)(iii):

(i) Window openings need not be protected in accordance with C3.11(g) provided the room served by the window is sprinkler protected.

(ii) The FRL for:

A. service penetrations through non-loadbearing internal walls and shafts, as required by C3.15, may be reduced to -/60/15; and
B. non-loadbearing fire-resisting lift and stair shafts, as required by Specification C1.1, may be reduced to -/60/60.

(iii) The maximum distance of travel may be increased from 6 m to 12 m.

(iv) The maximum distance of travel from a single exit serving the storey at the level of egress to a road or open space may be increased from 20 m to 30 m.

(v) The maximum distance between alternative exits, as required by D1.5(c)(i), may be increased from 45 m to 60 m.

(vi) Internal fire hydrants in accordance with E1.3 are not required where:

A. the building is served by external fire hydrants that provide compliant coverage installed in accordance with E1.3; or

B. a dry fire hydrant system that otherwise complies with AS 2419.1 is installed in the building except:

(aa) the system pipework is not connected to the water supply

(bb) an on-site fire pumpset is not required

(cc) the minimum fire hydrant outlet flow of 6 L/s may be achieved when boosted by a fire brigade pumping appliance

(dd) the minimum pipe sizes specified in AS 2419.1 do not apply

(ee) each fire hydrant head is located in accordance with E1.3 and fitted with a blank end cap or plug

(ff) a hydrant booster inlet connection is provided in accordance with E1.3

(gg) an external street or feed hydrant capable of providing the required system flow is located within 60 m of the hydrant booster connection.

c) The following concessions are permitted for Class 2 and 3 buildings provided with a required automatic fire sprinkler system in accordance with Clause 2(a)(iv):

(i) Window openings need not be protected in accordance with C3.11(g) provided the room served by the window is sprinkler protected.

(ii) The FRL for:

A. service penetrations through non-loadbearing internal walls and shafts, as required by C3.15, may be reduced to -/60/15
B. non-loadbearing fire-resisting lift and stair shafts, as required by Specification C1.1, may be reduced to -/60/60.

(iii) The maximum distance of travel, as required by D1.4(a)(i)(A), may be increased from 6 m to 12 m.

(iv) The maximum distance of travel from a single exit serving the storey at the level of egress to a road or open space, as required by D1.4(a)(i)(B), may be increased from 20 m to 30 m.

(v) The maximum distance between alternative exits, as required by D1.5(c)(i), may be increased from 45 m to 60 m.

SPECIFICATION E1.8 FIRE CONTROL CENTRES

1. SCOPE

This Specification describes the construction and content of required fire control centres and rooms. A fire control room is a fire control centre in a dedicated room with additional specific requirements. Clauses 2 to 5 apply to fire control centres (including fire control rooms). Clauses 6 to 12 apply additional requirements to fire control rooms.

2. PURPOSE AND CONTENT

A fire control centre must:

a) provide an area from which fire-fighting operations or other emergency procedures can be directed or controlled

b) contain controls, panels, telephones, furniture, equipment and the like associated with the required fire services in the building

c) not be used for any purpose other than the control of:

(i) fire-fighting activities

(ii) other measures concerning the occupant safety or security.

3. LOCATION OF FIRE CONTROL CENTRE

A fire control centre must be so located in a building that egress from any part of its floor, to a road or open space, does not involve changes in level which in aggregate exceed 300 mm.

4. EQUIPMENT NOT PERMITTED WITHIN A FIRE CONTROL CENTRE

An internal combustion engine, pumps, sprinkler control valves, pipes and pipe fittings must not be located in a fire control centre, but may be located in rooms accessed through the fire control centre.

5. AMBIENT SOUND LEVEL FOR A FIRE CONTROL CENTRE

a) The ambient sound level within the fire control centre measured when all fire safety equipment is operating in the manner in which it operates in an emergency must not exceed 65 dB(A).

b) The measurement must be taken for a sufficient time to characterize the effects of all sound sources. Where there is not a great variation in noise level, a measurement time of 60 seconds may be used.

6. CONSTRUCTION OF A FIRE CONTROL ROOM

A fire control centre in a building more than 50 m in effective height must be in a separate room where:

a) the enclosing construction is of concrete, masonry or the like, sufficiently impact resistant to withstand the impact of any likely falling debris, and with an FRL of not less than 120/120/120

b) any material used as a finish, surface, lining or the like within the room complies with the requirements of Specification C1.10

c) services, pipes, ducts and the like that are not directly required for the proper functioning of the fire control room do not pass through it

d) openings in the walls, floors or ceiling which separate the room from the interior of the building are confined to doorways, ventilation and other openings for services necessary for the proper functioning of the facility.

7. PROTECTION OF OPENINGS IN A FIRE CONTROL ROOM

Openings permitted by Clause 6 must be protected as follows:

a) Openings for windows, doorways, ventilation, service pipes, conduits and the like, in an external wall of the building that faces a road or open space, must be protected in accordance with Section C Fire Protection.

b) Openings in the floors, ceilings and internal walls enclosing a fire control room must, except for doorways, be protected in accordance with Section C Fire Protection.

c) A door opening in the internal walls enclosing a fire-control room, must be fitted with a self-closing –/120/30 smoke sealed fire door.

d) Openings associated with natural or mechanical ventilation must:

(i) not be made in any ceiling or floor immediately above or below the fire control room

(ii) be protected by a –/120/– fire damper if the opening is for a duct through a wall required to have an FRL, other than an external wall.

8. DOORS TO A FIRE CONTROL ROOM

a) Required doors to a fire control room must open into the room, be lockable and located so that persons using escape routes from the building will not obstruct hinder access to the room.

b) The fire control room must be accessible via two paths of travel:

(i) one from the front entrance of the building

(ii) one direct from a public place or fire-isolated passageway which leads to a public place and has a door with an FRL of not less than –/120/30.

9. SIZE AND CONTENTS OF A FIRE CONTROL ROOM

a) A fire control room must contain:

(i) a Fire Indicator Panel and necessary control switches and visual status indication for all required fire pumps, smoke control fans and other required fire safety equipment installed in the building

(ii) a telephone directly connected to an external telephone exchange

(iii) a blackboard or whiteboard not less than 1200 mm wide x 1000 mm high

(iv) a pin-up board not less than 1200 mm wide x 1000 mm high

(v) a raked plan layout table of a size suitable for laying out the plans provided under (vi)

(vi) colour-coded, durable, tactical fire plans.

b) In addition, a fire control room may contain:

(i) master emergency control panels, lift annunciator panels, remote switching controls for gas or electrical supplies and emergency generator backup

(ii) building security, surveillance and management systems if they are completely segregated from all other systems.

c) A fire control room must:

(i) have a floor area of not less than 10 m^2 and the length of any internal side must be not less than 2.5 m

(ii) if only the minimum prescribed equipment is installed — have a net floor area of not less than 8 m^2 with a clear space of not less than 1.5 m^2 in front of the Fire Indicator Panel

(iii) if additional equipment is installed — have an additional area of not less than 2 m^2 net floor area for each additional facility and a clear space of not less than 1.5 m^2 in front of each additional control or indicator panel, and the area required for any path of travel through the room to other areas must be provided in addition to the requirements (ii) and (iii).

10. VENTILATION AND POWER SUPPLY FOR A FIRE CONTROL ROOM

A fire control room must be ventilated by:

a) natural ventilation from a window or doorway in an external wall of the building which opens directly into the fire control room from a road or open space; or

b) a pressurisation system that only serves the fire control room

(i) is installed in accordance with AS 1668.1 as though the room is a fire-isolated stairway

(ii) is activated automatically by operation of the fire alarm, or sprinkler system complying with Specification E1.5, installed in the building and manually by an over-riding control in the room

(iii) provides a flow of fresh air through the room of not less than 30 air changes per hour when the system is operating and any door to the room is open

(iv) has fans, motors and ductwork that form part of the system but not contained within the fire control room protected by enclosing construction with an FRL of not less than 120/120/120

(v) has any electrical supply to the fire control room or equipment necessary for its operation connected to the supply side of the main disconnection switch for the building, and no openable devices other than necessary doorways, pressure controlled relief louvres and windows that are openable by a key, must be constructed in the fire control room.

11. SIGN FOR A FIRE CONTROL ROOM

The external face of the door to the fire control room must have a sign with the words:

FIRE CONTROL ROOM

in letters of not less than 50 mm high and of a colour which contrasts with that of the background.

12. LIGHTING FOR A FIRE CONTROL ROOM

Emergency lighting in accordance with the Deemed-to-Satisfy Provisions of Part E4 must be provided in a fire control room, except that an illumination level of not less than 400 lux must be maintained at the surface of the plan table.

SPECIFICATION E2.2A SMOKE DETECTION AND ALARM SYSTEMS

1. SCOPE

This Specification describes the installation and operation of automatic smoke detection and alarm systems.

2. TYPE OF SYSTEM

A required automatic smoke detection and alarm system must be provided in accordance with the following:

a) Class 2 buildings and Class 4 parts of a building:

(i) a smoke alarm system complying with Clause 3; or

(ii) a smoke detection system complying with Clause 4; or

(iii) a combination of a smoke alarm system and a smoke detection system complying with Clause 5.

b) Class 3 buildings:

(i) with a Class 3 part located more than 2 storeys above ground level — a smoke detection system complying with Clause 4; or

(ii) which accommodate more than 20 residents and are the residential part of a school, accommodation for the aged, children or people with a disability — a smoke detection system complying with Clause 4; or

(iii) all other Class 3 buildings:

A. a smoke alarm system complying with Clause 3; or
B. a smoke detection system complying with Clause 4; or
C. a combination of a smoke alarm system and a smoke detection system complying with Clause 5.

c) Class 5, 6, 7, 8, 9b and 9c buildings— a smoke detection system complying with Clause 4.

d) Class 9a health-care buildings :

(i) where more than 6 bed patients are accommodated— a smoke detection system complying with Clause 4; or

(ii) where 6 or less bed patients are accommodated:

A. a smoke alarm system complying with Clause 3; or
B. a smoke detection system complying with Clause 4.

3. SMOKE ALARM SYSTEM

a) All Class 2 - 9 buildings:

(i) A smoke alarm system must:

A. consist of smoke alarms complying with AS 3786
B. be powered from the consumer mains source.

(ii) In kitchens and other areas where the use of the area is likely to result in smoke alarms causing spurious signals:

C. any other alarm deemed suitable in accordance with AS 1670.1 may be installed provided that smoke alarms are installed elsewhere in the sole-occupancy unit in accordance with Clause 3(b)(i) and Clause 3(b)(ii); or
D. an alarm acknowledgement facility may be installed, except where the kitchen or other area is in a building protected with a sprinkler system complying with Specification E1.5 (other than a FPAA101D system), the alarms need not be installed in the kitchen or other areas likely to result in spurious signals.

b) Class 2 or 3 buildings or Class 4 parts of a building : In a Class 2 or 3 building or Class 4 part of a building provided with a smoke alarm system, the following applies:

(i) Alarms must be installed within each sole-occupancy unit, and located on or near the ceiling in any storey:

A. containing bedrooms:
(aa) between each part of the sole-occupancy unit containing bedrooms and the remainder of the sole-occupancy unit

(bb) where bedrooms are served by a hallway, in that hallway; and
B. not containing any bedrooms, in egress paths.

(ii) Where there is more than one alarm installed within a sole-occupancy unit, alarms must be interconnected within that sole-occupancy unit.

(iii) Subject to (iv), alarms must be:

A. installed in public corridors and other internal public spaces, located in accordance with the requirements for smoke detectors in AS 1670.1
B. connected to activate a building occupant warning system in accordance with Clause 7.

(iv) In a Class 2 or 3 building or Class 4 part of a building protected with a sprinkler system complying with Specification E1.5 (other than a FPAA101D system), alarms are not required in public corridors and other internal public spaces.

c) Class 9a buildings — smoke alarms must:

(i) installed in every room, public corridor and other internal public space

(ii) located in accordance with the requirements for smoke detectors in AS 1670.1

(iii) interconnected to provide a common alarm

(iv) have manual call points installed in evacuation routes so that no point on a floor is more than 30 m from a manual call point.

4. SMOKE DETECTION SYSTEM

a) All Class 2 - 9 buildings:

(i) A smoke detection system must:

A. subject to (b) and (c), comply with AS 1670.1
B. activate a building occupant warning system in accordance with Clause 7.

(ii) In kitchens and other areas where the use of the area is likely to result in smoke detectors causing spurious signals:

A. any other detector deemed suitable in accordance with AS 1670.1 may be installed provided that smoke detectors are installed elsewhere in the sole-occupancy unit in accordance with the requirements for alarms in Clause 3(b)(i) and Clause 3(b)(ii); or
B. an alarm acknowledgement facility may be installed, except where the kitchen or other area is in a building protected with a sprinkler system complying with Specification E1.5 (other than a FPAA101D or FPAA101H system), the detectors need not be installed in the kitchen or other areas likely to result in spurious signals.

b) Class 2 or 3 buildings or Class 4 parts of a building — In a Class 2 or 3 building or Class 4 part of a building provided with a smoke detection system, the following applies:

(i) Smoke detectors must be installed:

A. within each sole-occupancy unit, in accordance with the requirements for alarms in Clause 3(b)(i) and Clause 3(b)(ii)
B. subject to (ii), in public corridors and other internal public spaces.

(ii) In a Class 2 or 3 building or Class 4 part of a building protected with a sprinkler system complying with Specification E1.5 (other than a FPAA101D or FPAA101H system), smoke detectors are not required in public corridors and other internal public spaces.

c) Class 9a health-care buildings — The following applies in a Class 9a health-care building:

(i)

A. Photoelectric type smoke detectors must be installed in patient care areas and in paths of travel to exits from patient care areas
B. in areas other than patient care areas and paths of travel to exits from patient care areas, where the use of the area is likely to result in smoke detectors causing spurious signals, any other detector deemed suitable in accordance with AS 1670.1 may be installed in lieu of smoke detectors, except where an area is protected with a sprinkler system complying with Specification E1.5, smoke detectors need not be installed where the use of the area is likely to result in spurious signals.

(ii) Manual call points must be installed in evacuation routes so that no point on a floor is more than 30 m from a manual call point.

d) Class 9c buildings — In a Class 9c building:

(i) remote automatic indication of each zone must be given in each smoke compartment by means of:

A. mimic panels with an illuminated display; or
B. annunciator panels with alpha numeric display

(ii) if the building accommodates more than 20 residents, manual call points must be installed in paths of travel so that no point on a floor is more than 30 m from a manual call point.

5. COMBINED SMOKE ALARM AND SMOKE DETECTION SYSTEM

a) A Class 2 or 3 building or Class 4 part of a building provided with a combination of a smoke alarm system and smoke detection system in accordance with Clause 2 must:

(i) be provided with a smoke alarm system complying with Clause 3 within sole-occupancy units

(ii) subject to (b), be provided with a smoke detection system complying with Clause 4 in areas not within sole-occupancy units.

b) In a Class 2 or 3 building or Class 4 part of a building protected with a sprinkler system complying with Specification E1.5 (other than a FPAA101D or FPAA101H system), smoke detectors are not required in public corridors and other internal public spaces.

6. SMOKE DETECTION FOR SMOKE CONTROL SYSTEMS

a) Smoke detectors required to activate air pressurisation systems for fire-isolated exits and zone pressurisation systems must:

(i) be installed in accordance with AS 1670.1

(ii) have additional smoke detectors installed adjacent to each bank of lift landing doors set back horizontally from the door openings by a distance of not more than 3 m.

b) Smoke detectors required to activate:

(i) automatic shutdown of air-handling systems in accordance with Table E2.2b; or

(ii) a smoke exhaust system in accordance with Specification E2.2b,

must:

(iii) be spaced:

A. not more than 20 m apart and not more than 10 m from any wall, bulkhead or smoke curtain
B. in enclosed malls and walkways in a Class 6 building not more than 15 m apart and not more than 7.5 m from any wall, bulkhead or curtain; and

(iv) have a sensitivity:

A. in accordance with AS 1670.1 in areas other than a multi-storey walkway and mall in a Class 6 building
B. not exceeding 0.5% smoke obscuration per metre with compensation for external airborne contamination as necessary, in a multi-storey walkway and mall in a Class 6 building.

c) Smoke detectors provided to activate a smoke control system must:

(i)

A. form part of a building fire or smoke detection system complying with AS 1670.1; or
B. be a separate dedicated system incorporating control and indicating equipment complying with AS 1670.1

(ii) activate a building occupant warning system complying with Clause 7, except that smoke detectors provided solely to initiate automatic shutdown of air- handling systems in accordance with (b)(i) need not activate a building occupant warning system.

7. BUILDING OCCUPANT WARNING SYSTEM

Subject to Part E4.9, a building occupant warning system provided as part of a smoke hazard management system must comply with clause 3.22 of AS 1670.1 to sound through all occupied areas except:

a) in a Class 2 and 3 building or Class 4 part of a building provided with a smoke alarm system in accordance with Clause 3(b)(iii):

(i) the sound pressure level need not be measured within a sole-occupancy unit if a level of not less than 85 dB(A) is provided at the door providing access to the sole-occupancy unit

(ii) the inbuilt sounders of the smoke alarms may be used to wholly or partially meet the requirements

b) in a Class 2 and 3 building or Class 4 part of a building provided with a smoke detection system in accordance with Clause 4(b), the sound pressure level from a building occupant warning system need not be measured within a sole-occupancy unit if a level of not less than 100 dB(A) is provided at the door providing access to the sole-occupancy unit

c) in a Class 3 building used as a residential care building, the system:

(i) must be arranged to provide a warning for occupants

(ii) in areas used by residents, may have its alarm adjusted in volume and content to minimise trauma consistent with the type and condition of residents

d) in a Class 9a health-care building, in a patient care area, the system:

(i) must be arranged to provide a warning for occupants

(ii) in a ward area, may have its alarm adjusted in volume and content to minimise trauma consistent with the type and condition of the patients

e) in a Class 9c building, the system:

(i) must be arranged to provide a warning for occupants

(ii) must notify staff caring for the residents of the building

(iii) in areas used by residents, may have its alarm adjusted in volume and content to minimise trauma consistent with the type and condition of residents.

8. SYSTEM MONITORING

The following installations must be connected to a fire alarm monitoring system connected to a fire station or fire station dispatch centre in accordance with AS 1670.3

a) A smoke detection system in a Class 3 building provided in accordance with Clause 2(b)(i) or Clause 2 (b)(ii).

b) A smoke detection system in a Class 9a health-care building, if the building accommodates more than 20 patients.

c) A smoke detection system in a Class 9c building.

d) Smoke detection in accordance with Clause 6 provided to activate:

(i) a smoke exhaust system in accordance with Specification E2.2b; or

(ii) smoke-and-heat vents in accordance with Specification E2.2c.

e) An automatic fire detection and alarm system required by Table E2.2a for large isolated buildings subject to C2.3.

SPECIFICATION E2.2B SMOKE EXHAUST SYSTEMS

1. SCOPE

This Specification describes the requirements for mechanical smoke exhaust systems.

2. SMOKE EXHAUST CAPACITY

a) Smoke exhaust fans must have a sufficient capacity to contain the smoke layer:

   (i) within a smoke reservoir formed in accordance with Clause 4 and not less than 2 m above the highest floor level

   (ii) above the top of any openings interconnecting different smoke reservoirs.

b) Exhaust rates must be determined in accordance with Figure 2, with the height measurement taken from the lowest floor level to the underside of the smoke layer and the fire load determined in accordance with Table 1.

3. SMOKE EXHAUST FANS

Each smoke exhaust fan, complete with its drive, flexible connections, control gear and wiring must:

a) be constructed and installed so that it is capable of continuous operation (exhausting the required volumetric flow rate at the installed system resistance) at a temperature of 200° C for a period of not less than 1 hour

b) in a building not fitted with a sprinkler system, be capable of continuous operation at a temperature of 300° C for a period of not less than 30 minutes

c) be rated to handle the required volumetric flow rate at ambient temperature to be capable of exhausting cool smoke during the early stages of a fire and to allow routine testing

d) have any high temperature overload devices installed, automatically overridden during the smoke exhaust operation.

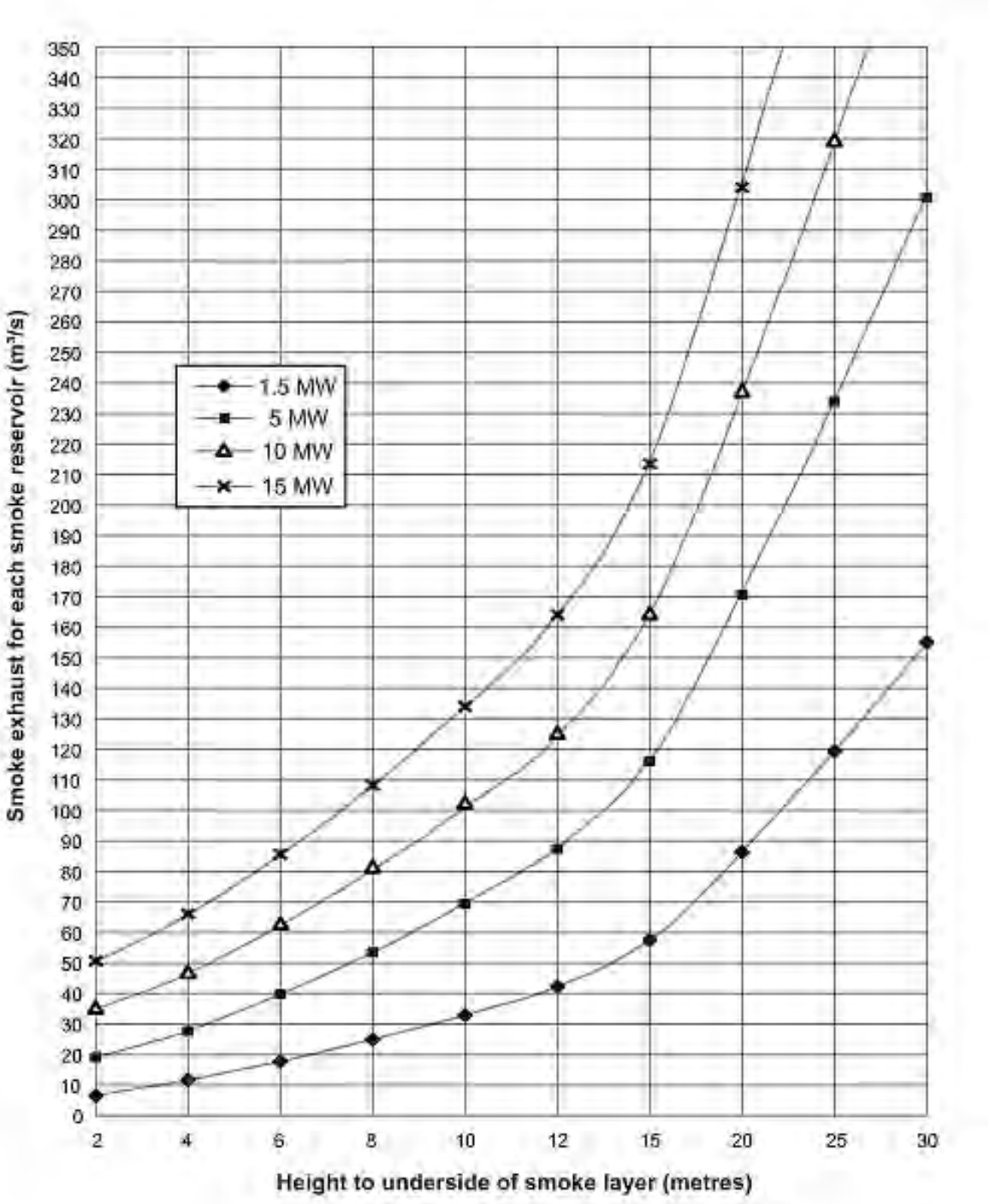


Figure 2 Smoke exhaust rate

Table 1 Fire load (MW)

Classification	Fire load (MW) for unsprinklered buildings	Fire load (MW) for sprinklered buildings
Class 2, 3 or 5	5	1.5
Class 6	10	5
Class 7 or 8	15	5
Class 9 — Generally	5	1.5
Class 9b buildings covered by Part H1 (see Note), or exhibition halls.	10	5

Note to Table 1:

If the smoke reservoir above the stage is smoke separated from the audience area, the fire load specified applies to the stage area only and the fire load for the audience area is as per Class 9 generally.

4. SMOKE RESERVOIRS

a) A fire compartment must be divided at ceiling level into smoke reservoirs formed by smoke baffles/curtains of non-combustible and non-shatterable construction.

b) The horizontal area of a smoke reservoir must not exceed 2000 m2 and in enclosed walkways and malls of a Class 6 building must not exceed 60 m in length.

c) Smoke reservoirs must be of sufficient depth to contain the smoke layer and must not be less than 500 mm below an imperforate ceiling or roof.

d)

(i) Within a multi-storey fire compartment, a non-combustible bulkhead or smoke baffle/curtain must be provided around the underside of each opening into a building void to minimise the spread of smoke to other storeys.

(ii) The depth of the bulkhead or smoke baffle must be not less than the depth of the smoke reservoir provided under (c) plus an additional 400 mm.

5. SMOKE EXHAUST FAN AND VENT LOCATION

Smoke exhaust fans and vents must be located:

a) such that each smoke reservoir is served by one or more fans with the maximum exhaust rate at any one point limited to avoid extracting air from below the smoke layer

b) to prevent the formation of stagnant regions resulting in excessive cooling and downward mixing of smoke

c) at natural collection points for the hot smoky gases within each smoke reservoir having due regard to the ceiling geometry and its effect on the migratory path of the smoke

d) away from the intersection of walkways or malls

e) to ensure that any voids containing escalators and/or stairs commonly used by the public are not used as a smoke exhaust path

f) to discharge directly to outdoor with a velocity of not less than 5 m/s, at a suitable point not less than 6 m from any air intake point or exit.

6. MAKE-UP AIR

a) Low level make-up air must be provided either automatically or via permanent ventilation openings to replace the air exhausted so as to minimise:

(i) any disturbance of the smoke layer due to turbulence created by the incoming air

(ii) the risk of smoke migration to areas remote from the fire due to the effect of make-up air on the air balance of the total system.

b) The velocity of make-up air through doorways must not exceed 2.5 m/s.

c) Within a multi-storey fire compartment, make-up air must be provided across each vertical opening from a building void to the fire-affected storey at an average velocity of 1 m/s so as to minimise the spread of smoke from the fire-affected storey to other storeys.

7. SMOKE EXHAUST SYSTEM CONTROL

a) Each smoke exhaust fan must be activated sequentially by smoke detectors complying with Specification E2.2a and arranged in zones to match the smoke reservoir served by the fan(s).

b) Subject to (c) and (d), an air handling system (other than individual room units less than 1000 L/s and miscellaneous exhaust air systems installed in accordance with Sections 5 and 6 of AS 1668.1) which does not form part of the smoke hazard management system must be automatically shut down on the activation of the smoke exhaust system.

c) In a single storey fire compartment, air handling systems in all non fire-affected zones may operate on 100% outdoor air to provide make-up air to the fire-affected zone.

d) Within a multi-storey fire compartment, air handling systems in all non fire-affected zones and storeys must operate at 100% outdoor air to provide make-up air to the fire-affected storey via building voids connecting storeys.

e) Manual override control and indication together with operating instructions for use by emergency personnel must be provided adjacent to the fire indicator panel in accordance with the requirements of clauses 4.11 and 4.13 of AS 1668.1.

f) Manual control for the smoke exhaust system must also be provided at a location normally used by the stage manager in a theatre.

g) Power supply wiring to exhaust fans together with detection, control, and indication circuits (and where necessary to automatic make-up air supply arrangements) must comply with AS 1668.1.

8. SMOKE DETECTION

A smoke detection system must be installed in accordance with Specification E2.2a to activate the smoke exhaust system.

SPECIFICATION E2.2C SMOKE-AND-HEAT VENTS

1. ADOPTION OF AS 2665

Automatic smoke-and-heat vents must be installed as a system complying with AS 2665 except that:

a) * * * * *

b) * * * * *

c) permanently open vents may form part of the smoke/heat venting system provided they comply with the relevant criteria for automatic smoke-and-heat vents in AS 2665.

2. CONTROLS

Where a smoke-and-heat vent system is installed to comply with Table E2.2b, the following must apply:

a) In addition to thermally released link operation, smoke-and-heat vents must also be initiated by smoke detection complying with Clauses 6 and 8 of Specification E2.2a and arranged in zones to match the smoke reservoirs.

SPECIFICATION E2.4 AIR HANDLING SYSTEMS IN BUILDINGS

1. SCOPE

This Specification outlines the performance and operation of mechanical ventilation and air-conditioning systems as they related to smoke control in buildings.

2. COMMONLY USED SYSTEMS

The following commonly used systems may be installed:

a) Small stand-alone or window units without ducting;

b) Central chilled water systems with fan coil unit located in each story without any ducting;

c) Central chilled water systems with separate air handling plants in each storey or fire compartment and associated independent ducting for the storey or fire compartment;

d) Individual packaged plants and associated ducting for each storey; or

e) Central plan where all the conditioning is done and with the ducting system connecting several fire compartments or storeys.

3. ACTION ON DETECTION OF SMOKE FIRE OR FLAME

In the case of small units the power supply to the unit must be switched of manually. With all other systems immediately on activation of any of the detection units:

a) The total system for the whole building must shut down;

b) Any required exit pressurization system must operate

c) Any required smoke exhaust system or smoke-and-heat vent must operate.

4. COMPLIANCE

The action required under 3(a),(b), or (c) must be automatic and activated by:

a) Smoke detectors located in each storey, or fire compartment in accordance with Specification NE1.8 and with ducted systems, located just upstream of the supply fan as well as in the main return duct; or

b) By any other suitable fire alarm system including a sprinkler system, installed within the building.

SPECIFICATION E4.8 PHOTOLUMINESCENT EXIT SIGNS

1. SCOPE

This Specification contains requirements for photoluminescent exit signs.

2. APPLICATION

A photoluminescent exit sign must comply with Section 5 and Appendix D of AS/NZS 2293.1, except where varied by this Specification.

3. ILLUMINATION

A photoluminescent exit sign must:

a) be maintained in a continuously charged state by a minimum illumination of 100 lux at the face of the sign by a dedicated light source with a colour temperature not less than 4000 K

b) in the event of a power failure, continue to provide a minimum luminance of 30 mcd/m2 for not less than 90 minutes

c) have its performance verified by testing in accordance with ASTM E2073-10, except the activation illumination in clause 8.3 is replaced with 54 lux.

4. PICTORIAL ELEMENTS

Pictorial elements on a photoluminescent exit sign must:

a) where the colour white is used, be replaced with a photoluminescent material

b) be not less than 1.3 times larger than that specified in Table 5.1 of AS/NZS 2293.1

c) have a border of photoluminescent material that extends not less than 15 mm beyond the pictorial elements.

5. VIEWING DISTANCE

The maximum viewing distance in clause 5.6 of AS/NZS 2293.1 must not be more than 24 m.

6. SMOKE CONTROL SYSTEMS

Smoke control systems required by clause 5.3 of AS/NZS 2293.1 do not apply to a photoluminescent exit sign.

SCHEDULE 5 FIRE-RESISTANCE OF BUILDING ELEMENTS

1. SCOPE

This Schedule sets out the procedures for determining the FRL of building elements.

2. RATING

A building element meets the requirements of this Schedule if:

a) it is listed in, and complies with Table 1 of this Schedule; or

b) it is identical with a prototype that has been submitted to the Standard Fire Test, or an equivalent or more severe test, and the FRL achieved by the prototype without the assistance of an active fire suppression system is confirmed in a report from an Accredited Testing Laboratory which:

   (i) describes the method and conditions of the test and the form of construction of the tested prototype in full

   (ii) certifies that the application of restraint to the prototype complied with the Standard Fire Test; or

c) it differs in only a minor degree from a prototype tested under (b) and the FRL attributed to the building element is confirmed in a report from an Accredited Testing Laboratory which:

   (i) certifies that the building element is capable of achieving the FRL despite the minor departures from the tested prototype

   (ii) describes the materials, construction and conditions of restraint which are necessary to achieve the FRL; or

d) it is designed to achieve the FRL in accordance with:

   (i) AS/NZS 2327, AS 4100 and AS/NZS 4600 if it is a steel or composite structure; or

   (ii) AS 3600 if it is a concrete structure; or

   (iii) AS 1720.4 if it is a timber element other than fire-protected timber; or

   (iv) AS 3700 if it is a masonry structure; or

e) the FRL is determined by calculation based on the performance of a prototype in the Standard Fire Test and confirmed in a report in accordance with Clause 3; or

f) for fire-protected timber, it complies with Specification C1.13a where applicable.

3. FRLS DETERMINED BY CALCULATION

If the FRL of a building element is determined by calculation based on a tested prototype:

a) the building element may vary from the prototype in relation to:

   (i) length and height if it is a wall

   (ii) height if it is a column

   (iii) span if it is a floor, roof or beam

   (iv) conditions of support

   (v) to a minor degree, cross-section and components

b) the report must demonstrate by calculation that the building element would achieve the FRL if it is subjected to the regime of the Standard Fire Test in relation to:

   (i) structural adequacy (including deflection)

   (ii) integrity

   (iii) insulation

c) the calculations must take into account:

   (i) the temperature reached by the components of the prototype and their effects on strength and modulus of elasticity

   (ii) appropriate features of the building element such as support, restraint, cross-sectional shape, length, height, span, slenderness ratio, reinforcement, ratio of surface area to mass per unit length, and fire protection

   (iii) features of the prototype that influenced its performance in the Standard Fire Test although these features may not have been taken into account in the design for dead and live load

   (iv) features of the conditions of test, the manner of support and the position of the prototype during the test, that might not be reproduced in the building element if it is exposed to fire

   (v) the design load of the building element in comparison with the tested prototype.

4. INTERCHANGEABLE MATERIALS

a) Concrete and plaster — An FRL achieved with any material of Group A, B, C, D or E as an ingredient in concrete or plaster, applies equally when any other material of the same group is used in the same proportions:

Group A: any portland cement.

Group B: any lime.

Group C: any dense sand.

Group D: any dense calcareous aggregate, including any limestone or any calcareous gravel.

Group E: any dense siliceous aggregate, including any basalt, diorite, dolerite, granite, granodiorite or trachyte.

b) Perlite and vermiculite — an FRL achieved with either gypsum-perlite plaster or gypsum-vermiculite plaster applies equally for each plaster.

5. COLUMNS COVERED WITH LIGHTWEIGHT CONSTRUCTION

If the fire-resisting covering of a steel column is lightweight construction, the construction must comply with Specification C1.8 Structural Test for Lightweight Construction and Section C3.D15 of the FNBC.

6. NON-LOADBEARING ELEMENTS

If a non-loadbearing element is able to be used for a purpose where the Deemed-to-Satisfy Provisions prescribe an FRL for structural adequacy, integrity and insulation, that non-loadbearing element need not comply with the structural adequacy criteria.

Table 1 FRLs Deemed to be achieved by certain building element

Building Element		Minimum Thickness (mm) of Principal Material for FRL's					Annexure Reference
Wall							
		60/60/60	90/90/90	120/120/120	180/180/180	240/240/240	Clause
Masonry							
Ashlar	-	-	-	-	300	**1**, **2**, **5**, **6**	
Calcium silicate		see 2(d)(iv) of this Specification					
Concrete		see 2(d)(iv) of this Specification					
Fired clay (inc terracotta)		see 2(d)(iv) of this Specification					
Concrete							
No-fines	-	-	-	150	170	**1**, **5**, **6**	
Prestressed		see 2(d)(iv) of this Specification					
Reinforced		see 2(d)(iv) of this Specification					
Plain	-	-	-	150	170	**1**, **5**, **6**	
Solid gypsum blocks		75	90	100	110	125	**1**, **5**, **6**
Gypsum — perlite or Gypsum vermiculite - plaster **on metal lath and channel (non-*loadbearing* walls only)**		50	50	65	-	-	**1**, **5**, **7**
CONCRETE COLUMN							
		60/60/60	90/90/90	120/120/120	180/180/180	240/240/240	Clause
Prestressed		see 2(d)(ii) of this Specification					
Reinforced		see 2(d)(ii) of this Specification					
HOT-ROLLED STEEL COLUMN							
		60/60/60	90/90/90	120/120/120	180/180/180	240/240/240	Clause
(inc a fabricated column) exposed on no more than 3 sides:							**8**
Fire protection of Concrete **— Cast in-situ—**							
loadbearing	25	30	40	55	75	**9**, **11**, **12**	
non-*loadbearing*							
unplastered	25	30	40	50	60	**9**, **11**, **12**	
plastered 13mm—	25	25	30	40	50	**1**, **6**, **9**, **11**, **12**	
Gypsum **— Cast in-situ—**		-	-	-	-	50	**9**, **11**, **12**

Gypsum — perlite or Gypsum-vermiculite plaster								
sprayed to contour	20	25	35	50		55	**1**, **11**	
sprayed on metal lath	20	20	25	35		45	**1**, **7**	
HOT-ROLLED STEEL COLUMN								
		60/60/60	90/90/90	120/120/120		180/180/180	240/240/240	Clause
(inc a fabricated column) exposed on no more than 3 sides and with column spaces filled:								**8**, **9**
Fire protection of —								
Solid calcium-silicate masonry	50	50	50	50		65	**1**, **3**, **11**, **12**	
Solid clay masonry	50	50	50	65		90	**1**, **3**, **11**, **12**	
Solid concrete masonry	50	50	50	65		90	**1**, **3**, **11**, **12**	
Solid gypsum blocks	50	50	50	50		65	**1**, **3**, **11**, **12**	
Hollow terracotta blocks—								
plastered 13mm	50	50	50	65	90	**1**, **3**, **6**, **10**, **11**, **12**		
HOT-ROLLED STEEL COLUMN								
		60/60/60	90/90/90	120/120/120		180/180/180	240/240/240	Clause
(inc a fabricated column) exposed on no more than 3 sides and with column spaces unfilled:								**8**, **9**
Fire protection of —								
Solid calcium-silicate masonry	50	50	50	-		-	**1**, **3**, **11**, **12**	
Solid clay masonry	50	50	65	-		-	**1**, **3**, **11**, **12**	
Solid concrete masonry	50	50	65	-		-	**1**, **3**, **11**, **12**	
Solid gypsum blocks	50	50	50	-		-	**1**, **3**, **11**, **12**	
Hollow terracotta blocks—								
plastered 13mm	50	50	65	-	-	**1**, **3**, **6**, **10**, **11**, **12**		
HOT-ROLLED STEEL COLUMN								
		60/-/-	90/-/-	120/-/-		180/-/-	240/-/-	Clause
(inc. a fabricated column) exposed on 4 sides:								**8**
Fire protection of —								
Concrete **— Cast in-situ—**								
loadbearing	25	40	45	65		90	**9**, **11**, **12**	

non-*loadbearing*								
unplastered	25	30	40	50	65	**9**, **11**, **12**		
plastered 13mm—	25	25	30	40	50	**1**, **6**, **9**, **11**, **12**		
Gypsum **— Cast in-situ—**			-	-	-	-	50	**9**, **11**, **12**
Gypsum — perlite or Gypsum-vermiculite plaster								
sprayed to contour		25	30	40	55	65	**1**, **11**	
sprayed on metal lath		20	20	30	40	50	**1**, **7**	
HOT-ROLLED STEEL COLUMN								
			60/-/-	90/-/-	120/-/-	180/-/-	240/-/-	Clause
(inc. a fabricated column) exposed on 4 sides and with column spaces filled:								**8**, **9**
Fire protection of —								
Solid calcium-silicate masonry here		50	50	50	65	75	**1**, **3**, **11**, **12**	
Solid clay masonry		50	50	50	75	100	**1**, **3**, **11**, **12**	
Solid concrete masonry		50	50	50	75	100	**1**, **3**, **11**, **12**	
Solid gypsum blocks		50	50	50	65	75	**1**, **3**, **11**, **12**	
Hollow terracotta blocks—								
plastered 13mm	50	50	50	75	100	**1**, **3**, **6**, **10**, **11**, **12**		
HOT-ROLLED STEEL COLUMN								
			60/-/-	90/-/-	120/-/-	180/-/-	240/-/-	Clause
(inc. a fabricated column) exposed on 4 sides and with column spaces unfilled:								**8**
Fire protection of —								
Solid calcium-silicate masonry here		50	50	50	-	-	**1**, **3**, **11**, **12**	
Solid clay masonry		50	50	65	-	-	**1**, **3**, **11**, **12**	
Solid concrete masonry		50	50	65	-	-	**1**, **3**, **11**, **12**	
Solid gypsum blocks		50	50	50	-	-	**1**, **3**, **11**, **12**	
Hollow terracotta blocks—								
plastered 13mm	50	50	65	-	-	**1**, **3**, **6**, **10**, **11**, **12**		
BEAM								
			60/-/-	90/-/-	120/-/-	180/-/-	240/-/-	Clause

Concrete —							
Prestressed		see 2(d)(ii) of this Specification					
Reinforced		see 2(d)(ii) of this Specification					
Hot-rolled Steel **(inc. an open-web joist girder truss etc.) exposed on no more than 3 sides:**							**8**
Fire protection of —							
Concrete **— Cast in-situ—**		25	30	40	50	65	**11**, **12**
Gypsum — perlite or Gypsum-vermiculite plaster							
sprayed to contour	20	25	35	50	55	**1**, **11**	
sprayed on metal lath	20	20	25	35	45	**1**, **7**	
Hot-rolled Steel **(inc. an open-web joist girder truss etc.) exposed on 4 sides:**							**8**
Fire protection of —							
Concrete **— Cast in-situ—**		25	40	45	60	90	**11**, **12**
Gypsum — perlite or Gypsum-vermiculite plaster							
sprayed to contour	25	30	40	55	65	**1**, **11**	
sprayed on metal lath	20	20	30	40	50	**1**, **7**	
FLOOR, ROOF OR CEILING							
		60/60/60	90/90/90	120/120/120	180/180/180	240/240/240	Clause
Concrete —							
Prestressed		see 2(d)(ii) of this Specification					
Reinforced		see 2(d)(ii) of this Specification					

PART E4 VISIBILITY IN AN EMERGENCY, EXIT SIGNS AND WARNING SYSTEMS

EP 4.1 VISIBILITY IN AN EMERGENCY

.1 To facilitate safe evacuation in an emergency, a building must be provided with a system that:

a) Ensures a level of visibility sufficient to enable exits, paths of travel to exits and any obstacles along a path of travel to an exit to be identified

b) Activates instantaneously upon the failure of an artificial lighting system, to the degree necessary, appropriate to:

i. the function or use of the building

ii. the floor area of the building

iii. the distance of travel to an exit.

EP4.2 IDENTIFICATION OF EXITS

.1 To facilitate evacuation, suitable signs or other means of identification must, to the degree necessary:

a) Be provided to identify the location of exits

b) Guide occupants to exits

c) Be clearly visible to occupants

d) Operate in the event of a power failure of the main lighting system for sufficient time for occupants to safely evacuate.

.2 EP4.2 does not apply to the internal parts of a sole-occupancy unit in a Class 2 or 3 building or Class 4 part of a building.

EP4.3 EMERGENCY WARNING AND INTERCOM SYSTEMS

.1 To warn occupants of an emergency and assist evacuation of a building, an emergency warning and intercom system must be provided, to the degree necessary, appropriate to:

a) Floor area of the building

b) Function or use of the building

c) Height of the building.

VERIFICATION METHODS

EV4.1 Emergency lighting

.1 Compliance with EP4.1 is verified for the level of visibility for safe evacuation in an emergency and instantaneous activation, when an emergency lighting system satisfies the following:

a) The calculated horizontal illuminance is not less than—

i. 0.2 lux at floor level in the path of travel to an exit; and

ii. 1 lux at each floor level or tread in every required—

1. fire-isolated stairway; or
2. fire-isolated passageway; or
3. fire-isolated ramp; or
4. non-fire-isolated stairway; or
5. non-fire-isolated ramp.

b) The emergency lighting provides a level of illuminance not less than—

i. 10% of that required by (a) within 1 second of energization; and

ii. 80% of that required by (a) within 15 seconds of energization.

c) The full level of illumination required by (a) must be achieved within 60 seconds of energization.

d) An emergency lighting system must operate at not less than the minimum required level of illuminance for not less than 90 minutes.

EV4.2 Fire Safety Verification Method

.1 Compliance with EP4.1, EP4.2 and EP4.3 is verified when a building is designed in accordance with Schedule 7 Fire Safety Verification Method of the NCC Australian Building Code.

SPECIFICATION G3.8 FIRE AND SMOKE CONTROL SSYTEMS IN BUILDINGS CONTAINING ATRIUMS

1. SCOPE

This Specification sets out the requirements for the design and operation of systems of fire and smoke control in buildings containing an atrium.

2. AUTOMATIC SPRINKLER SYSTEM

2.1 GENERAL REQUIREMENT

A sprinkler system (other than a FPAA101D or FPAA101H system) complying with Specification E1.5 must be installed in every building containing an atrium, except where varied or superseded by this Specification.

2.2 ROOF PROTECTION

.1 A roof of an atrium which does not have the FRL prescribed in Specification C1.1 or the Deemed-to-Satisfy Provisions of Part C2 must be protected by automatic sprinklers arranged to wet both the covering membrane and supporting structure if the roof is:

a) less than 12 m above the floor of the atrium or the floor of the highest storey where the bounding construction is set back more than 3.5 m from the atrium well if a Class 2, 3, 5 or 9 part of a building is open to the atrium; or

b) less than 20 m above the floor of the atrium or the floor of the highest storey where the bounding construction is set back more than 3.5 m from the atrium well if a Class 6, 7 or 8 part of a building is open to the atrium, and the temperature rating of sprinkler heads providing roof protection must be within the range 79°C–100°C.

2.3 ATRIUM FLOOR PROTECTION

.1 The floor of the atrium must be protected by sprinklers with:

a) the use of sidewall pattern sprinkler heads together with overhead sprinklers where dictated by the dimensions of the atrium

b) sprinkler heads of the fast response type.

2.4 SPRINKLER SYSTEMS TO GLAZED WALLS

2.4.1 Location of protection

.1 Where an atrium is separated from the remainder of the building by walls or doors incorporating glazing, a wall wetting system must be provided to protect the glazing as follows:

a) On the atrium side of the glazing : to all glazed walls which are set back more than 3.5 m from the atrium well.

b) On the atrium side of the glazing : to all glazed walls which are not set back, or are set back 3.5 m or less, from the atrium well, for all levels which are less than:

i. 12 m above the floor of an atrium or the floor of the highest storey where the bounding wall is set back more than 3.5 m from the atrium well if a Class 2, 3, 5 or 9 part of the building is open to the atrium; or

ii. 20 m above the floor of an atrium or the floor of the highest storey where the bounding wall is set back more than 3.5 m from the atrium well if a Class 6, 7 or 8 part of the building is open to the atrium.

c) On the side of the glazing away from the atrium well:to all glazing forming part of the bounding wall at each storey.

2.4.2 Sprinkler head location

.1 Sprinklers must be located in positions allowing full wetting of the glazing surfaces without wetting adjacent sprinkler heads.

2.4.3 Head rating and response time

.1 Sprinkler heads must be of the fast response type and have a maximum temperature rating of 74°C.

2.4.4 Water discharge rate

.2 The rate of water discharge to protect glazing must be not less than:

a) on the atrium side of the glazing:

i. 0.25 L/s.m^2 where glazing is not set back from the atrium well; or

ii. 0.167 L/s.m^2 where glazing is set back from the atrium well

b) on the side away from the atrium well:0.167 L/s.m^2.

2.4.5 Water supply

.1 In addition to that of the basic sprinkler protection for the building, the water supply to required wall wetting systems must be of adequate capacity to accommodate the following on the atrium side of the glazing:

a) Where the bounding walls are set back less than 3.5 m from the atrium well:wall wetting of a part not less than 6 m long for a height of not less than:

i. 12 m above the floor of an atrium or the floor of the highest storey where the bounding wall is set back more than 3.5 m from the atrium well if a Class 2, 3, 5 or 9 part of the building is open to the atrium; or

ii. 20 m above the floor of an atrium or the floor of the highest storey where the bounding wall is set back more than 3.5 m from the atrium well if a Class 6, 7 or 8 part of the building is open to the atrium

b) Where the walls are set back 3.5 m or more from the atrium well : wetting of a part not less than 12 m long on one storey.

2.5 STOP VALVES

.1 Basic sprinkler and wall wetting systems protecting a building containing an atrium must be provided with easily accessible and identified stop valves.

.2 Sprinkler and wall wetting systems must be provided with independent stop valves.

.3 Sprinkler heads protecting the roof of the atrium must be provided with a stop valve.

.4 Stop valve to wall wetting and roof sprinklers may be of the gate type.

.5 All sprinkler and wall wetting stop valves must be monitored to detect unauthorised closure.

3. SMOKE CONTROL SYSTEM

3.1 GENERAL REQUIREMENT

Except where varied or superseded by this Specification, mechanical air-handling systems in a building containing an atrium must comply with AS 1668.1. must be installed in every building containing an atrium, except where varied or superseded by this Specification.

3.2 OPERATION OF ATRIUM MECHANICAL AIR-HANDLING SYSTEMS

.1 Mechanical air-handling systems serving an atrium must be designed to operate so that during a fire:

a) a tenable atmosphere is maintained in all paths of travel along balconies to required exits during the period of evacuation

b) smoke exhaust fans serving the atrium are only activated when smoke enters the atrium

c) central plant systems do not use the atrium as a return air path

d) central plant systems which use return air paths remote from the atrium:

i. cycle to the full outside air mode

ii. stop supply air to the fire affected storey or fire compartment

iii. continue to fully exhaust the fire affected storey or fire compartment and reduce the exhaust from other storeys or fire compartments by at least 75%

iv. continue to supply air to fire compartments or storeys other than the fire affected storey or fire compartment

e) fans performing relief or exhaust duty from the atrium stop normal operation

f) floor by floor, or unitary, air-handling plant serving a single fire compartment or storey:

i. ceases normal operation in the fire affected storey or fire compartment

ii. commences full relief or exhaust from that fire affected storey or fire compartment

iii. continue to supply air to fire compartments or storeys other than the fire affected storey or fire compartment.

3.3 ACTIVATION OF SMOKE CONTROL SYSTEM

.1 The smoke control system must be activated by:

a) operation of an automatic fire alarm; or

b) operation of the sprinkler system; or

c) a manual start switch.

.2 All controls for the smoke control system must be located:

a) in the fire control room; or

b) in the emergency control centre, (if any); or

c) adjacent to the sprinkler control valves; or

d) incorporated in the Fire Indicator Panel.

3.4 SMOKE EXHAUST SYSTEM

.1 A smoke exhaust system serving an atrium must be designed on the basis of:

a) the sprinkler system limiting the size of a fire to:

i. a heat output of 1.5 MW and perimeter of 7.5 m if a Class 2, 3, 5 or 9 part of the building is open to the atrium; or

ii. a heat output of 5 MW and perimeter of 12 m if a Class 6, 7 or 8 part of the building is open to the atrium

b) a smoke plume reaching a level 3 m above the highest storey having a path of travel to a requiredexit along a balcony bounding the atrium well, and not less than:

i. 12 m above the floor of an atrium or the floor of the highest storey where the bounding wall is set back more than 3.5 m from the atrium well if a Class 2, 3, 5 or 9 part of the building is open to the atrium; or

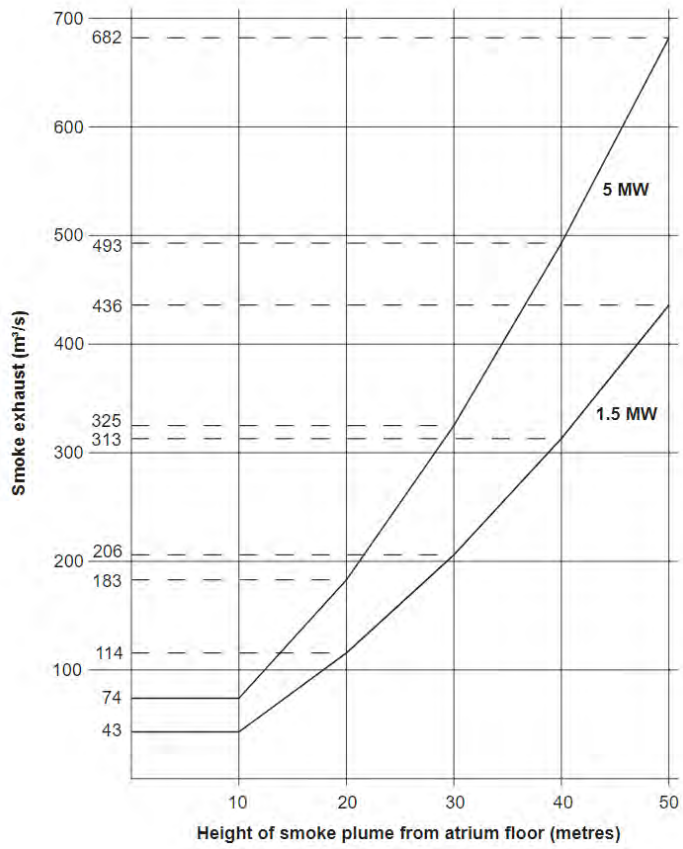
ii. 20 m above the floor of an atrium or the floor of the highest storey where the bounding construction is set back more than 3.5 m from the atrium well if a Class 6, 7 or 8 part of the building is open to the atrium

c) the smoke exhaust system discharging smoke at a rate of not less than that shown in Figure 3.4 for the appropriate height of smoke plume and fire size:

d) from the top of the atrium; or

e) horizontally where calculations of wind velocity induced pressure profiles for the building verify that the exhaust system will operate effectively for all wind directions.

Figure 3.4 Smoke exhaust rate



3.5 UPWARD AIR VELOCITY

.1 Notwithstanding 3.4(c), the average upward air velocity in the atrium, due to the required smoke exhaust quantity must:

a) be not less than 0.2 m/s at any level over an 18 m height above the floor of the atrium

b) not exceed the following maximum velocities in atriums of constant cross sectional plan area:

i. for occupancy classification qualifying for 1.5 MW fire size — 3.5 m/s.

ii. for occupancy classifications qualifying for 5 MW fire size — 5 m/s.

3.6 EXHAUST FANS

.1 Smoke exhaust must be provided by fans capable of continuous and required operation for a period of not less than 1 hour when handling exhaust gases at 200°C.

.2 Where a Class 2, 3 or 9 part of a building adjoins an atrium, the atrium must be provided with a minimum of 3 fans each capable of 50% of the total required smoke exhaust capacity.

.3 Atriums other than those referred to in (b) must be provided with a minimum of 2 fans each capable of 50% of the total required smoke exhaust capacity.

3.7 SMOKE AND HEAT VENTS

.1 Notwithstanding Clause 3.6, automatic vents complying with AS 2665 may be used, except where a Class 6 part of a building adjoins the atrium, in lieu of exhaust fans provided that—

.2 the height from the atrium floor to the bottom of the highest vent is not more than 12 m

.3 the vents are fitted with a remote manual operation switch located adjacent to the sprinkler control valves or incorporated in the Fire Indicator Panel.

3.8 MAKE-UP AIR SUPPLY

.1 Uniformly distributed make-up air must be provided to the atrium exhaust system from:

a) outside the atrium at or near the lowest storey level

b) relief air from non-fire storeys.

.2 A discharge volume sufficient to maintain a velocity of not less than 0.1 m/s towards the atrium well must be provided on all storeys where the bounding wall is set back from the atrium well.

.3 The requirements of (a)(i) are satisfied if make-up air is provided to the atrium exhaust system in such a manner as to prevent, as far as possible, disturbance of the smoke layer due to turbulence created by the incoming air, through:

a) openings directly from the outside air to the atrium and located as close as practicable to the lowest level of the atrium; or

b) ducts from the outside air to the atrium which deliver air as close as practicable to the lowest level of the atrium and, where passing through any other fire compartment having an FRL of at least 60/60/60; or

c) a combination of (i) or (ii).

4. FIRE DETECTION AND ALARM SYSTEMGUIDE

4.1 GENERAL REQUIREMENTS

.1 Except where superseded by this Specification, automatic fire detection and alarm systems in a building containing an atrium must comply with AS 1670.1.

4.2 SMOKE DETECTION SYSTEM

.1 Smoke detection within an atrium:

.2 must be provided within all outside air intakes and at individual floor return air intakes of all air-handling systems to initiate automatic fire mode operation, and where applicable, comply with the restart facilities in AS 1668.1

.3 must operate at an obscuration level not greater than 0.5% per metre with compensation for external airborne contamination as necessary

.4 must sample air within the atrium and in storeys where the bounding wall is set back more than 3.5 m from the atrium well

.5 must be calibrated to compensate for smoke dilution where sampling occurs within return air path common to more than one room

.6 may incorporate beam type detectors to sense smoke in an atrium in a Class 5, 6, 7 or 8 building with an effective height of not more than 25 m if:

a) the beam detectors are located at intervals of not more than 3 storeys

b) arranged to scan at 90 degrees orientation to adjacent beam units.

4.3 SMOKE DETECTION IN SPACES SEPARATED FROM THE ATRIUM BY BOUNDING WALLS

.1 Smoke detection systems must be located at all return and relief air openings associated with the building air-handling systems and be:

.2 of the sampling type system as required in 4.2; or

.3 of the point type photoelectric smoke detector.

4.4 ALARM SYSTEMS

.1 A break-glass fire alarm point must be provided at each door to a fire-isolated stairway, fire-isolated ramp, or fire-isolated passageway.

.2 A staged alarm must be provided where an air sampling type smoke detection system is provided for the atrium, and must operate as follows:

a) Alert building management when abnormal smoke levels of 0.03% obscuration per metre are detected.

b) Initiate a second alarm to management and start all smoke control systems including pressurisation of escape routes when smoke levels of 0.07% obscuration per metre are detected.

c) Automatically call the fire brigade, activate the emergency warning and intercom system, and de-activate all plant not necessary for fire safety within the building when smoke levels of 0.09% obscuration per metre are detected.

.3 Beam and point type smoke detectors required must simultaneously operate all functions referred to above and activate at the level set out in AS 1670.1.

5. EMERGENCY WARNING AND INTERCOM SYSTEMSGUIDE

.1 All buildings containing an atrium must be provided with an emergency warning and intercom system which:

.2 complies with AS 1670.4

.3 incorporates visual warning devices that:

a) operate upon the evacuation signal

b) display the words "EVACUATE" in red with letters conforming with the requirements of the Deemed-to-Satisfy Provisions of Part E4 for exit signs.

6. STANDBY POWER SYSTEMGUIDE

.1 If a required path of travel to an exit is within an atrium, a suitable alternative power supply must be provided to operate required safety systems, including sprinkler systems and fire hydrant pumps, air handling systems, alarms, warning and communication systems and emergency lighting circuits.

.2 The alternative power supply must:

a) be connected automatically if the normal power supply fails

b) if located within the building, be separated from the remainder of the building by an enclosure with an FRL of at least 120/120/120

c) be connected to the safety systems by means of cabling complying with C2.13(c)(iii) and (iv).

.3 The requirements of (a) are satisfied by:

a) a single medium voltage supply taken from an electricity substation situated within, or adjacent to, the building concerned where the power supply to the substation consists of two or more high voltage cables each taking electricity from separate transformers; or

b) two or more medium voltage supplies each taking electricity from separate electricity substations situated:

   i. outside the building concerned

   ii. at a suitable distance from each other; or

c) a single medium voltage supply taken from an electricity substation together with an electricity generating plant capable of:

   i. generating a medium voltage supply

   ii. starting and taking the required electrical load within a period of not more than 30 seconds from the time of normal supply failure.

7. SYSTEM FOR EXCLUDING SMOKE FROM FIRE-ISOLATED EXITSGUIDE

.1 Required fire-isolated exits in a building containing an atrium must be protected from the entry of smoke in accordance with E2.2.

Section
SPECIFICATIONS

CR

Fire Protection

E2.2d Residential Fire Safety Systems

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SPECIFICATION E2.2D RESIDENTIAL FIRE SAFETY SYSTEMS

1. APPLICATION

This Specification describes the requirements for residential fire safety systems referenced in Specification E1.5a.

Clause 2 applies to Class 3 residential care buildings. It covers installation requirements for local fire indicator panels (or alarm panels) that provide information to staff when a fire alarm is activated.

Clause 3 describes requirements for connecting residential sprinkler systems in Class 2 and 3 buildings or a residential care building, to a fire station or other approved monitoring service.

2. RESIDENTIAL LOCAL FIRE ALARM SYSTEMS — RESIDENTIAL CARE BUILDINGS

a) General requirements:

(i) This Clause applies to Class 3 residential care buildings.

(ii) The installation must consist of a system of smoke alarms powered either:

A. directly from the low voltage supply mains; or
B. from an extra-low voltage power source originating at a local fire indicator panel with a battery back-up facility.

(iii) A smoke detector complying with AS 1670.1 Clause 2.1.2(a)(ii), (xi) or (xv) may be substituted for a smoke alarm, provided an audible alarm device is associated with each detector.

(iv) The sound pressure level provided by a warning device must be equivalent to that required in Clause 3.22 of AS 1670.1, except that the sound pressure level need not be measured inside a sole-occupancy unit, provided that a level of not less than 85 dB(A) is attained at the access door to the unit.

(v) The alarm system must be wired for low voltage or extra-low voltage wiring.

(vi) The system must be designed so:

A. an audible alarm is given in the area in which the smoke alarm activates
B. visible and audible indication of an alarm is provided at the local fire indicator panel
C. an audible alarm is given in any area (including sleeping quarters and staff outbuildings) set aside for staff use.

(vii) The maximum number of smoke alarms on any one alarm zone must:

A. be determined by the maximum current output rating of the system source; and
B. not exceed 10.

(viii) Each alarm zone must be located around a single central access passageway, corridor or similar thoroughfare, to enable staff to readily identify the source of the alarm.

(ix) Where the smoke alarm is functionally dependent on an external power source, an audible fault signal must sound at the local fire indicator panel if that power source fails. The local fire indicator panel must be permanently connected to a reliable 240 V separate low voltage final sub-circuit. Source power must be protected by a separate circuit breaker, or fuse, supplied from the live side of the main switch.

(x) The smoke alarm system is not required to be connected to a fire alarm monitoring system (refer to Clause 2(b)(iii) of Specification E1.5a.

b) Local fire indicator panel:

(i) The local fire indicator panel must be located in a central area, such as a reception area, so that it is readily accessible by staff at all times.

(ii) The local fire indicator panel must be fixed wired.

(iii) The local fire indicator panel must incorporate the following:

A. A suitable mains power supply with battery back-up (capable of operating the system for 12 hours) for the local fire indicator panel and extra-low voltage smoke alarms supplied directly from the local fire indicator panel.
B. Terminals for input signal conductors from the smoke alarm and residential sprinkler system. If the signal source is from a low voltage smoke alarm external isolation must be provided.
C. Visible indication of the alarm zone in which the actuating device is located.
D. Automatic audible and visible indication of the following faults:
(aa) A break in the wiring of any circuit between smoke alarms or sprinkler alarm switch and the local fire indicator panel.
(bb) Low battery condition.
E. Automatic visible indication of mains power failure.
F. Initiation of any ancillary control facilities such as smoke door release or air-conditioning shut-down.
G. Local operation of individual smoke alarms, in the event of alarm zone isolation at the local fire indicator panel.

(iv) If the local fire indicator panel is also used for other non-fire related purposes such as security, then these functions must be on separate and distinct circuits. When disabled or isolated, these functions must not interfere with the operation of fire alarm circuitry.

(v) The local fire indicator panel must comply with AS 1670.1.

(vi) The local fire indicator panel must have the capacity to incorporate heat detectors deemed suitable in accordance with AS 1670.1 on either the same or separate alarm zones as the smoke alarms.

c) Smoke alarms:

(i) Extra-low voltage smoke alarms must be compatible with the local fire indicator panel.

(ii) Low voltage smoke alarms must be configured to send an output alarm signal to the local fire indicator panel.

(iii) Unless there is internal isolation of the signal output conductors, they must at all times be treated as low voltage conductors.

d) Signal isolation interface units:

(i) Signal isolation interface units must isolate any low voltage connected to the smoke alarms from the local fire indicator panel.

(ii) Signal isolation interface units must be certified by an Accredited Testing Laboratory as compatible with the specific types of smoke alarms used in the system.

(iii) Signal isolation interface units must be accepted by the electricity supply authority.

(iv) Units must be marked in a clearly visible location, with letters greater than or equal to 35 mm containing the following information:

SMOKE ALARM SIGNAL ISOLATION UNIT WARNING — 240V
Isolate power supply before removing cover

e) Wiring:

(i) Smoke alarms and associated equipment must be fixed wired for low voltage or extra-low voltage wiring systems, as applicable.

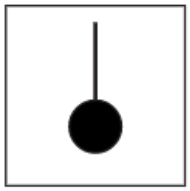
(ii) All extra-low voltage wiring must be red sheathed 0.6/1 kV stranded, with conductors having a cross sectional area of not less than 0.75 mm2.

(iii) Clear and concise "as-installed" single line drawings to a suitable scale, showing rooms, external and internal walls, fixed partitions, doorways etc., are to be provided for each installation at the local fire indicator panel.

(iv) Drawings must also include the actual location of fire alarms, smoke alarms, sprinkler flow switches (where installed), alarm connection points and local fire indicator panel, to enable easy identification of alarm system elements and their relationship to the building layout. Symbols to be used are:

Flow Switch

Heat Detector

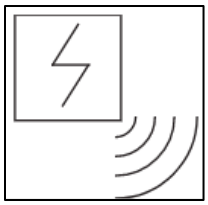


Smoke Detector

End-of-Line Device

Fire Indicator Panel

Smoke Alarm



3. CONNECTION OF RESIDENTIAL SPRINKLER SYSTEMS TO A FIRE STATION OR OTHER APPROVED MONITORING SERVICE

a) Connection to monitoring service:

(i) Connection of a residential sprinkler system to a fire station or other approved monitoring service must be via a sprinkler alarm switch, connected to alarm signaling equipment. The connection from the alarm signaling equipment must be in accordance with AS 1670.3.

(ii) The alarm signaling equipment must be installed:

A. in a secure, accessible position
B. in a weatherproof housing, if located externally
C. not more than 500 mm from the system flow switch.

b) Indication at the fire indicator panel — the fire signal from the alarm signaling equipment must be mimicked by an audible and visible signal at the fire indicator panel.

Section D
SPECIFICATIONS AND PARTS

Access & Egress

D1.12 Non-Required Stairways, Ramps and Escalators
D3.6 Braille and Tactile Signs
D3.10 Accessible Water Entry/Exit for Swimming Pools

E5 Lift Installations
E4 Exit Signs

See Section C for:

Part E4 Visibility in an Emergency, Exit Signs and Warning Systems

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SPECIFICATION D1.12 NON-REQUIRED STAIRWAYS, RAMPS AND ESCALATORS

1. SCOPE

This Specification contains the requirements to allow non-required stairways, ramps or escalators to connect any number of storeys in a Class 5 or 6 building. The requirements do not apply in an atrium or outside a building.

2. REQUIREMENTS

An escalator, moving walkway or non-required non-fire-isolated stairway or pedestrian ramp must comply with the following:

a) The escalator, walkway, stairway or ramp must be bounded by a shaft of:

   i. construction with an FRL of not less than 120/120/120 if loadbearing or –/120/120 if non-loadbearing and if of lightweight construction must comply with Specification C1.8: or

   ii. glazed construction with an FRL of not less than –/60/30 protected by a wall wetting system in accordance with Clause 2 of Specification G3.8 Fire and Smoke Control Systems in Buildings Containing Atriums.

b) The void of each non-required stairway, ramp or escalator must not connect more than 2 storeys.

c) Rising and descending escalators, walkways, stairways and ramps within one shaft must be separated by construction with an FRL of not less than –/60/30.

d) Openings into the shaft must be protected by fire doors with an FRL not less than –/60/30.

e) When the fire door is in the closed position, the floor or any covering over the floor beneath the fire door must not be combustible.

f) Fire doors must be fitted with smoke seals and the assembly must be tested in accordance with AS 1530.4.

g) Fire doors must be:

   i. closed and locked for security reasons: or

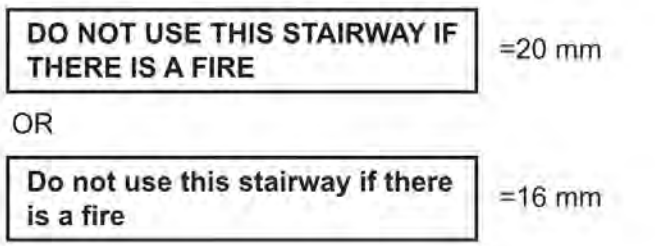
   ii. held open and be automatic closing.

h) Smoke detectors must be installed on both sides of the opening, not more than 1.5 m horizontal distance from the opening.

i) In the closed position, fire doors must be openable on a single hand downward action or horizontal pushing action on a single device within the shaft and by key only from outside the shaft.

j) A warning sign must be displayed where it can readily be seen outside the shaft near all fire doors opening to the shaft. The sign must comply with the details and dimensions of Figure 2.

Figure 2 Warning sign for non-required stairway, ramp or escalator



k) All doors opening into the shaft must be within 20 m of a required exit.

l) Signs showing the direction of the nearest required exit must be installed where they can be readily seen.

m) Materials attached to any wall, ceiling or floor within the shaft must comply with Specification C1.10.

n) Emergency lighting must be installed in the shaft in accordance with Part E4.4.

o) No step or ramp may be closer to the threshold of the doorway than the width of the door leaf.

SPECIFICATION D3.6 BRAILLE AND TACTILE SIGNS

1. SCOPE

This Specification sets out the requirements for the design and installation of braille and tactile signage as required by D2.21, D3.6 and Specification F2.9.

2. LOCATION OF BRAILLE AND TACTILE SIGNS

Signs including symbols, numbering and lettering must be designed and installed as follows:

a) Braille and tactile components of a sign must be located not less than 1200 mm and not higher than 1600 mm above the floor or ground surface.

b) Signs with single lines of characters must have the line of tactile characters not less than 1250 mm and not higher than 1350 mm above the floor or ground surface.

c) Signs identifying rooms containing features or facilities listed in this Specification must be located:

   i. on the wall on the latch side of the door with the leading edge of the sign located between 50 mm and 300 mm from the architrave

   ii. where (i) is not possible, the sign may be placed on the door itself.

d) Signs identifying a door required by Part E4.5 to be provided with an exit sign must be located:

   i. on the side that faces a person seeking egress

   ii. on the wall on the latch side of the door with the leading edge of the sign located between 50 mm and 300 mm from the architrave

   iii. where (ii) is not possible, the sign may be placed on the door itself.

3. BRAILLE AND TACTILE SIGN SPECIFICATION

a) Tactile characters must be raised or embossed to a height of not less than 1 mm and not more than 1.5 mm.

b) Title case must be used for all tactile characters, and:

   i. upper case tactile characters must have a height of not less than 15 mm and not more than 55 mm, except that the upper case tactile characters on a sign identifying a door required by E4.5 to be provided with an exit sign must have a height of not less than 20 mm and not more than 55 mm

   ii. lower case tactile characters must have a minimum height of 50% of the related upper case characters.

c) Tactile characters, symbols, and the like, must have rounded edges.

d) The entire sign, including any frame, must have all edges rounded.

e) The background, negative space or fill of signs must be of matt or low sheen finish.

f) The characters, symbols, logos and other features on signs must be matt or low sheen finish.

g) The minimum letter spacing of tactile characters on signs must be 2 mm.

h) The minimum word spacing of tactile characters on signs must be 10 mm.

i) The thickness of letter strokes must be not less than 2 mm and not more than 7 mm.

j) Tactile text must be left justified, except that single words may be centre justified.

k) Tactile text must be Arial typeface.

4. LUMINANCE CONTRAST

The following applies to luminance contrast:

a) The background, negative space, fill of a sign or border with a minimum width of 5 mm must have a luminance contrast with the surface on which it is mounted of not less than 30%.

b) Tactile characters, icons and symbols must have a minimum luminance contrast of 30% to the surface on which the characters are mounted.

c) Luminance contrasts must be met under the lighting conditions in which the sign is to be located.

5. LIGHTING

Braille and tactile signs must be illuminated to ensure luminance contrast requirements are met at all times during which the sign is required to be read.

6. BRAILLE

The following applies to braille:

a) Braille must be grade 1 braille (uncontracted) in accordance with the criteria set out by the Australian Braille Authority.

b) Braille must be raised and domed.

c) Braille must be located 8 mm below the bottom line of text (not including descenders).

d) Braille must be left justified.

e) Where an arrow is used in the tactile sign, a solid arrow must be provided for braille readers.

f) On signs with multiple lines of text and characters, a semicircular braille locator at the left margin must be horizontally aligned with the first line of braille text.

SPECIFICATION D3.10 ACCESSIBLE WATER ENTRY/EXIT FOR SWIMMING POOLS

1. SCOPE

This Specification sets out the requirements for types of accessible water entry/exit for swimming pools.

2. FIXED OR MOVEABLE RAMP

A fixed or moveable ramp must:

a) have a slip-resistant surface

b) have a maximum gradient of 1:14

c) have handrails complying with the requirements for ramps in AS 1428.1, installed on both sides of the ramp

d) have kerbs in accordance with the requirements for ramps in AS 1428.1

e) extend to a depth of not less than 900 mm and not more than 1100 mm below the stationary water level

f) have landings in accordance with the requirements for ramps in AS 1428.1, with a landing located at the bottom and top of each ramp and a landing must be located at a level between 900 mm and 1100 mm below the stationary water level.

3. ZERO DEPTH ENTRY

A zero depth entry must have:

a) a slip-resistant surface

b) a maximum gradient of 1:14

c) a single handrail complying with the requirements for handrails in AS 1428.1, from the top of the entry point continuous to the bottom level area

d) a level area:

i. 1500 mm long for the width of the zero depth entry at the entry point

ii. located at the bottom of the zero depth entry at a level between 900 mm and 1100 mm below the stationary water level.

4. PLATFORM SWIMMING POOL LIFT

A platform swimming pool lift must be:

a) capable of being operated from the swimming pool surround, within the swimming pool, and on the platform

b) located where the water depth is not more than 1300 mm

c) designed to withstand a weight capacity of not less than 160 kg and be capable of sustaining a static load of not less than 1.5 times the rated load.

5. SLING-STYLE SWIMMING POOL LIFT

A sling lift must comply with the following:

a) A sling lift must be located where the water depth is not more than 1300 mm.

b) When the sling is in the raised position and in the transfer position, the centreline of the sling must be located over the swimming pool surround and not less than 450 mm from the swimming pool edge.

c) The surface of the swimming pool surround between the centreline of the sling and the swimming pool edge must have a gradient of not more than 1:50 and must be slip-resistant.

d) A clear space:

i. not less than 900 mm x 1300 mm

ii. with a gradient of not more than 1:50

iii. having a slip-resistant surface

iv. located so that the centreline of the space is directly below the lifting point for the sling,

must be provided on the swimming pool surround parallel with the swimming pool edge on the side remote from the water (see Figures 5a and b).

e) A sling lift must be capable of being operated from the swimming pool surround, within the swimming pool and from the sling.

f) A sling must be designed so that it will submerge to a water depth of not less than 500 mm below the stationary water level.

g) A sling lift must be designed to withstand a weight of not less than 136 kg and be capable of sustaining a static load not less than 1.5 times the rated load.

Figure 5 Clear swimming pool surround space for sling lift in the transfer position
Figure 5a Plan view

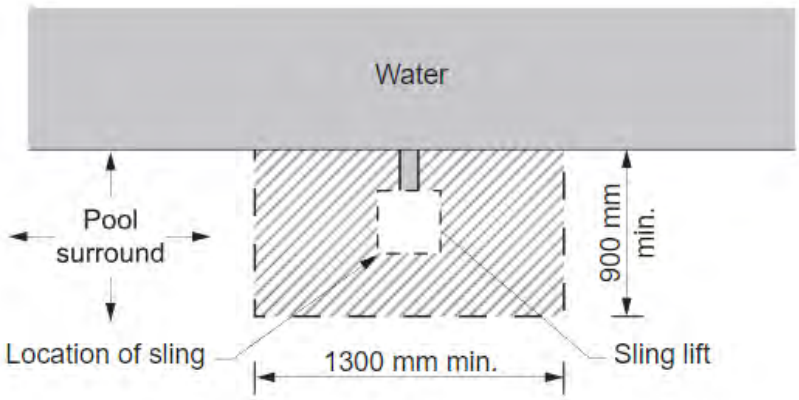
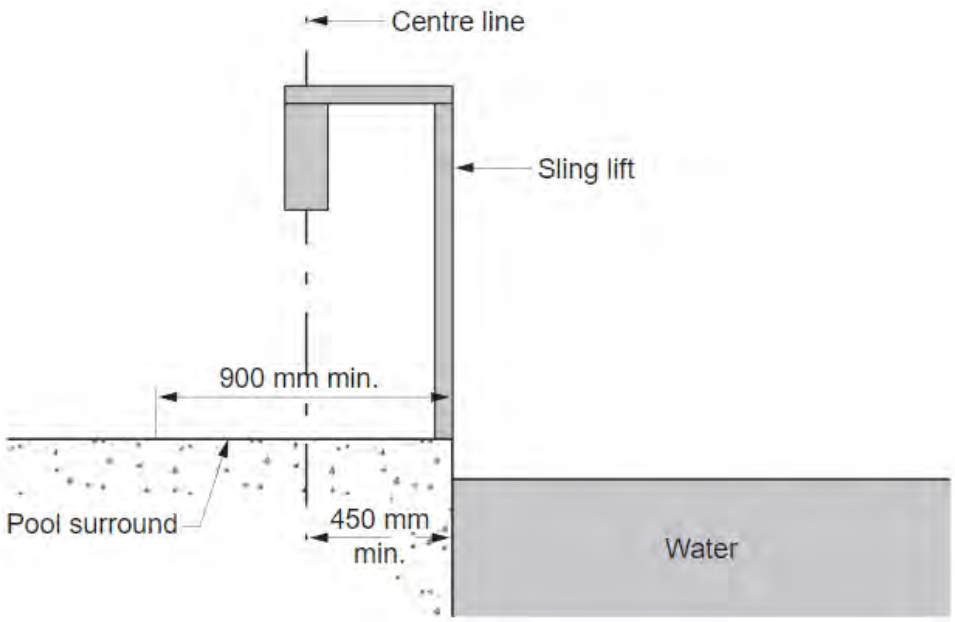


Figure 5b Sectional elevation



6. AQUATIC WHEELCHAIR

An aquatic wheelchair must comply with the following:

a) The height of the top surface of the seat must be not less than 430 mm.

b) The seat width must not be not less than 480 mm.

c) A footrest must be provided.

d) Armrests must be located on both sides of the seat and must be capable of being moved away from the side of the chair to allow a person to transfer on and off the seat.

SPECIFICATION E3.1 LIFT INSTALLATIONS

1. SCOPE

This Specification contains requirements for electric passenger lift installations and electrohydraulic passenger lift installations.

2. LIFT CARS EXPOSED TO SOLAR RADIATION

a) A lift car exposed to solar radiation directly, or indirectly by re-radiation, must have:

(i) mechanical ventilation at a rate of one air change per minute; or

(ii) mechanical cooling.

b) A 2 hour alternative power source for ventilation or mechanical cooling at (a) must be provided in the event of normal power loss.

3. LIFT CAR EMERGENCY LIGHTING

A lift car must have an emergency lighting system designed"

a) to come on automatically upon failure of the normal lighting supply

b) to provide at least 20 lux of lighting for 2 hours on the alarm initiation button.

4. COOLING OF LIFT SHAFT

While a lift in a lift shaft is in service, the cooling of the lift shaft must:

a) ensure that the dry bulb air temperature in the lift shaft does not exceed 40°C

a) if the cooling is by a ventilation system, be provided with an air change rate determined using a temperature rise of no more than 5 K.

5. LIFT FOYER ACCESS

Where there is a security foyer in a building, access may be via locked security doors provided:

a) security doors revert to the unlocked state in the event of:

(iii) power failure; or

(iv) fire alarm; and

b) locked foyer areas are monitored by closed circuit television and intercom system to a 24 hour staffed location.

6. EMERGENCY ACCESS DOORS IN A SINGLE ENCLOSED LIFT SHAFT

a) Where a lift is installed in a single enclosed lift shaft having a distance between normal landing entrances greater than 12.2 m, emergency access doors must be provided and constructed as follows:

(i) The clear opening size of emergency doors must be not less than 600 mm wide x 980 mm high.

(ii) Hinged doors must not open towards the interior of the lift shaft.

(iii) Doors must be self-closing and self-locking.

(iv) Doors must be marked on the landing side with the letters not less than 35 mm high:

"**DANGER LIFTWELL ACCESS**"

"**KEEP FURNITURE AND FIXTURES CLEAR**".

(v) Doors from the landing side must only be openable by a tool.

(vi) Each emergency door must be provided with a positive breaking electrical contact, wired into the control circuit to prevent movement of the lift until the emergency door is both closed and locked.

b) In single enclosed lift shafts where:

(i) ropes are installed

(ii) the vertical distance between the lift car sill and the landing door head is less than 600 mm

(iii) the counterweight is resting on its fully compressed buffer, emergency egress from the lift car must be provided in the form of an interlocked door with clear opening dimensions not less than 600 mm x 600 mm, accessible from the lift car entrance or the lift car roof (where the door is located in the wall of the lift shaft).

SPECIFICATION E4.8 PHOTOLUMINESCENT EXIT SIGNS

1. SCOPE

This Specification contains requirements for photoluminescent exit signs.

2. APPLICATION

A photoluminescent exit sign must comply with Section 5 and Appendix D of AS/NZS 2293.1, except where varied by this Specification.

3. ILLUMINATION

A photoluminescent exit sign must:

a) be maintained in a continuously charged state by a minimum illumination of 100 lux at the face of the sign by a dedicated light source with a colour temperature not less than 4000 K

b) in the event of a power failure, continue to provide a minimum luminance of 30 mcd/m^2 for not less than 90 minutes

c) have its performance verified by testing in accordance with ASTM E2073-10, except the activation illumination in clause 8.3 is replaced with 54 lux.

4. PICTORIAL ELEMENTS

Pictorial elements on a photoluminescent exit sign must:

a) where the colour white is used, be replaced with a photoluminescent material

b) be not less than 1.3 times larger than that specified in Table 5.1 of AS/NZS 2293.1

c) have a border of photoluminescent material that extends not less than 15 mm beyond the pictorial elements.

5. VIEWING DISTANCE

The maximum viewing distance in clause 5.6 of AS/NZS 2293.1 must not be more than 24 m.

6. SMOKE CONTROL SYSTEMS

Smoke control systems required by clause 5.3 of AS/NZS 2293.1 do not apply to a photoluminescent exit sign.

Section F

SPECIFICATIONS AND PARTS

Health & Amenity

DRAFT 1 2023 04 Apr21
JTG REVIEW

SPECIFICATION F2.1 LATRINES FOR AREAS WHERE THERE IS NO PIPED WATER SUPPLY

1. SCOPE

This Specification sets out the requirements in relation to the location and types of latrines in areas where there is no piped water supply

2. PRECAUTIONS

Care must be exercised to ensure that:

a) Disease transmitting files and other insects do not have access to the excreta

b) There is no nuisance to the public or the neighbours

c) The sub-soil water is not polluted if it is likely to be used for domestic purposes

d) The biological oxygen demand (BOD) of any resulting effluent is limited to the requirements of the Department of Health so that streams rivers and oceans are not polluted

3. LOCATION

The latrines must be screened from public view and be located not less than:

a) 30 metres from any well or other similar potable source of water

b) 6 metres from the front of street boundary of the allotment

c) 3 metres from any boundary other than the front or street boundary

d) 3 metres from any dwelling within or outside the allotment

4. TYPES OF LATRINES

The following disposal methods can be used:

(1) Dry on-site treatment: dry pit latrines and composting latrines

(2) Wet on-site treatment: wet put latrines, aqua privles, septic tanks and biogas plants

All these disposal methods rely on the reduction of BOD by aerobic bacteria (where free oxygen is available) and/or anaerobic bacteria (where free oxygen is excluded).

.1

Composting Latrines (Fig 4.1) are of two types, the single-vault continuous operation type and alternative twin-vault batch systems such as the WHO Vietnamese design.

Continuous operation types utilize aerobic bacteria to act on excreta and vegetable wastes suspended on a rack above the floor of the ventilated vault. Urine is evaporated off or drained away. As the mixture decomposes, it falls through the rack and is removed for use as fertilizer.

Figure 4.1 Composting Latrine

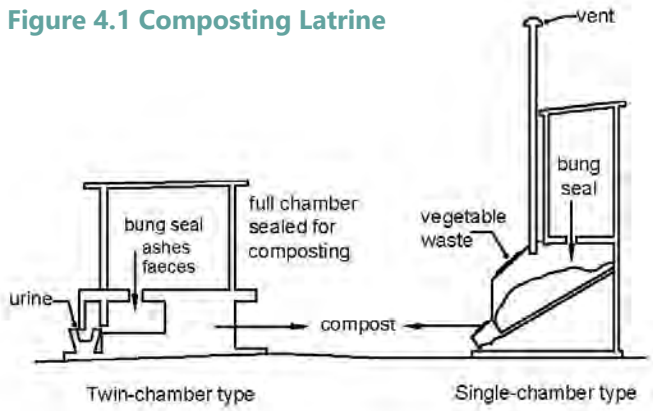
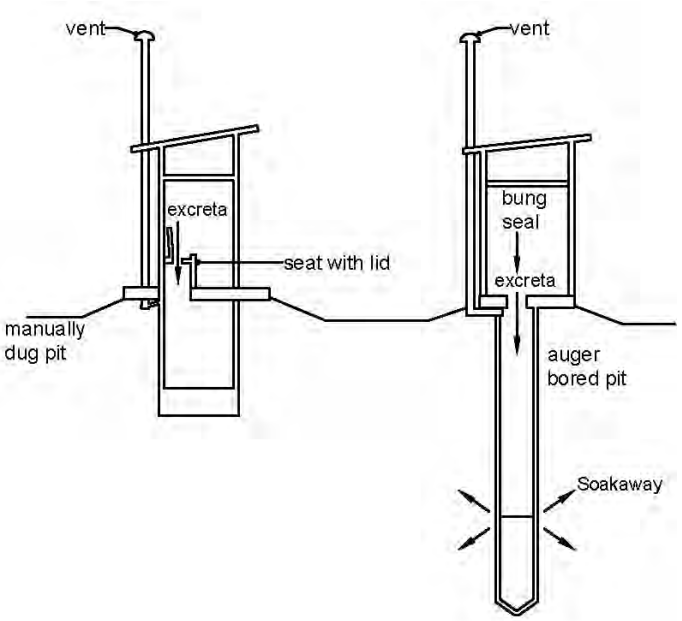


Figure 4.2 Dry Pit Latrine



In the alternating twin-vault type, one vault at a time receives excreta. Urine is drained away in a separate surface channel. The excreta are covered with loose earth, ashes, or sawdust to reduce odors. When the vault is nearly full, it is sealed with lime mortar and left for a few months to compost by anaerobic bacterial action. Contents are then removed and used for fertilizer.
During this time the other vault is used as the latrine. Both types work best in warm climates and with little or no urine loading.

.2

Dry Pit Latrines have no flushing facility (Fig 4.2). They are manually dug pit or mechanically bored holes a few meters deep over which a squatting plate with a bung seal or seat with lid is placed. These latrines operate more efficiently when the bottom of the pit is below the water table, which allows excreta to be decomposed by anaerobic bacteria below water level and to soak away into the surrounding ground. However, this could lead to the pollution of potable water sources in the area. Gases generated, such as methane, are vented through a tall vent pipe. When pits are dry , a combination of anaerobic and aerobic decomposition takes place. When a pit is almost full, the surface cover is removed, and the top of the pit filled with a mixture of lime and earth. A new pit is then dug.

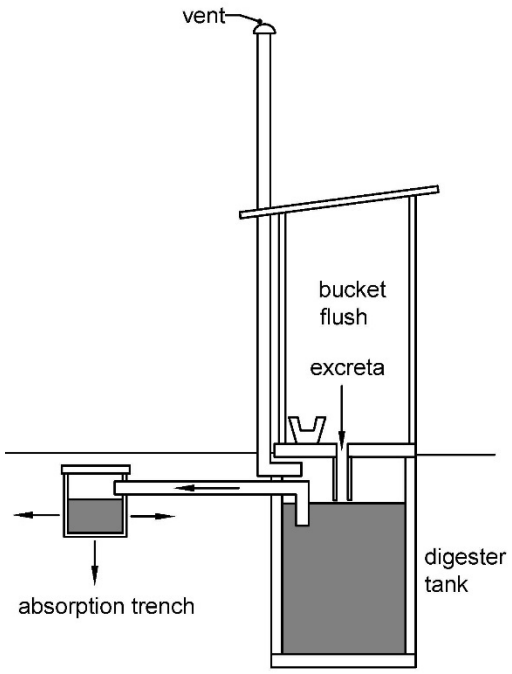
.3

Wet Pit Latrines are bucket-flushed, water-seal, floor-pan latrines with a soak-away pit in porous soil. Digestion of excreta is by anaerobic bacteria below water level. The lower section of the pit is lined to retain water when the pit does not reach the water table. Gases from the digestion are vented through the tall pipe.

For more details of dry pit and wet pit latrines see Annexure 1 to this Specification.

.4

Figure 4.4 Aqua Privy



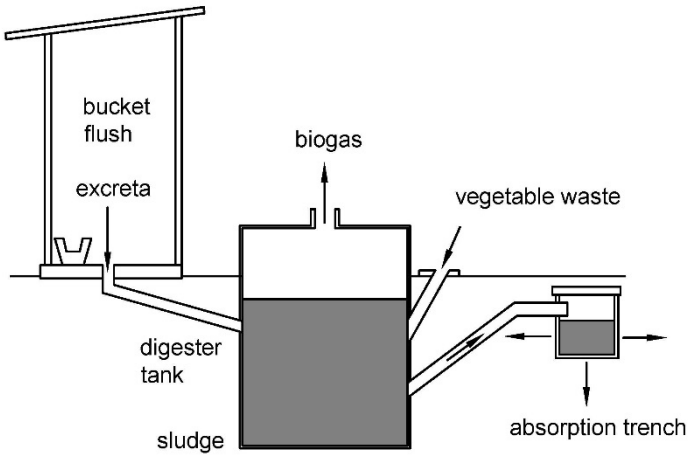
Aqua Privies (Fig 4.4) are simplified septic tanks with a single chamber and without a full flush pan. Where bucket-flushed squat plates are used, excreta enter the tank through a short pipe that penetrates below the surface of the liquid in the tank to minimise odours. Alternately, excreta may enter through a low-volume, water seal, bucket-flushed floor trap set in the squat plate. Decomposition is by anaerobic bacteria below water level in a permanent tank, which periodically requires desludging. Gases generated in decomposition are vented through a tall vent pipe. Excess effluent from the tank is drained to absorption trenches.

.5

Septic Tanks can be either single or double chamber. They are generally used with full cistern flush water-seal pans. Single-chamber designs use anaerobic digestion; in double-chamber designs the second chamber is ventilated and uses aerobic bacteria for digestion. The permanent tanks need desludging periodically. The effluent is piped into absorption trenches. For details of septic tanks see Annexure 2 to this Specification.

.6

Figure 4.4 Biogas Digester



Biogas (Gobar Gas) Digestors (Fig 4.6) operate similarly to a single-chamber anaerobic septic tank, but provision is made to trap the gas, which is largely methane, given off during digestion. The methane gas can be used as fuel for cooking and lighting buildings. For efficient gas production, the content of the digestor tank should have a carbon: nitrogen ratio of approximately 30:1. Vegetable wastes are usually adopted to the excrement to raise the carbon content in the tank. Excess effluent from the tank is often drained into ponds, where algae are grown as feed for domestic animals such as ducks. The digestor tank requires desludging periodically.

The choice of latrine is determined by local ground conditions, rainfall, water table, water

supply, ground temperature range, and social, cultural, and religious influences within the community.

ANNEXURE 1 PIT LATRINES

1. INTRODUCTION

Pit latrines can be of two types – dry pit and wet pit

This specification covers the details of both, when correctly constructed and maintained according to this specification and details available from the Health Department, the nuisance from flies and bad odour could be substantially reduced

2. LOCATION

Pit latrines whether wet or dry must be located:

a) At least 30 m away from any well or other potable source of water if the pit does not go through any fissured rock or coral

b) 3 m from any dwelling within or outside the allotment

c) 6 m from any boundary with a street

d) 3 m from boundaries other than with a street

e) Preferably at a lower ground level than where a potable source of water is located

f) Such that is it is accessible to the household at all times

g) So that the prevailing wind around the latrine is not shaded

Where the pit penetrates through fissured rock or coral through which liquids from the pit might pass unfiltered, the advice of the Health Department must be sought on the location. Otherwise all the fissures must be closed with concrete or cement mortar.

The site must be on firm ground which will not cave in or slump while digging the pit. If there is some problem in this regard, one solution could be to line the affected area with an old drum with both ends removed. The site should not be subject to flooding or remain water-logged.

3. CALCULATION OF DIMENSIONS

The pit volume depends on the number of users, the period for which it is used and a freeboard allowance of 0.5 m depth. If the put remains dry the annual accumulation of sludge is about 0.08 m^3 /person. In wet pit latrines or where washing water is allowed to enter it, the accumulation rate could be taken as 0.05 m^3.

For example, for a family of 5 which plans to use the pit for 5 years, the volume required to hold the sludge would be:

For a dry pit: 5 x 0.08 x 5 = 2.0 m^3
For a pit area of 0.6 m x 1.0 m the depth required for the sludge: 2.0 / (0.6 x 1.0) = 3.3 m

Add freeboard allowance = 0.5 m
Total depth required = 3.8 m

For a wet pit, the volume of sludge: 5 x 0.05 x 5 = 1.25 m^3
For a pit diameter of 600 mm, area of cross section: 0.6 x 0.6 x 3.14/4 = 0.28 m^2
Depth of pit for sludge: 1.25 / 0.28 = 4.5 m
Add freeboard: 0.5 m
Total depth = 5.0 m

If these depths are considered impractical either the sectional size of the pit can be slightly increased (for instance, for 700 mm diameter the depth of the pit would be 3.8 m for a 5 year life) or the depth reduced to cater for a shorter life for the pit

A cover slab size 1.4 m x 1.0 m would be appropriate for the dimensions chosen for the dry pit if the sides of the pit are very stable, otherwise the size of the slab must be larger. The pit need not be rectangular in shape. It can be an auger cored circular pit 600 to 700 mm diameter.

4. CONSTRUCTION

.1 DIGGING THE PIT

The pit may be dug manually in which case it is usually rectangular or square. A power operated or hand auger can be used to dig circular pits. Whichever method is used care must be exercised to ensure that the dimensions at the top remain true. Otherwise there could be difficulty and additional cost in placing the cover slab.

Where it is necessary to close off any fissures or crevices in rock or coral in the pit, the pit dimensions must be sufficient for someone to be lowered down to do the work. Great care must be exercised in lowering anyone. A safety rope must be used and at the first sign of any cave in or other problem others on top must promptly pull the person from out of the pit. If the fissures are large concrete to a mix of one part cement, two part clean sand and four parts gravel/coral/stones must be used to close them. If not use cement mortar with 1 part cement and 2 parts sand. The concrete or mortar must be to a stiff mix.

.2 FOUNDATION

The foundation provides a sealed support for the cover slab and raises it above the surrounding ground. The foundation may be cast and concrete or be made up of concrete block masonry or durable timber. The ground around the pit must be levelled and preferably raised with a layer of gravel/coral or earth before pouring/erecting the foundation.

.3 COVER SLAB

Cover slabs are of two types:

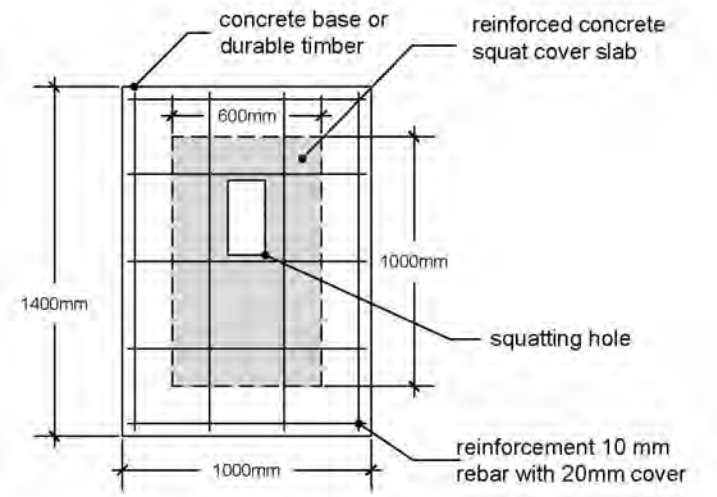
a) Squat type with small platforms for the feet, or

b) A pedestal type on which the user can sit.

The cover slab can be purchased from private suppliers. It could also be locally precast. Figures 4.3 A and B give some details of the cover slab.

The cover slab must be placed over the foundation so that it is fully supported without any gaps. Cement mortar may be used to firmly seal mor the slab over the foundation. The finished surface of the slab must be at least 150 mm above the immediate surrounds.

Figure 4.3A Concrete cover slab – plan

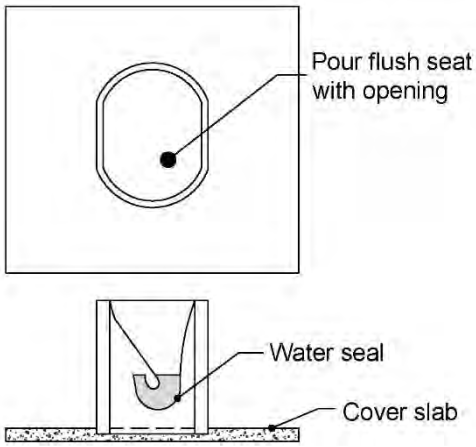


.4 VENT PIPE

A 100 mm PVC vent pipe may be erected over the pit to remove foul gases generated by the decomposition of the waste matter. The squat slab has a matching PVC insert shown in Figures 4.4A and 4.5 on which the vent pipe can be erected. The vent pipe must be supported to the frame of the shed over the pit. One way of strapping the pipe is also shown in Figure 4.4.A. The vent pipe must be at least 2.5 m high and 500 mm above the roof at the point of penetration or the nearest point. The open end of the vent must be covered with durable fly screen to prevent flies and mosquitos from entering (Figure 4.4B)

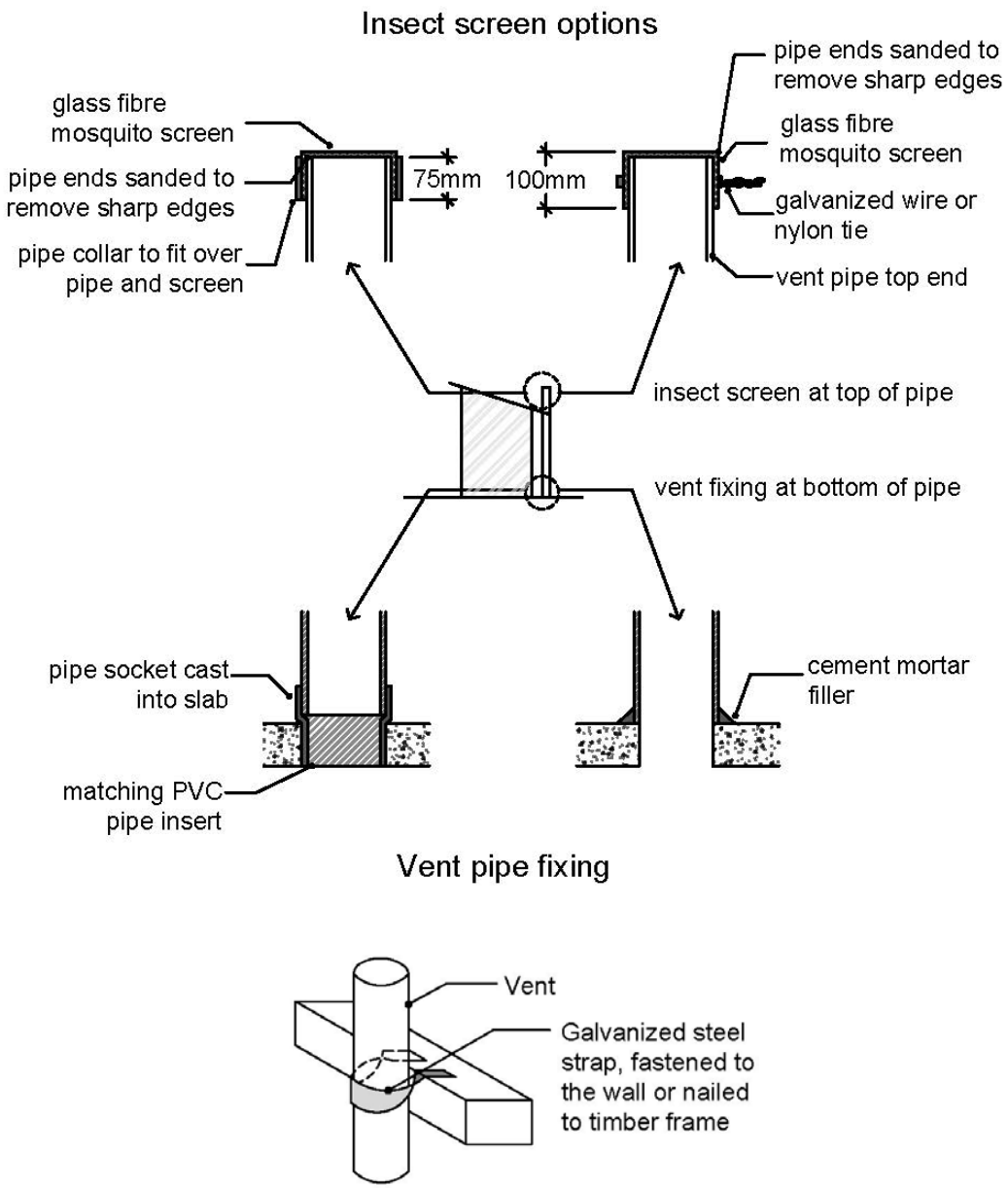
Mosquito breeding inside the pit is not likely problem where a pour-flush water seal is used over the cover slab (see figure 4.3B). In the case of a squat slab a wooden bung seal can be used to cover the squat hole when it is not being used. This would prevent mosquitoes and flies from gaining entry into the pit. In the case of seats without a water seal, a folding lid can be used to keep it covered when it is not in use.

Figure 4.3B Pour-flush water seal seat



It is good to extend the squat hole or (seat without water seal) into the pit by about 300mm by using an insert. This would reduce the chances foul gases escaping through the hole rather than through the vent. (When the restricted space in the shed gets hot from the sun, foul gases would tend to escape through the hole slab rather than through the vent).

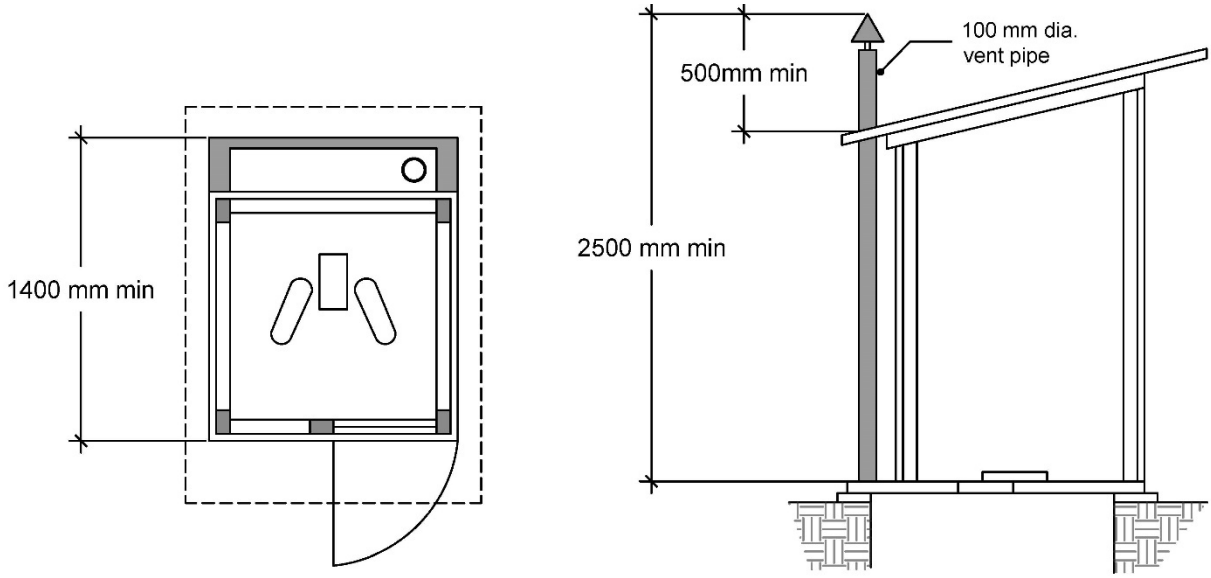
Figure 4.3B Insect screen and vent fixing options

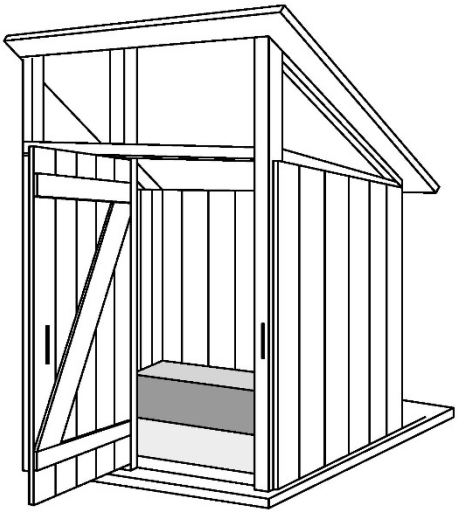


.5 THE SHED

A typical shed is shown in Figure 4.5. Although it could be built of any locally available material, it should be durable and firmly held down. Otherwise it could be blown away during cyclones and act as a wind-borne missile. The shed must afford privacy and have good ventilation. Good ventilation would keep the shed must be shaded from too much light as flies are attracted to light.

Figure 4.5 Typical Shed





.6 MAINTENANCE

The pit latrine must be kept clean at all times. However do not use strong disinfectants in large quantities. It is best to use a wet mop or wet rag soaked in diluted disinfectant or clean agent to clean the cover slab and seat. If chemicals and cleaning agents are allowed inside the pit, they would drastically affect the bacterial degradation of the waste matter and there could be problems with the foul smells and the pit could be filled sooner.

Any erosion of the fill around the foundation must be noted and repaired. The fly screen cover over the vent pipe must also be checked periodically and replaced promptly if damaged. The shed over the pit must be kept in good repair.

5. PIT CLOSURE

When the pit is full to within about 0.5 m of the cover slab it must not be used any more. Another pit must be located at least 3 m away (deeper the pit, the greater the separation distance). The cover slab, vent pipe, and shed can be re-used over the new pit. The remaining space in the old pit must be filled with earth. It is good to over-fill and form a mound so that enough surplus earth is available when the material subsides with decomposition. The pit can be dug out after the minimum period of one year and the material safely used as a fertiliser.

ANNEXURE 2 SEPTIC TANKS FOR DOMESTIC USE

1. FUNCTION OF A SEPTIC TANK

The basic function of a household septic tank is to receive normal liquid household wastes and to condition them for such a time, and in such a manner, that the clarified effluent may be percolated efficiently into the subsoil, where it is absorbed and evaporated . in order to perform this basic function, all septic tanks must fulfill the following requirements:

a) Remove solids – a septic tank must have a primary or liquefying chamber of such shape and size that the rate of flow of all sewage is so reduced that at least the larger solids sink to the bottom and are retained and the clarified effluent is discharged. The inlet and outlet pipes of this primary chamber must be so shaped and located that the scum which forms on the surface of the sewage is not disturbed. The capacity of the tank is usually kept equal to the inflow during 24 hours to allow a days retention.

b) Promote bacterial action – to ensure that the solids and liquids in the tank will decompose it is necessary that the tank be designed so that either:

   (i) A variety of bacteria – anaerobic bacteria which thrive in the absence of free oxygen are present, or

   (ii) A variety of bacteria – aerobic bacteria which thrive with access to air is also present

   A tank that is designed to achieve the purpose defined in (i) is a single-treatment septic tank, and a tank that is designed to achieve the purpose defined in (ii) is a double-treatment septic tank. A double-treatment tank is generally more expensive. Therefore, details of only single-treatment tanks with or without aerobic filters will be included in this Specification.

c) Store sludge – a fine silt-like sludge accumulates at the base of the primary tank. It follows that the primary tank must be of sufficient size to store sludge for a considerable period, otherwise if the tank is not cleaned out at the frequent intervals, the sludge will eventually be scoured from the tank and clog the outlet drain, the absorption trench or soil and an aerobic filter where provided.

2. LOCATION

Septic tanks and other connected works such as absorption trenches and soak pits must be located at a sufficient distance to prevent contamination of potable water sources and nuisance. Figure 2 shows typical layouts with the minimum separation distances marked on them. It will be seen that a minimum distance of 30 m is required between soak pits and potable water sources whereas this distance is only 15 m in the case of absorption trenches.

Another important consideration in the siting of a septic tank is that an adequately absorbent area must be available for discharging the effluent through absorption trenches or soak pits.

3. CONSTRUCTION

.1

Septic tanks may be of reinforced concrete or of reinforced block masonry walls over a reinforced concrete base. Tanks of precast concrete construction may be made from rectangular slabs which are assembled on the site, or be of cylindrical construction, either as a single cylinder open at the top, or a stack of short, open-ended cylinders. There are also prefabricated septic tanks made of fibre glass.

.2

Whatever form of construction or materials are used for the sides and bottoms of septic tanks the resulting work must be impervious to water. For tanks of rectangular section, it is important that all internal angles be well rounded, so as to minimize shrinkage cracking. Leakage at the corners of tanks of precast concrete construction made from rectangular slabs, or at the joints of precast tanks made from a number of open ended cylinders, must be detected and corrected in advance

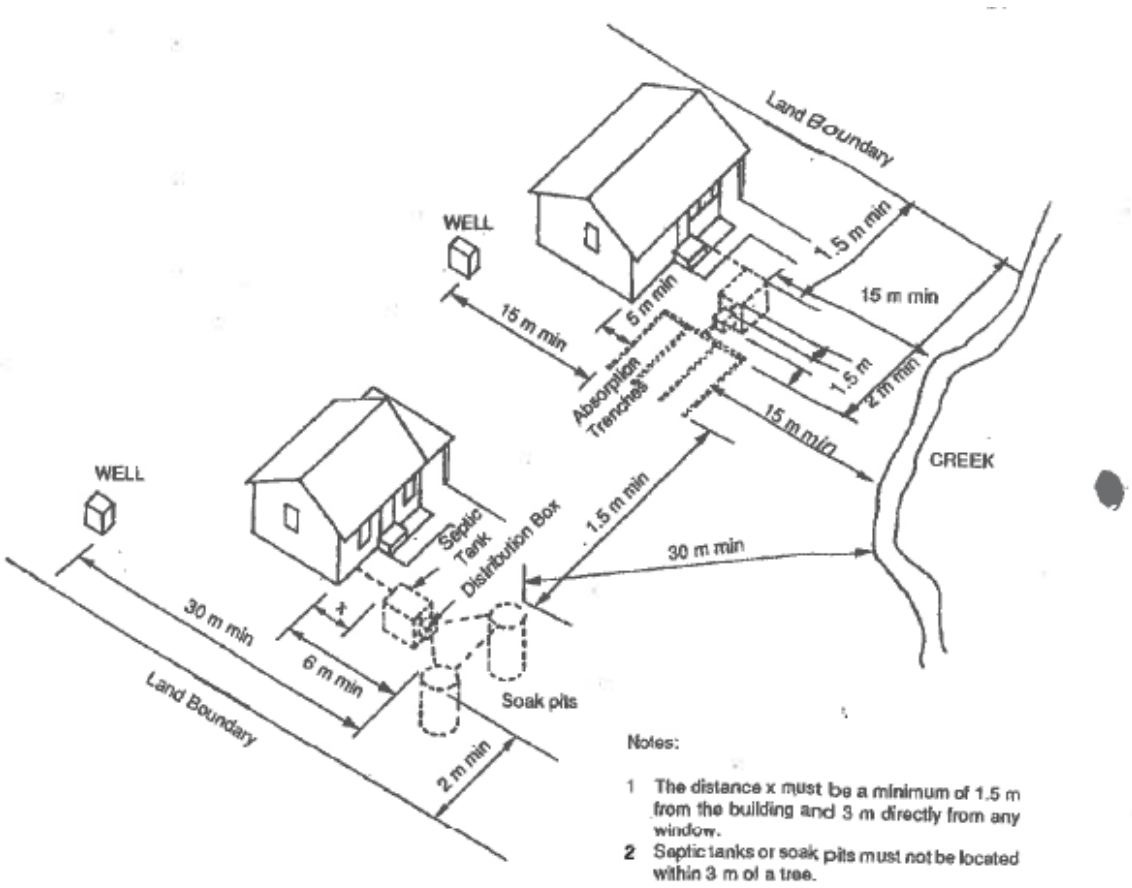
.3

Every septic tank of block masonry or concrete construction must be covered with reinforced concrete slabs and removable manhole covers fitted over every compartment. The manholes are used when it is necessary to pump out or otherwise clean the tanks. Inspection openings are also required over the inlet and outlet square junctions. The aerobic filter where provided must be filled with hard, impervious and durable stone, coral or gravel. These must be graded from 60 mm to 75 mm.

.4 DESIGN DETAILS

The design of the type of septic tank system to be installed will be governed by the results of the investigations of the site and locality, taken in conjunction with results of the percolation test discussed in clauses 5.2 and 5.3. Where the soil is of a suitable type and is sufficiently large to dispose of the final effluent, a single treatment septic tank will be suitable. If there is any doubt about the porosity of the site and that the effluent might seep on to adjoining premises or public places, then an aerobic filter must be installed with a septic tank. A surface area of one square metre of filtering materials must be provided in aerobic filters for up to every 0.9 m^3 of flow of sewage per day. This works out to about 1 m^3 of filter for 50 m^3 of daily flow of sewage.

Figures 3.4A, B and C and Tables 3.4A and B give details of the dimension required of built-in-situ septic tanks. Table 3.4A also gives the volume of 60-75 mm stones for any aerobic filter that may be provided.



.5

Figure 3.5 shows an arrangement for aerobic filters. The filter chamber can also serve as a distribution box for the absorption trenches.

4. GREASE TRAPS

.1

The satisfactory disposal of the discharge from kitchen waste fixtures is frequently difficult because it is charged with grease which cannot be satisfactorily dealt with in a septic tank. This difficult may be overcome by a grease trap located near the kitchen through which all discharge from the kitchen must pass before entering the drain to the septic tank. For satisfactory working of the trap it is necessary that both laundry and roof waters, and liquid and powder detergents, be excluded from it. A grease trap constructed as shown in Fig. 4.1 has been found effective in arresting grease. Alternatively, a smaller precast concrete or other type of grease trap may be installed.

The capacity of the grease trap below the level of the invert of the outlet must be not less than the total capacity of the sinks and dishwashers served. The cover over the trap should be removable to facilitate the cleaning of the trap.

Figure 3.4A Longitudinal Section

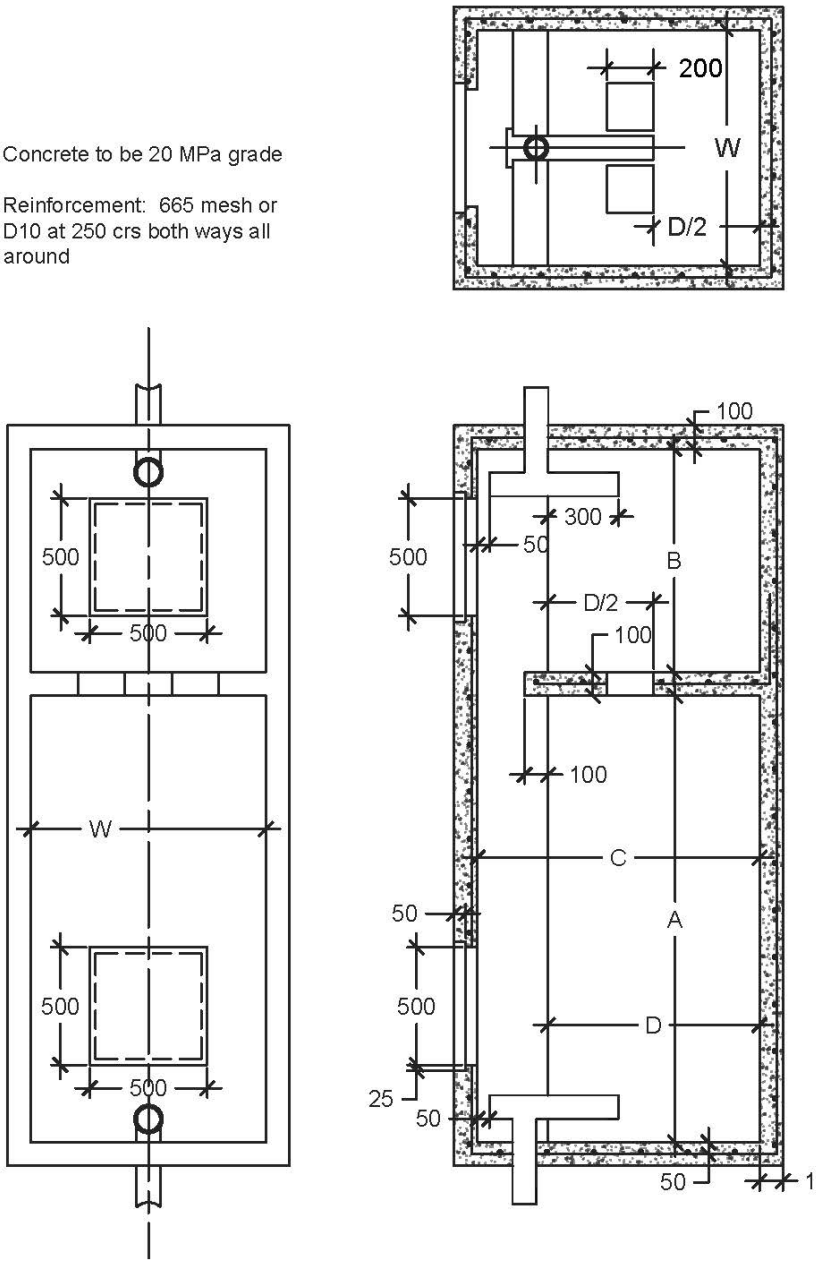


Figure 3.4B Longitudinal Section

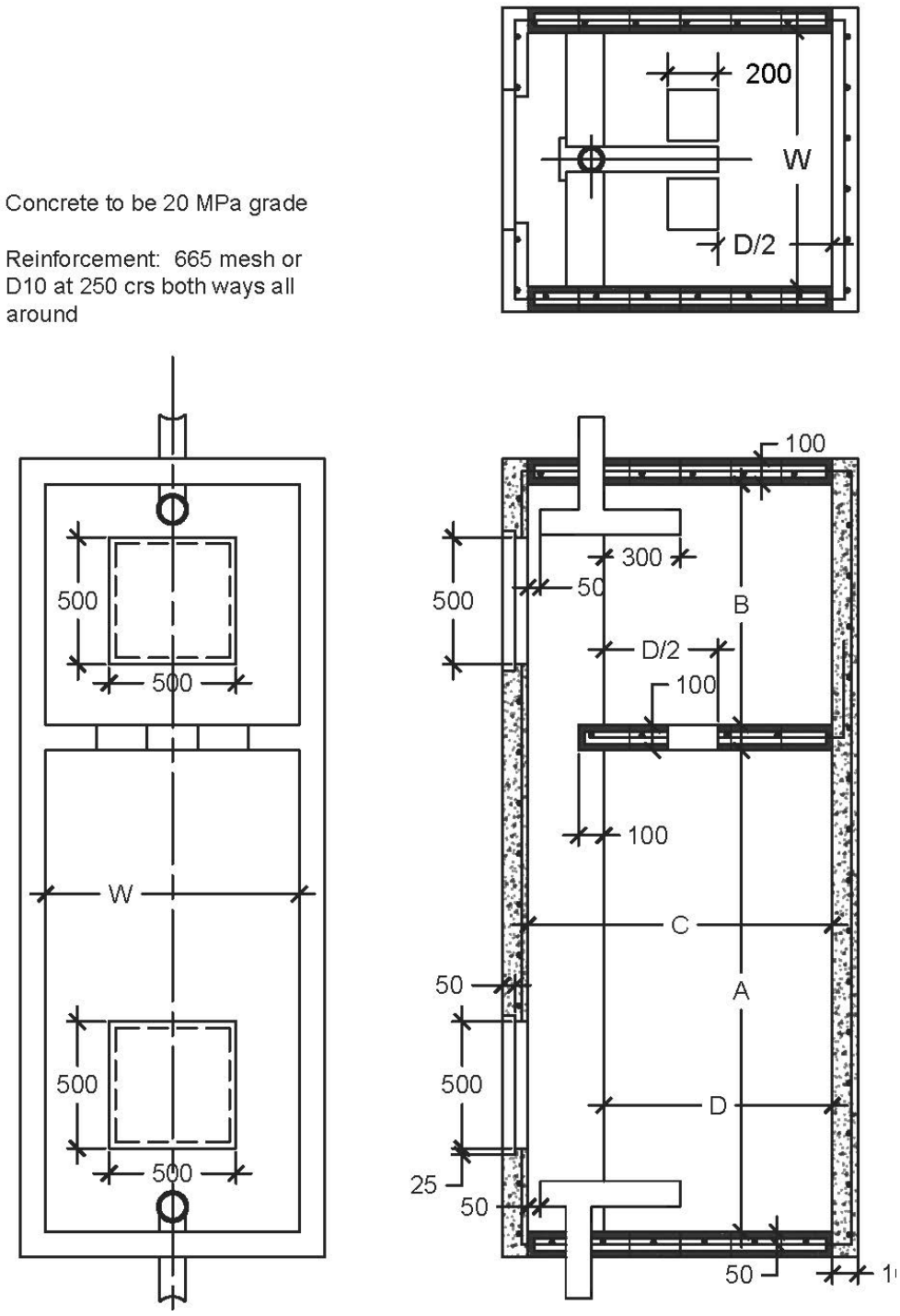


Figure 3.4B Longitudinal Section

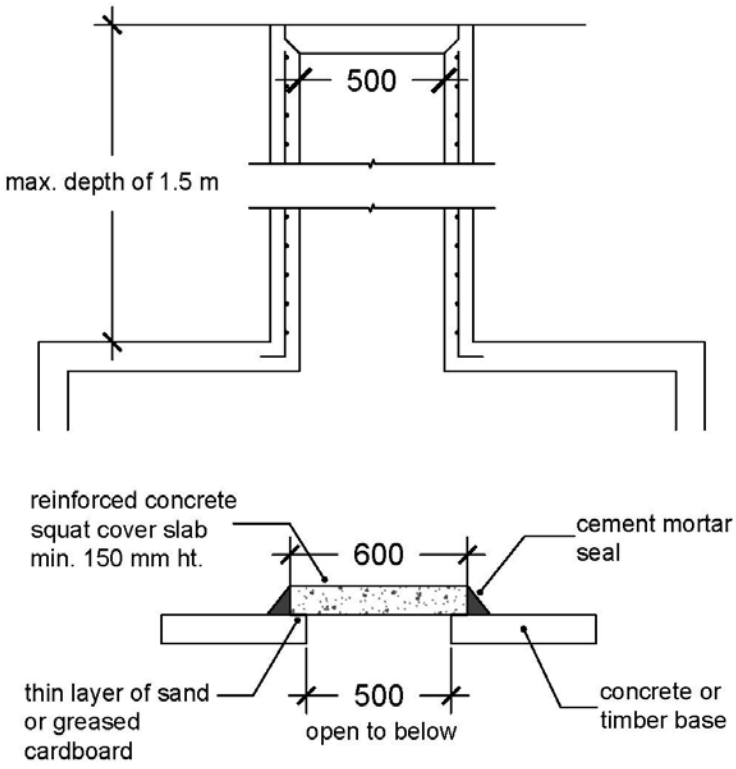
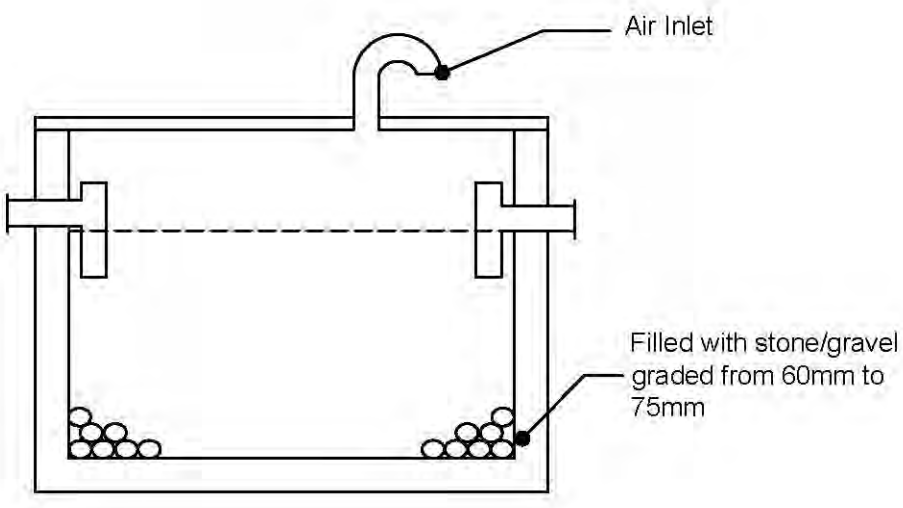


Figure 3.4B Longitudinal Section



No. of Persons	ONLY SOIL WASTE						
	A	B	C	D	W	V (m^3)	F (m^3)
8	1000	400	1000	850	800	0.95	0.02
10	1000	600	1000	850	800	1.22	0.02
12	1000	600	1000	850	800	1.22	0.02
15	1000	600	1200	1050	800	1.34	0.03
25	1200	800	1200	1050	1000	2.10	0.05
50	1600	800	1400	1250	1000	3.00	0.06
100	2400	1200	1400	1250	1200	5.40	0.11
150	2600	1400	1600	1450	1400	8.12	0.16
200	3000	1600	1600	1450	1600	10.67	0.21
300	3400	1800	1800	1650	1800	15.44	0.31
400	4000	2200	1800	1650	2000	20.46	0.41
500	4200	2200	1800	1650	2400	25.34	0.51
600	4400	2400	2000	1850	2400	30.19	0.61

Note:

V = Volume of Septic Tank

F = Volume of Aerobic Filter

For details of A, B, C, D and W see Figure 3, 4A and B

No. of Persons	ALL DOMESTIC WASTE						
	A	B	C	D	W	V (m^3)	F (m^3)
8	1400	800	1000	850	1000	1.87	0.04
10	1400	800	1200	1050	1000	2.31	0.05
12	1800	800	1200	1050	1000	2.73	0.06
15	1800	800	1200	1050	1200	3.28	0.07
25	200	1200	1400	1250	1400	5.60	0.11
50	3200	1600	1600	1450	1600	11.14	0.22
100	4000	2000	1800	1650	2200	21.78	0.44
150	5000	2400	2000	1850	2400	32.86	0.66
200	5600	2400	2000	1850	3000	44.40	0.89
300	6600	3400	2000	1850	3600	66.60	1.33
400	8000	4000	2000	1850	4000	88.80	1.78
500	8200	4200	2000	1850	4800	110.11	2.20
600	9000	4300	4000	1850	5200	132.76	2.66

Note:

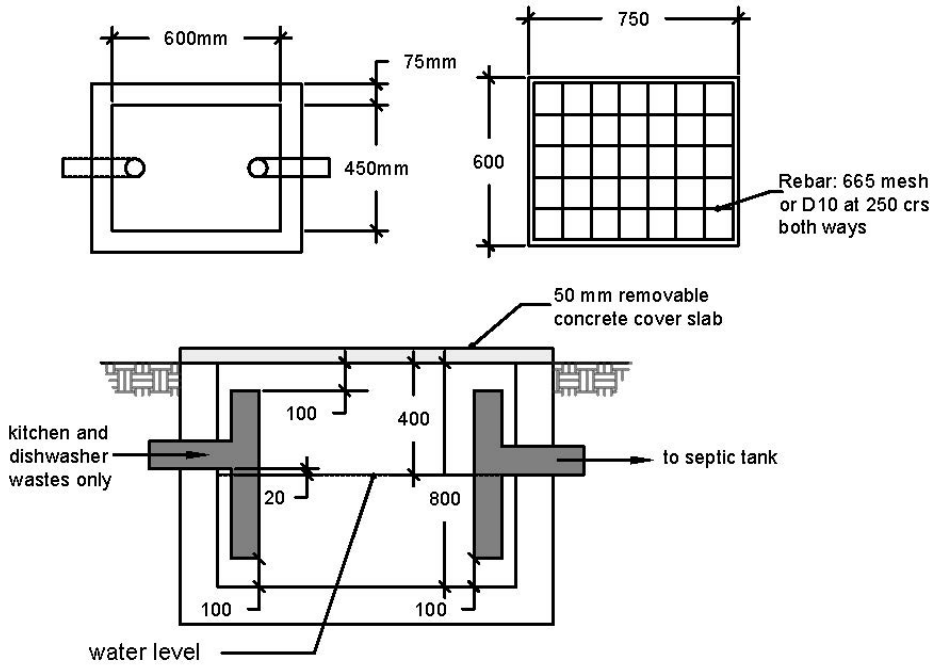
V = Volume of Septic Tank

F = Volume of Aerobic Filter

For details of A, B, C, D and W see Figure 3, 4A and B

Block wall thickness	Height of Tank (m)	Vertical bars	Horizontal bars
150	1.0	D10 @ 600	D12 @ 600
	1.2	D12 @ 600	D12 @ 600
	1.4	D12 @ 400	D12 @ 600
200	1.6	D12 @ 400	D12 @ 600
	1.8	D16 @ 600	D12 @ 600
	2.0	D12 @ 400 fill all cells	D16 @ 800

Figure 3.4B Longitudinal Section



.2

If grease traps are not regularly cleared of the accumulated grease it would give rise to the blocking of drains, unsightly overflow through the sides of the - cover slab of the trap and unpleasant odour.

5. EFFLUENT ABSORPTION AREA

.1

An important factor when considering the installation of a septic tank is to determine whether the soil is suitable to absorb the effluent and whether the soil is of adequate depth and area. Generally, it can be said that the most suitable soil for an absorption area is a sandy or silty foam, and the most unsuitable soil, hard impervious clay, or rock. Where an impervious stratum such as rock or clay is present, it may not be possible to provide an absorption trench. If the slope of the ground allows the provision of imported absorbent fill of sufficient thickness, it will still be possible to have a trench or soak pit.

.2

The absorption rate of the soil may be ascertained by carrying out the following percolation test.:

At a number of representative spots within the area to be used for installation of the absorption drains, dig holes 300 mm square to the depth of the absorption drain. Pour water into the holes to a depth of 150 mm or more and allow the water to soak away. Again pour water into the holes to a depth of 150 mm and record the times taken for the surface of the water to fall 25 mm.

.3

The recommended dosage of effluent in litres per metre of absorption trench per day, according to the time taken for the water surface to fall 25 mm in the test is given in Table 5.3, and the minimum length of the absorption trench in metres may be determined from the formula at the base of the Table.

Table 5.3 Length of absorption trench for different absorption rates

Time for water level in test to fall by 25 mm (minutes)	Dosage of effluent in litres per metre of trench per day (E)
1	75
2	60
5	45
10	30
20	18
30	15
60	11

Notes:

(a) Length of absorption trench in metres = 1000 V/E, Where V is the volume given in cubic meters in Table 3.4 A.

(b) If the time taken for a fall in level of 25 mm is more than 60 minutes the soil is not suited for absorption trench method of disposal.

6. ABSORPTION TRENCHES

.1

Typical dimensions for an absorption trench are approximately, width 450 mm and minimum depth of 400 mm. the trenches are packed with 75 mm size hard stone, gravel and coral to a height of 150 mm, over which a line of perforated pipes is laid along the centre of the trench, commencing about 300 mm from the beginning of the trench and thereafter running the full length of the trench. The drain pipe conveying the effluent to the trench extends into the trench and butts against the first perforated pipe.

.2

The joints between the pipes in the trench must not be sealed. The pipes should be surrounded and covered with 75 mm broken hard stone or hard coral to within a few millimetres from the top of the trench, over which should be placed a protective covering of old iron, bag, bark or the like, before covering the trench with soil or turf.

.3

The absorption trench may also be constructed of concrete slabs laid in such a manner that there are many vertical joints left open so as to allow the effluent to escape. Concrete slabs are used to cover the top of the trench, and these may be themselves be covered by soil or turf.

.4

The absorption trench should be constructed along the general contour of the ground. It must be so positioned that the prepared ground level at the trench is lower than the invert of the outlet pipe from the septic tank so as to prevent the effluent back-flooding into the septic tank. Typical absorption trenches are shown in Fig. 6.4A and their general layout in Fig 6.4B.

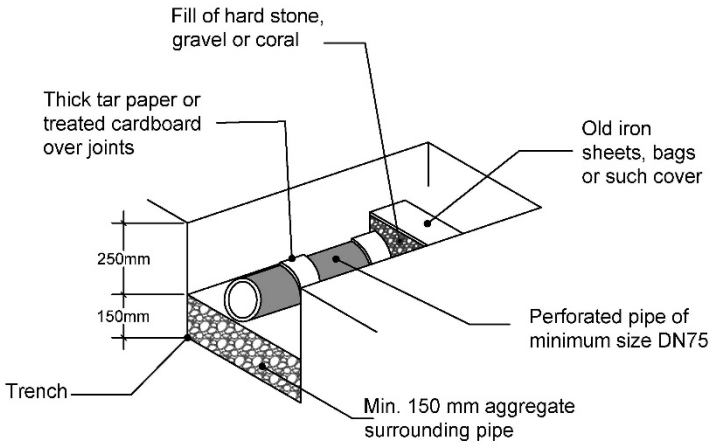
.5

Moisture seeking shrubs or other vegetation planted in the vicinity of the trench will assist in the absorption of the effluent, but care should be taken in selecting the shrubs so that their roots are not likely to interfere with the efficiency of the trench. Roof water, and as far as possible surface and ground water, must be excluded from absorption trenches, so as to maintain their efficiency.

7. SOAK PITS

Where sufficient area for absorption trenches is not available, but there is sufficient depth of absorbent material, soak pits may be used. A typical arrangement is shown in Figure 7. Old bitumen drums with he ends removed are shown arranged in tiers. The drums are pierced at about 200 mm centres with a pick or so. They are surrounding by 75 mm hard stone, gravel or coral. The effluent is drained into the drums. The minimum thickness of stone surrounding the drums must be 300 mm. the actual dimensions of the soak pit will depend on the nature of the soil and the volume of the effluent.

In general a soak pit is not as effective or desirable a means of disposal as absorption trenches.



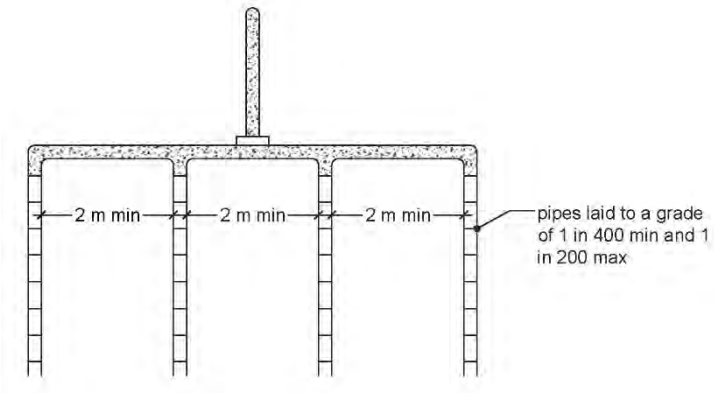
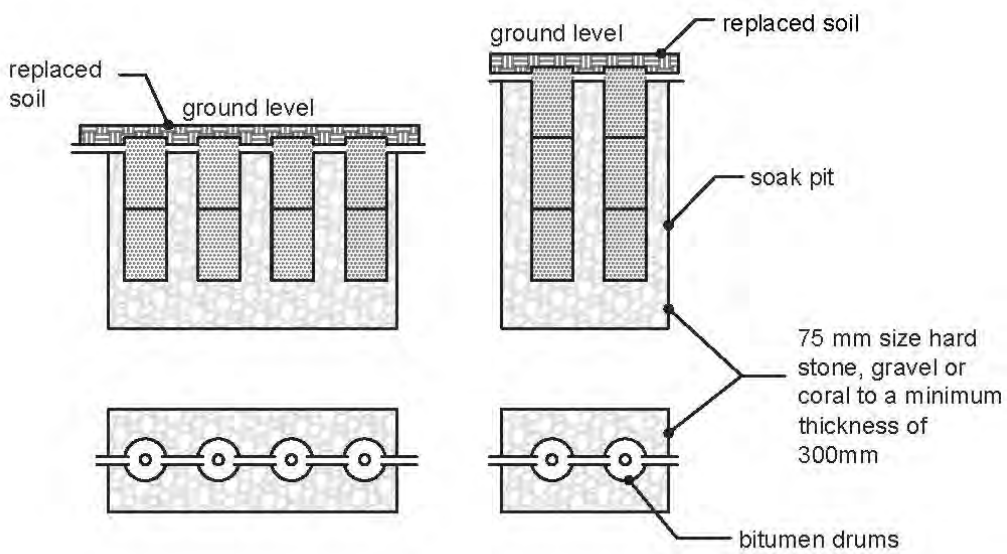


Figure 3.4B Longitudinal Section

Figure 3.4B Longitudinal Section



8. SPECIAL CIRCUMSTANCES

.1

Site conditions can necessities the adoption of special measures, such as:

a) Importation of suitable soil and its retention to act as an absorption area. Alternatively, it may be necessary for wastes from the kitchen, laundry and bathroom to by-pass the septic tank and be absorbed in an area away from that used to absorb the effluent from the septic tank.

b) It may be necessary to construct a number of trenches as a grid, to distribute the effluent over as wide an area as possible. A distributor may be incorporated in the effluent-drain system, to direct the effluent to any desired trench. Typical examples of distribution boxes are shown in Figure 8.1.

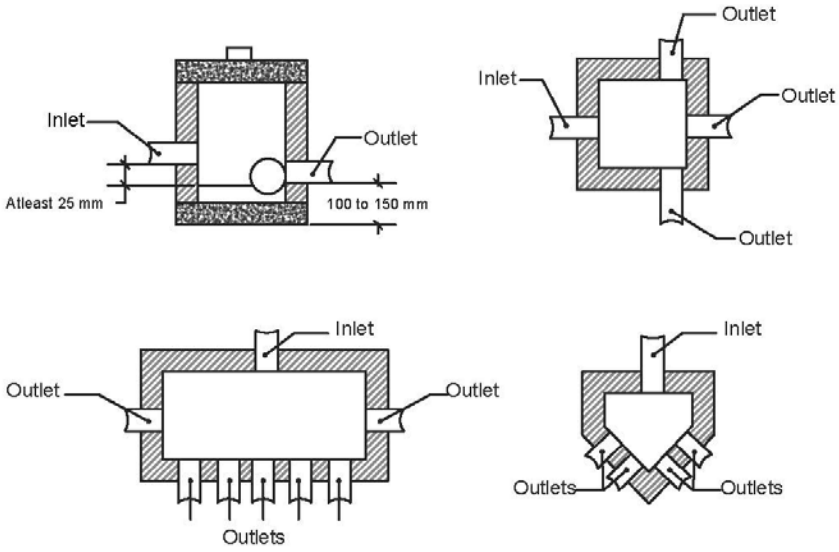
c) On some sites it may be necessary to located the absorption area uphill from the septic tank,, and to install an electric pump. The pump is operated by a float switch and automatically pumps the effluent up to the absorption trench when the effluent in the tank reaches a nominated level. The cost of installing and maintaining such a pump should be considered.

d) In some areas where there are many septic tanks, a drainage system can be made available to take the effluent away from each septic tank, either by gravity or by pumping, to an absorption area, public sewerage or treatment ponds.

9. VENTS

A vent is required in order to allow ventilation through the septic tank and drainage system. Vents are usually of PVC capable of withstanding ultra violet radiation, and are normally taken off at the head of the house drain farthest away from the septic tank. At various stages in the operation of a septic tank, offensive odours may be given off. The height and location of the vent outlet must be a minimum of 150 mm above its point of penetration through any roof covering and 600 mm above the top of any opening situated within a radius of 3 m from the vent.

Figure 3.4B Longitudinal Section



SPECIFICATION F2.9 ACCESSIBLE ADULT CHANGE FACILITIES

1. SCOPE

This Specification contains the requirements for accessible adult change facilities.

2. GENERAL REQUIREMENTS

a) Each accessible adult change facility must

   i. be constructed so that all required equipment and fixtures are contained within the same room

   ii. if it is a unisex facility, be located such that it can be entered without crossing an area reserved for one sex only.

b) In each accessible adult change facility, the following must be provided:

   i. A hoist complying with Clause 3

   ii. A toilet pan, seat, backrest and grabrails complying with Clause 4

   iii. A washbasin and tap complying with Clause 5

   iv. Fixtures and fittings as specified in Clause 6

   v. A change table complying with Clause 7

   vi. Changing rails complying with Clause 8

   vii. An automated sliding entrance door complying with Clause 9

   viii. Signage complying with Clause 10

   ix. Operating instructions for the hoist and change table in accordance with Clause 11

   x. Circulation spaces complying with Figure 2

Figure 2 Required circulation spaces

Diagram a. Turning space, each side of the pan and in front of the pan

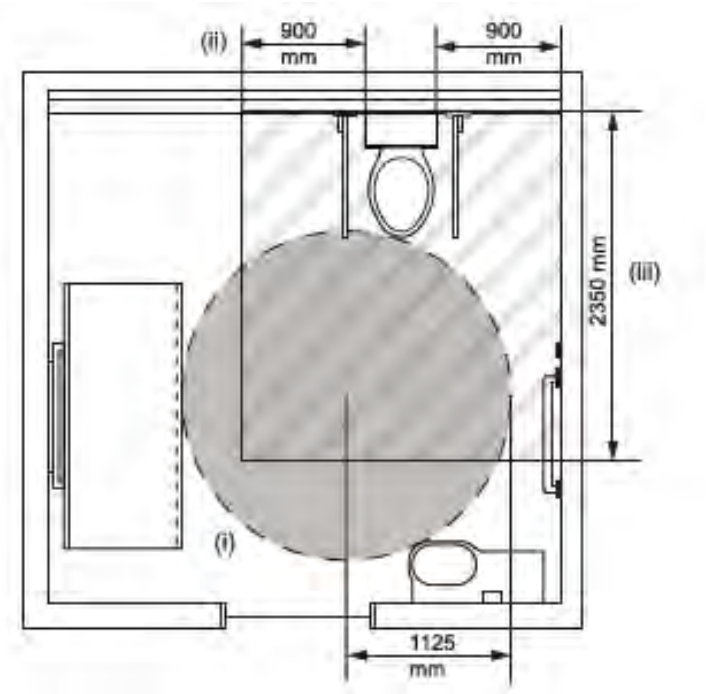


Diagram b. Turning space and circulation space for a washbasin

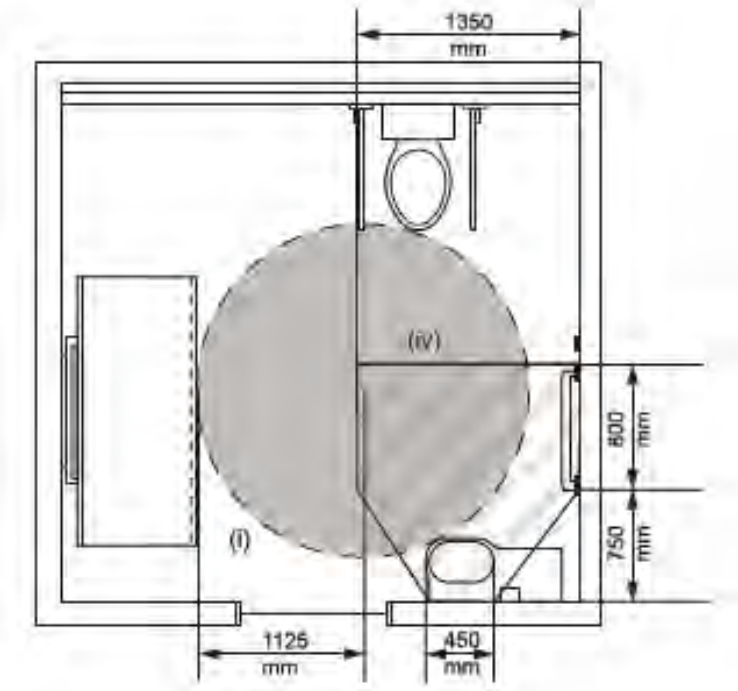
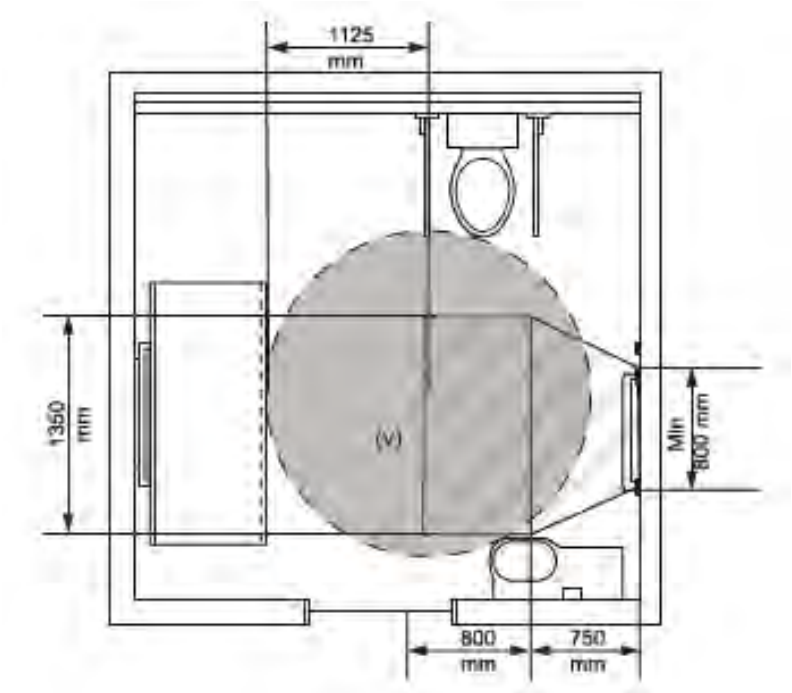


Diagram c. Turning space and circulation space for changing rails



Notes to Figure 2:

(1) The Roman numerals shown in Figure 2 indicate the following required circulation spaces:

i. Turning space: a full circle of 1125 mm radius.

ii. Each side of the pan: 900 mm (measured from each edge of the pan).

iii. In front of the pan: 2350 mm (measured from the wall behind the pan, and therefore includes the pan itself).

iv. For a washbasin: the width of the basin (450 mm) increasing to a width of 1350 mm measured at a distance of 750 mm out from the wall against which the washbasin is mounted then continuing at that width for a further 800 mm (to a total of 1550 mm out from the wall).

v. For changing rails: the width of the rails increasing to a width of 1350 mm at a distance of 750 mm out from the wall to which the rails are fixed then continuing at that width for a further 800 mm (to a total of 1550 mm out from the wall).

(2) All required circulation spaces must extend for a minimum height of 2000 mm above finished floor level.

(3) Required circulation spaces may be overlapped.

(4) The floor surface must have a slip resistance classification of not less than R10 or P3 when tested in accordance with AS 4586.

3. HOIST

The hoist must:

a) provide a constant charge in-line room coverage hoist system (also known as an "XY" system or gantry) including 2 parallel fixed rails and a moving traverse rail

b) provide coverage over the entire room

c) have a maximum safe working load of not less than 180 kg

d) be capable of sustaining a static load of not less than 1.5 times the rated load

e) have a minimum lifting height of 2100 mm.

4. TOILET PAN, SEAT, BACKREST AND GRABRAILS

a) The toilet pan must be of the centrally located ("peninsula-type") design.

b) The toilet pan must be installed so that:

i. the front edge of the pan is 800 mm (±10 mm) from the rear wall

ii. the top of the seat is between 460 mm and 480 mm above finished floor level

iii. there is a minimum clearance of 900 mm, measured horizontally, between each side of the pan and any adjacent wall or privacy screen.

c) The toilet seat must:

i. be of the full-round type (not open-fronted) with minimal contours to the top surface

ii. be securely fixed in position when in use

iii. have seat fixings that provide lateral stability to the seat when the seat is in use

iv. be load-rated to 150 kg

v. have a minimum luminance contrast of 30% against the pan, wall or floor

vi. remain in the fully upright position when raised.

d) Hand-operated flushing controls must:

i. be located on the centreline of the toilet, at a height of:

A. not less than 600 mm
B. not more than 1100 mm,

above finished floor level

ii. not be located within the area required for any grabrails or backrest

iii. have the button mounted so that it is proud of the wall surface, and activates the flushing operation before the button becomes level with the surrounding surface.

e) An automatically activated flushing system need not comply with the requirements of

f) The backrest must:

i. be capable of withstanding a force, in any direction, of not less than 1100 N

ii. have a minimum height, between the lower edge of the backrest and the top of the seat, of between 120 mm and 150 mm

iii. have a vertical height, between the upper and lower edges of the backrest, of between 150 mm and 200 mm

iv. have a width of between 350 mm and 400 mm

v. be positioned such that the face of the backrest achieves an angle of between 95°and 100° back from the seat, when the seat is in use.

g) Grabrails must be installed adjacent to each side of the pan and must be:

i. of the drop-down type

ii. located such that:

A. the top of each rail is between 800 mm and 810 mm above finished floor level
B. the rails are between 750 mm and 770 mm apart, measured centre-to-centre, and equidistant to the centreline of the pan

iii. at least 850 mm long

iv. with a diameter of between 30 mm and 40 mm

v. securely fixed to withstand a force, in any direction, of not less than 1100 N

vi. provided with a toilet paper dispenser on one side

vii. capable of being lifted up or swung away when not in use, so as to allow unimpeded access to the toilet pan.

5. WASHBASIN AND TAP

a) The washbasin must be installed so that the rim of the basin is between 800 mm and 830 mm above finished floor level.

b) Exposed heated water supply pipes must be insulated or located so as not to pose a hazard.

c) Water supply or sanitary drainage pipes must not encroach on the space under the basin.

d) The washbasin must have an integrated shelf not less than 300 mm long.

e) Water taps must have a single lever flick-mixer handle or a sensor plate or the like.

f) Where lever handles are provided, they must be installed with a clear space of not less than 50 mm between the tap and any adjacent surface.

g) Heated water must be provided and temperature controlled in accordance with Part B2 of NCC Volume Three.

6. FIXTURES AND FITTINGS

a) Mirror:

i. A vertical mirror must be provided at the washbasin, with a reflective surface that

A. is not less than 600 mm wide
B. has its bottom edge not more than 900 mm above finished floor level
C. has its top edge not less than 1850 mm above finished floor level.

ii. If a second vertical mirror is provided in the facility, it must have a reflective surface that:

A. is not less than 600 mm wide
B. has its bottom edge not less than 600 mm above finished floor level
C. has its top edge not less than 1850 mm above finished floor level.

b) Towel dispensers, hand dryers and the like:

Towel dispensers, hand dryers, soap dispensers and the like must be operable using one hand, and must be installed with their output or operative components:

i. between 900 mm and 1100 mm above finished floor level

ii. not less than 500 mm from any internal corner.

c) Soap dispenser:

A soap dispenser must be installed above the integrated shelf required by Clause 5(d).

d) Clothing hook:

A clothing hook must be installed so that it is located:

i. at a height of between 1200 mm and 1350 mm above finished floor level

ii. adjacent to the washbasin

iii. not less than 500 mm from any internal corner.

e) Sling hook:

A sling hook with a minimum projection of 50 mm from the wall must be installed beside the change table at a height of 1500 mm above finished floor level.

Explanatory information:
The purpose of the sling hook is to store the sling when it is not in use.

f) Disposal bins:

i. A sanitary disposal bin must be provided in the corner adjacent to the toilet pan.

ii. An incontinence pad disposal bin must be provided in the corner adjacent to the change table.

7. CHANGE TABLE

a) The change table must be:

i. permanently installed, with one of the long edges up against a wall and with a retractable safety rail on the opposite side

ii. motorised for the purposes of height adjustment

iii. height adjustable between 450 mm and 900 mm above finished floor level

iv. not less than 700 mm wide

v. not less than 1800 mm long.

b) The change table must have a maximum safe working load of not less than 180 kg, including when raising or lowering the table.

c) The change table must not encroach on any required circulation space.

d) A dispenser for sanitary wipes must be provided.

e) A shelf not less than 400 mm long and 150 mm wide must be provided.

8. CHANGING RAILS

Changing rails must be installed as two horizontal and parallel rails fixed to a wall, not less than 800 mm long, each with a diameter between 30 and 40 mm

a) the lower rail must be installed between 800 mm and 810 mm above finished floor leve

b) the upper rail must be installed between 1000 mm and 1010 mm above finished floor level

c) the rails must be able to withstand a force of not less than 1100 N in any direction.

9. DOOR AND DOOR CONTROLS

The entrance door and associated door controls must be automated and must comply with the following:

a) The threshold must incorporate a smooth transition without a step or lip.

b) The minimum clear opening width must be:

   i. 1100 mm in locations where beach wheelchairs are likely to be used, or

   ii. 950 mm in all other locations.

c) The doorway must achieve a luminance contrast of at least 30% between:

   i. Door leaf and door jamb, or

   ii. Door leaf and adjacent wall, or

   iii. Architraves (where used) and adjacent wall, or

   iv. Door leaf and architrave (where used), or

   v. Door jamb and adjacent wall.

d) The operation of the door must be calibrated such that:

   i. it has a gentle opening and closing movement

   ii. there is sufficient dwell time for a user to safely travel through the doorway.

e) The door must be fitted with a fail-safe opening mechanism that opens the door if an obstruction is detected during its closing movement.

f) Door controls must be located internally and externally

   i. between 900 mm and 1200 mm above finished floor level

   ii. not less than 500 mm from any internal corner.

g) Door control buttons must:

   i. have a minimum diameter of 25 mm

   ii. be proud of the surrounding surface

   iii. activate the door operation before the button becomes level with the surrounding surface

   iv. be of a contrasting colour to the surrounding plate.

h) The surrounding plates of both internal and external door controls must include the words "Push to Open".

i) The following indicator lights must be provided:

   i. "Occupied" and "Vacant" on the external plate.

   ii. "Locked" and "Unlocked" on the internal plate.

j) Braille and tactile signage complying with Specification D3.6 must identify the door controls.

10. SIGNAGE

a) External signage must incorporate:

   i. the symbol shown in Figure 10

   ii. the words "Accessible Adult Change Facility".

b) The symbol required by (a)(i) must have a blue (B21, ultramarine) background with the hoist and table elements shown in white.

c) Signage must be braille and tactile signage complying with Specification D3.6

Figure 10 Symbol

11. OPERATING INSTRUCTIONS

Signage provided within the facility must include the following information for the hoist and change table:

a) Operating instructions.

b) Safe working load limits

SPECIFICATION F5.2 SOUND INSULATION FOR BUILDING ELEMENTS

1. SCOPE

a) This Specification lists the weighted sound reduction index Rw for some common forms of construction.

b) Wall systems listed in Table 2 having a minimum 20 mm cavity between 2 separate leaves, with:

i. for masonry, where wall ties are required to connect leaves, the ties are of the resilient type

ii. for other than masonry, there is no mechanical linkage between leaves except at the periphery,

are deemed to be discontinuous construction.

2. CONSTRUCTION DEEMED-TO-SATISFY

The forms of construction listed in Table 2 for wall construction and Table 3 for floor construction, are considered to have the Rw , Rw + Ctr and Lnw stated in that Table. The forms of construction must be installed as follows:

a) Masonry: Units must be laid with all joints filled solid, including those between the masonry and any adjoining construction.

b) Concrete slabs: Joints between concrete slabs or panels and any adjoining construction must be filled solid.

c) Sheeting materials:

i. if one layer is required on both sides of a wall, it must be fastened to the studs with joints staggered on opposite sides

ii. if two layers are required, the second layer must be fastened over the first layer so that the joints do not coincide with those of the first layer

iii. joints between sheets or between sheets and any adjoining construction must be taped and filled solid.

d) Timber or steel-framed construction: perimeter framing members must be securely fixed to the adjoining structure and:

i. bedded in resilient compound, or

ii. the joints must be caulked so that there are no voids between the framing members and the adjoining structure.

e) Services:

i. Services must not be chased into concrete or masonry elements.

ii. A door or panel required to have a certain Rw + Ctr that provides access to a duct, pipe or other service must:

A. not open into any habitable room (other than a kitchen)
B. be firmly fixed so as to overlap the frame or rebate of the frame by not less than 10 mm, be fitted with a sealing gasket along all edges and be constructed of:
    a. wood, particleboard or blockboard not less than 33 mm thick, or
    b. compressed fibre-reinforced cement sheeting not less than 9 mm thick, or
    c. other suitable material with a mass per unit area not less than 24.4 kg/m^2

iii. A water supply pipe must:

A. only be installed in the cavity of discontinuous construction
B. in the case of a pipe that serves only one sole-occupancy unit, not be fixed to the wall leaf on the side adjoining any other sole-occupancy unit and have a clearance not less than 10 mm to the other wall leaf.

iv. Electrical outlets must be offset from each other:

A. in masonry walling, not less than 100 mm
B. in timber or steel-framed walling, not less than 300 mm.

SPECIFICATION F5.5 IMPACT SOUND — TEST OF EQUIVALENCE

1. SCOPE

This Specification describes a method of test to determine the comparative resistance of walls to the transmission of impact sound.

2. CONSTRUCTION TO BE TESTED

a) The test is conducted on a specimen of prototype wall construction and on a specimen of one or other of the constructions specified in Table 2 of Specification F5.2

b) The testing of a construction specified in Table 2 of Specification F5.2 need not be repeated for subsequent comparisons provided complete records of the results, the test equipment and the technique of testing are kept so that identical equipment can be employed and an identical technique can be adopted in the testing of specimens of prototype wall construction.

3. METHOD

a) The wall constructions to be compared must be tested in accordance with AS 1191.

b) A horizontal steel platform 510 mm x 460 mm x 10 mm thick must be placed with one long edge in continuous and direct contact with the wall to be tested on the side of the wall on which the impact sound is to be generated.

c) A tapping machine complying with ISO 140/6 — 1998 (E) must be mounted centrally on the steel platform.

d) The sound transmission through the wall must be determined in accordance with AS 1191 except that the tapping machine as mounted on the steel platform must be used as the source of sound.

e) The impact sound pressure levels measured in the receiving room must be converted into normalised levels using a reference equivalent absorption area of $10m^2$.

SPECIFICATION F5.5A RAINWATER STORAGE

1. INTRODUCTION

Rainwater collection from the roof depends on a number of factors. Unless these are suitably matched the supply would not be satisfactory. The factors are:

a) the average annual rainfall and its variability through the year

b) the roofing material and the available area of the roof

c) the daily rate of consumption of water

d) the storage volume and the material of the tank

e) the desired reliability of the supply

2. RELATIONSHIP OF RAINFALL, ITS VARIABILITY, ROOF AREA AND STORAGE VOLUME

The higher the average annual rainfall, the smaller the collection area of roof required for a given rate of consumption. In order to allow for variation in actual rainfall from the monthly averages, it is advisable to have the available roof area to be twice the theoretical area.

If the pattern of rainfall is fairly uniform through the year, the size of storage tank for a given rate of consumption would be relatively smaller. The tank size could be as small as to hold 50 days consumption where rainfall is quite uniform through the year. Where most (such as 75%)of the annual rainfall occurs in 3 or 4 months it will be necessary to size the tank to hold 100 to 120 days of consumption. This assumes that the available roof collection area is twice the theoretical area. Where the available roof area is less than about 1.4 times the theoretical area, the required storage volume tends to increase very steeply. The size of the tank determined from these considerations should normally give an average reliability of supply with a failure rate of about once every 5 years. If an average chance of failure of supply of once a year is acceptable, the calculated tank size can be reduced by about 30% in areas of high rainfall and by 40% in areas of lower rainfall.

3. DESIGN

The theoretical relationship outlined in para 2 can be expressed as:

$A = 365 \times C/R$ where

A is the roof area acting as the catchment in square metres

C, the daily average consumption of water by the household in litres

R, the average annual rainfall in millimetres

However, for the reasons stated earlier the practical value of the roof catchment is:

$A = 2 \times 365 \times C/R \approx 730\ C/R$

In order to assess the size of the storage tanks Fiji has been divided into 2 categories - areas with a more uniform spread of rainfall and those with rainfall concentrated over 3 or 4 months of the year. In the case of the areas with a more uniform rainfall, It Is estimated that a storage capacity of 80 days consumption would be adequate to provide a reasonably reliable supply with the risk of failure of only once in 5 years. For a similar level of reliability in areas with an uneven spread rainfall, the estimated storage is equal to 100 days consumption.

Taking a family size of 5 members, each consuming no more than 30 litres per day of the stored water, the minimum roof area and storage capacity required in representative regions in Fiji have been calculated far the average rainfall in those regions. These are shown in Table 3. If the family size and for daily consumption is different, the required roof area and tank size can easily be calculated from the Table.

Table 3 Minimum Roof Area and Tank Capacity for Rainwater Collection

Total tank capacity of 15 kilolitres (3400 gallons)		**Total tank capacity of 12 kilolitres (2700 gallons)**	
Minimum roof catchment to drain into storage (m^2)			
64	50	40	30
Sigatoka / Nadi	Ba	Suva / Nausori	Navua
Lautoka	Vanua Levu	Rakiraki	Monasavu
Lau Group	Kadavu	Taveuni	Rotuma
Yasawa group			
Example: if the family size considered in say, Rotuma is 7 and the daily consumption per head is 20 litres, the required roof catchment = 30 x 20 x 7 / (30 x 5) = 28 m^2 *Tank size = 12 x 20 x 7 / (30 x 5) = 11.2 kilolitres (2500 gallons)* ***Note:** if risk of failure of supply once a year is acceptable, the tank size can be reduced by 30%*			

4. EFFECT OF ROOFING MATERIAL AND THE ENVIRONMENT.

Rainwater in general is very pure and hence many metals dissolve in it much faster than in land based water. For instance, if any lead is used in the roof for flashing or in the form of lead-based paint, the rainwater would leach the lead into the storage tank. If this happened the water would not be potable. The nature of the materials used in the roof must be ascertained and their safety confirmed before a decision is taken to use the run-off from the roof. In general, galvanised iron sheets, zinc-aluminium coated sheets and a number of other products are safe.

As far as possible leaves and twigs must not be allowed to fall on the roof. The leached extracts from some leaves would make the water unfit for consumption. In addition, the organic matter from leaves and twigs would encourage the growth of microorganisms in the tank, thereby polluting the water. Accumulation of any dust on the roof, such as from industrial activity nearby would also make the water unfit.

5. TANK MATERIAL

Tanks are generally made of galvanised or zinc-aluminium coated steel plates and sometimes of fiberglass. Whereas suitable fibre glass would be inert and therefore not affected by the rainwater, galvanised steel could. The greater the purity of the stored water, the greater the risk of the galvanising getting leached out very fast. If the roofing sheets are of galvanised steel, the stored water would already

contain some of the zinc from the roofing material and hence the tank would last longer. This is not the case where the roofing is of zinc-aluminium coated or painted steel or of some other man-made material.

In order to prevent the corrosive effects of pure rainwater on the tank coating, suitably formulated metaphosphates are commercially available. These produce a protective film inside the tank and thus extend the life of metal coated tanks, such methods must be used from the very first filling of the tank. There are also plastic protective coatings compatible with potability which are applied to metal tanks.

The inside of the tank must not be painted with any ordinary paint.

In no case must lead be used in any form such as in sheets for flashing or as paint etc. on roofs from which water is collected.

6. ERECTION OF RAINWATER TANKS

It is best to erect the tank in a shady location but away from falling leaves which could clog the strainer, and in the case of translucent material like fibre glass, have a dark colour to exclude light. Organic growth could develop on the sides of tanks in the presence of light and warmth. When the tank is part empty, the organic growth would decay and give off gases, discolour the water, and produce corrosive acids. The absorption of the gases and acids could also give the water an unpleasant flavour.

The overflow pipes fitted to tanks for the disposal of excess inflow of rainwater must be adequate to prevent uncontrolled overflow. Such pipes must not terminate very close to storm water drains and soak pits as otherwise unpleasant gases might enter the tank. The pipe end and all openings to the tank must be fitted with strong, durable mesh to prevent birds, mosquitoes and other insects gaining entry into the tank.

No copper pipe should be used with any metal water tank. The inlet pipe must discharge the water through a durable strainer fitted well above the high water level. The inlet must not be close to the tank wall. Where tanks are interconnected each tank must receive at least some of the water directly from the roof. No tank must get its supply entirely from other tanks. It is convenient to have individual domestic tanks of no greater capacity than 4 or 5 kilo litres (1000 gallons).

SPECIFICATION F7.2 SIZING OF GUTTERS AND DOWNPIPES

1. DESIGN CRITERIA

The design of a roof-drainage system is based on the following factors:

- Rainfall intensity and risk of flooding
- Catchment area of roof
- Gutter efficiency
- Spacing of downpipes.

.1 RAINFALL INTENSITY

In rainstorms long periods of steady rainfall are interspersed with peak intensities for short periods. The roof-drainage system must be capable of handling the peak intensities without flooding or overflow. Peak Intensities for Fiji are as follows:

5-year return period	85 mm/hr
20-year return period	115 mm/hr
100-year return period	150 mm/hr

Any known local variations should be taken into account. The 5-year return intensity is used in the design of temporary structures of short life. The design of eaves gutters of permanent buildings must be based on the 20-year return intensity and of internal box gutters and valley gutters on the 100-year return intensity. A freeboard of 25 mm for eaves gutters and of 35 mm for internal box gutters and valley gutters are required to provide against overflow into buildings.

2. CATCHMENT

A roof drainage system is best analysed by dividing it into lengths of gutter each sloping down from a high point to an outlet with a downpipe. A long length of roof usually drains into several lengths of gutter separated by expansion joints that are also high points. The catchment area for a length of gutter Is determined by multiplying the rafter length by the length of gutter (G) and adding a proportion of any vertical surface against which rain can be driven. A reasonable procedure is to add half the area of a very exposed vertical surface and smaller proportions for less extreme conditions (see Figure 2.1).

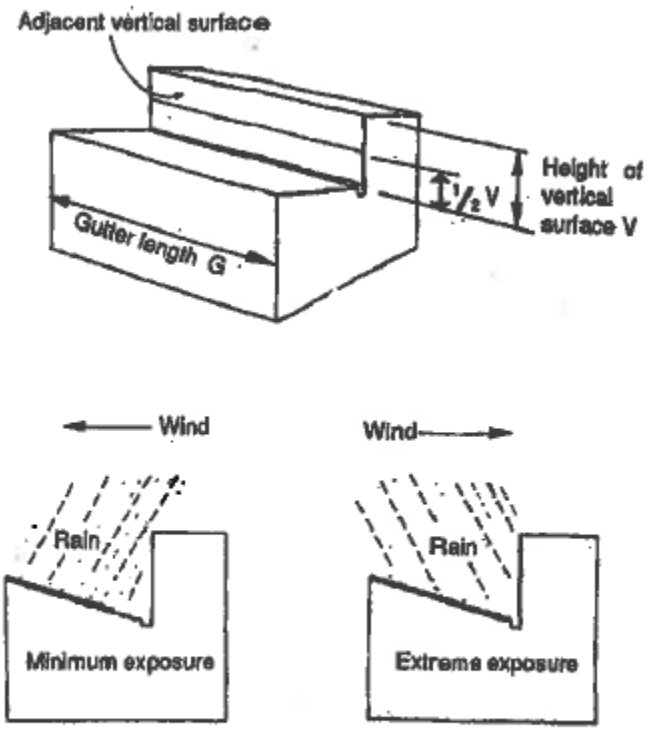


FIGURE 2.1 EFFECT OF VERTICAL SURFACE ON CATCHMENT

The length G of a gutter is measured as the distance from a high point in the gutter to the downpipe when the downpipe is at the end of the gutter and between high points when the downpipe is not at the end (see Figure 2.2).

FIGURE2.2 MEASURING GUTTER LENGTH

3. EAVES GUTTER

The procedure for the design of eaves gutter is as follows:

.1 SIZE

Space the downpipes suitably and calculate the catchment area per downpipe. For eaves gutters of permanent buildings determine the gutter discharge area by matching the catchment area against the 115 mm/hr intensity line in Figure 3.1. If the gutter discharge area obtained is more than what is available from a standard gutter after allowing for a 25 mm freeboard, either reduce the spacing of the down pipes and recalculate or proceed to specify a specially fabricated gutter. With rectangular fabricated gutters an additional allowance of 10 percent of area must be made in addition to the freeboard allowance.

The net cross-sectional area of each vertical downpipe including the nozzle must be not less than 50 per cent of the gutter discharge area.

.2 SLOPE

The fall of an eaves gutter must never be less than 1 in 500 but in areas where dust or debris is likely to build up between rain periods the slope must be as steep as 1 in 50.

.3 LEAF GUARDS AND OVERFLOWS

Leaf guards must be fitted to prevent the nozzle to the downpipe from becoming blocked wherever leaves or other debris are likely to collect in the gutter. If the eaves gutter has a fascia front higher than the rear lip, an overflow must be fitted at a level below that of the lowest point in the rear lip.

.4 PROPORTION

The proportions of a rectangular eaves gutter are ideal when its width is twice the maximum depth of water flowing in it. Although a narrow deep gutter will provide a greater head of water over the outlet with a consequent improvement in the discharge capacity of the outlet, a shallower gutter is usually easier to maintain.

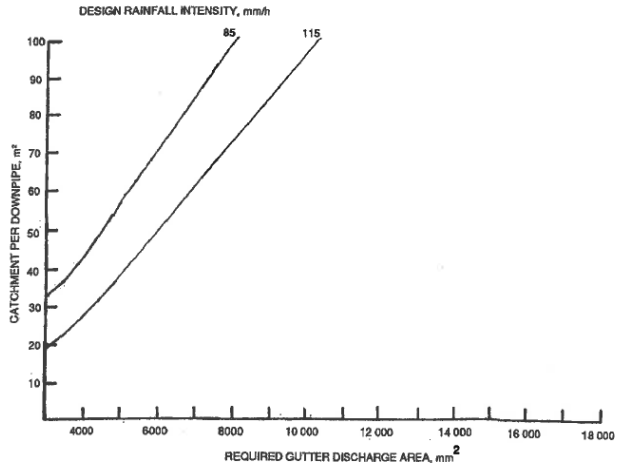


FIGURE 3.1 EAVES GUTTER SIZING

4. BOX GUTTERS

The procedure for the design of box gutters is as follows:

Ideally, box gutters must be straight, at least 300 mm wide, capable of supporting a workman, fired at a slope of not less than 1 in 200, and provided with an overflow and adequate downpipe outlets not more than 18 m apart. The gutters must have sufficient slope to clear dust and debris, and they might need leaf guards.

.1 SIZE OF GUTTER

Space the downpipes suitably and calculate the catchment area per downpipe. From Figure 4.1.1 using the calculated catchment area and 150 mm/hr rain intensity, determine the design flow for the gutter and the downpipe. Select a width of not less than 300 mm for the box gutter. The required depth can then be read from Figure 4.1.2 by using the selected width and the design flow. The depth allows for a freeboard of 35 mm which will be necessary during cyclonic winds along with normal turbulence and ripples. The depth thus determined assumes that the gutter is laid to zero slope. To adjust for the slope, use the depth determined from Figure 4.1.2. In Figure 4.1.3 and read off the depth adjusted for slope against the appropriate slope line. The minimum depth must be 80 mm.

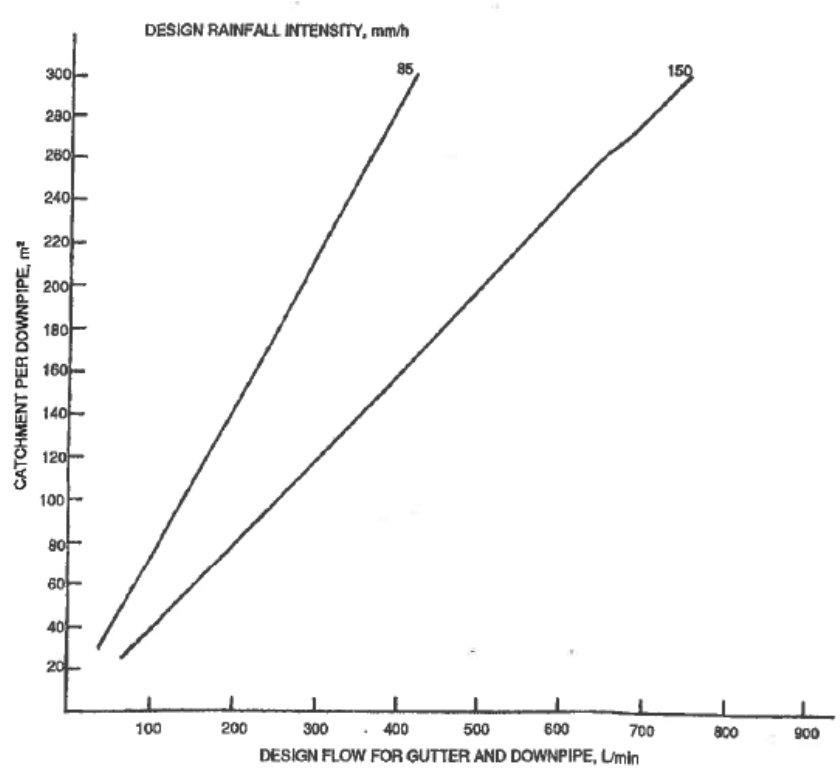
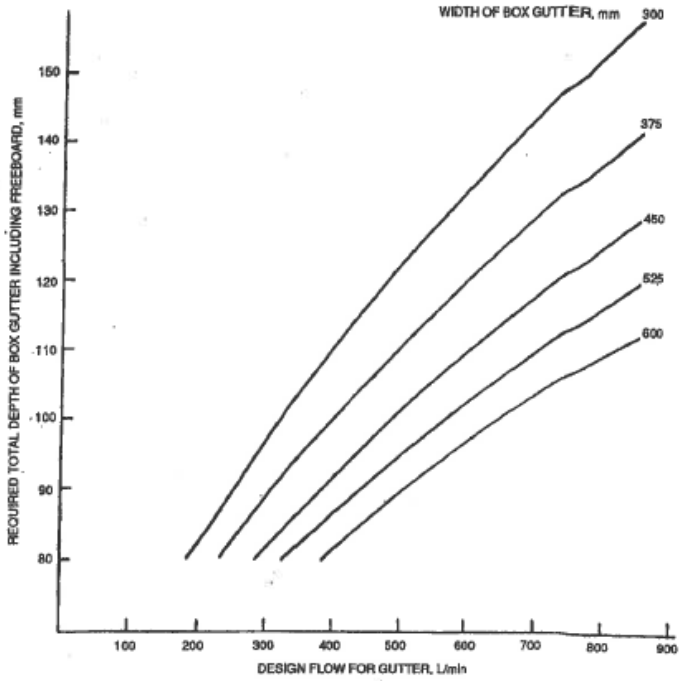


FIGURE 4.1.1 INTERNAL BOX GUTTER DESIGN FLOW



Notes:

1 Graph assumes zero slope. To take advantage of slope, see Fig. 4.1.3.
2 Graph assumes 35 mm freeboard.

FIGURE 4.1.2 REQUIRED DEPTH OF BOX GUTTER FOR DESIGN FLOW

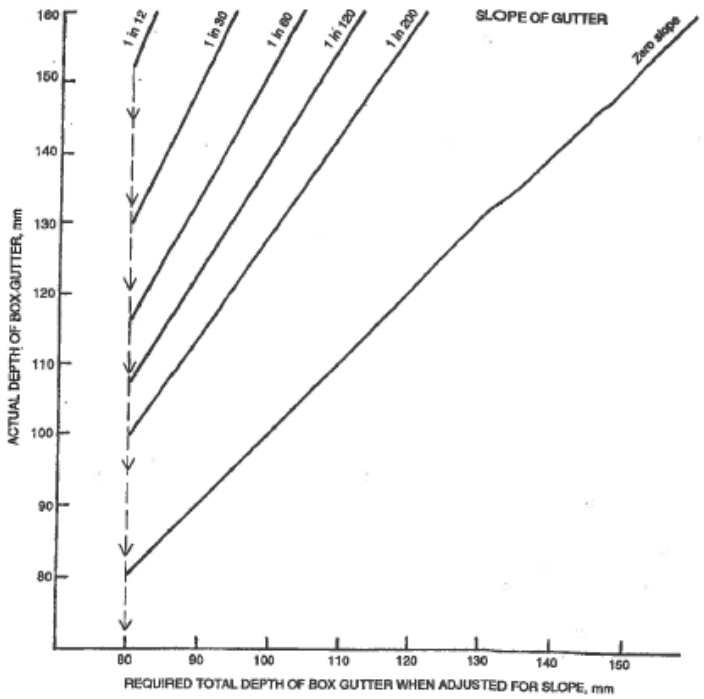


FIGURE 4.1.3 BOX GUTTER DEPTH - ADJUSTED FOR SLOPE

.2 SIZE OF DOWNPIPE

The size of the downpipe can be determined from Figure 4.2 by reading against the design flow and the actual depth of the gutter determined from using Figure 4.1.3. The downpipe can be round or rectangular.

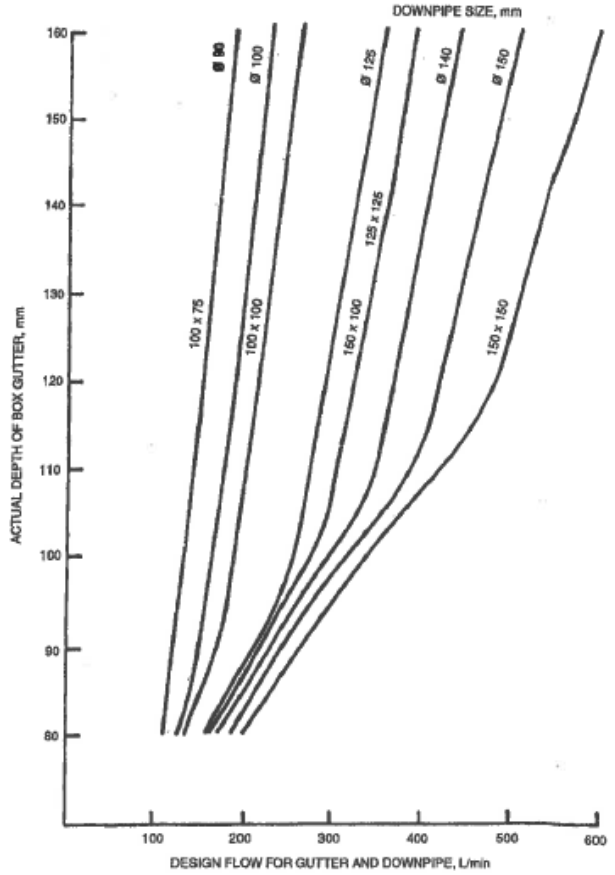


FIGURE 4.2 REQUIRED SIZE OF DOWNPIPE FOR BOX GUTTER (RAINHEAD AND SUMP NOT CONSIDERED)

.3 OVERFLOW

A box gutter discharging directly into a downpipe must have an overflow outlet to allow for blockage and to provide for rainfall intensities greater than those used for design. To cope only with peaks in rainfall it is sufficient for the overflow outlet to have a cross sectional area equal to 15 percent of the total cross-sectional area of the gutter, that is an overflow area of 0.15 dw (see Figure 4.3.1).

FIGURE 4.3.1 OVERFLOW OUTLET

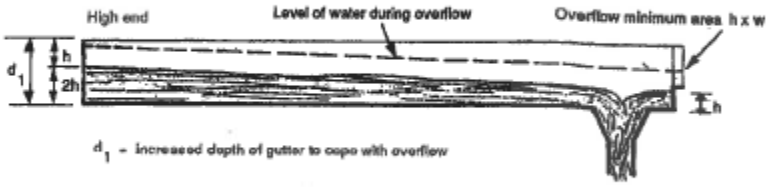


FIGURE 4.3.2 OVERFLOW WITH BLOCKED DOWNPIPE

But if the overflow is intended to cope with the effect of a total blockage of the downpipe during a peak period then the cross-sectional area of the overflow outlet must equal the cross-sectional area of the water flow at the outlet of the gutter (h x w for minimum fall). The overflow should be slightly above level h in order to accommodate the flow of water in a crisis (see Figure 4.3.2). The slope factor must not be taken into account when determining the new depth for the gutter and the amount of freeboard added to the increased gutter depth will depend on the risk the designer wishes to take regarding the possibilities of failure of the roof-drainage system during a peak period. Other methods of preventing overflow due to blocked downpipes are the provision of rainheads and sumps.

5. RAINHEADS AND SUMPS

.1 RAINHEADS

The rainhead is a device used to increase the capacity of a downpipe at the end of a box gutter and to allow for overflow in case of a blocked downpipe. The discharge capacity of an outlet increases with he depth of water (head) over the outlet. The rainhead is located at the far end of the box gutter and consists of a sump and overflow arrangements. The sump increases the flow through the downpipe by providing an additional head of water. The overflow provides safety against water spilling into the building if the downpipe is blocked. The detailed design of rainheads is given in AS 2180.

.2 SUMPS

Where a sump is fitter to the sole of the gutter it provides a local reservoir and the additional head increases the flow through the downpipe. The detailed design of sumps is given in AS 2180.

6. DOWNPIPES

.1 LOCATION

Downpipes must be located externally, but where it is necessary to locate a downpipe internally the pipe must be accessible so that any blockage can be cleared. Access for cleaning must be provided at the base of all downpipes that are connected directly to a storm water drain. Downpipes are most efficient when located at the centre of a length of gutter.

.2 SWIRL

The performance of an outlet with the head of water more then 1/3 of its diameter will be reduced of swirl occurs at the outlet. This would generally happen only where rainheads or sumps are included in the system. Swirl can be eliminated if the centreline of the downpipe is kept no more than a distance equal to its diameter or the average of its cross-sectional dimensions, away from the nearest vertical side of the rainhead of the sump.

.3 GRATINGS

Where a grating or strainer is fitter to a rain-water outlet the total area of the perforations in the grating must be at least 1.5 times the cross-sectional area of the outlet. Strainer gratings must project above the calculated level of flow at the outlet and must be cleared of accumulated debris regularly.

7. INCOMPATIBLE MATERIALS

Dissimilar metals must be separated by a non-conducting gasket or similar device to prevent electro-chemical corrosion. Water draining from copper components must not discharge onto non-copper components for the same reason. However, water can be safely drained from non-copper onto copper components. (the prevention of electro-chemical corrosion between metals will not necessarily prevent atmospheric corrosion of the individual metals).

8. EXPANSION JOINTS FOR GUTTERS

Metal gutters must be provided with expansion joints to prevent distortion and resulting damage and reduced flow. The maximum length between expansion joints is given in Table 8.

Table 8 Maximum Distance between Gutter Expansion Joints

Material	Estimated exposed temperature range (°C)	Distance between 20 mm expansion joints (m)
Aluminium	45	18
Copper	55	21
Stainless steel	40	30
Steel	50	33
Zinc	50	15

9. STORMWATER

.1

Where a downpipe discharges into a stormwater gully it must terminate below the gully grating, and where the connection is made directly to a stormwater pipe underground the internal diameter of the underground pipe must be greater than that of the downpipe. Underground stormwater pipes draining roof and paved catchments must be laid in straight lines at uniform gradients between sumps or collection pits. Large paved areas and roadways must slope towards drainage points with a minimum cross-fall of 1 in 60 for bitumen or concrete surfaces and 1 in 20 for concrete kerb channels.

.2 PIPE SIZES

Table 9.2 indicates the maximum total catchment area of roof and paving that can be drained by underground pipes laid at different gradients, of various diameters and running half full. Areas shown above the heavy line will have a flow velocity insufficient to flush out debris.

The table is for a rainfall intensity of 115mm.h. for other rainfall intensities, the horizontal area to be drained must be proportionally adjusted by multiplying the area by 115 and dividing by the required rainfall intensity. The proportionally adjusted area can be used in the Table to determine the pipe size.

Table 9.2 Stormwater drain sizes to take flow from downpipes and pavements

Diameter of Pipe (mm)	Maximum horizontal projected areas (m) that can be drained at various gradients when the rainfall intensity is 115 mm/h			
	1 in 50	1 in 100	1 in 150	1 in 200
100	220	150	130	110
150	600	430	350	260
200	1300	950	780	650
250	2350	1650	1300	1130
300	3700	2600	2170	1910
375	6700	4700	3820	3130
450	8800	6950	5650	4600

Section
SPECIFICATIONS AND PARTS

G

Energy Efficiency

G2.2 Installation of Boilers and Pressure Vessels

DRAFT 1 2023 04 Apr21
JTG REVIEW

SPECIFICATION G2.2 INSTALLATION OF BOILERS AND PRESSURE VESSELS

1. SCOPE

This Specification sets out the requirements for the installation of boilers and pressure vessels in buildings.

2. BOILERS AND PRESSURE VESSELS

.1 EXPLOSION RELIEF

The distance between the vent of any explosion relief device and any adjacent wall, roof, ceiling or other solid construction shall be calculated in accordance with Table 2.1.

Table 2.1 Minimum clearances for explosion relief

Clearance from	Minimum clearance (metres)
Adjacent wall or ceiling/roof	0.4(V/3)1/3 or 0.4 m, whichever is the greater
Two walls at right angles; or one wall and a ceiling/roof	0.6(V/3)1/3 or 0.6 m, whichever is the greater
Note to Table 2.1: V is the internal volume of the boiler or pressure vessel being vented up to the connection of the flue.	

.2 FLOORS AND DRAINAGE

a) Floor surfaces beneath boilers and pressure vessels shall be water resistant and formed to drain away from supports and structural building elements.

b) Where a safe tray is provided to trap liquids, it must be manufactured from a material resistant to corrosion from the contents of the boiler or pressure vessel.

.3 PROTECTION FROM HEAT

Building elements surrounding a boiler must be protected from any surface heat by refractory material or effective air spaces so that:

a) Steel elements do not exceed a temperature of more than 300°C

b) Concrete elements do not exceed a temperature of more than 200°C

c) Timber elements do not exceed a temperature of more than 150°C.