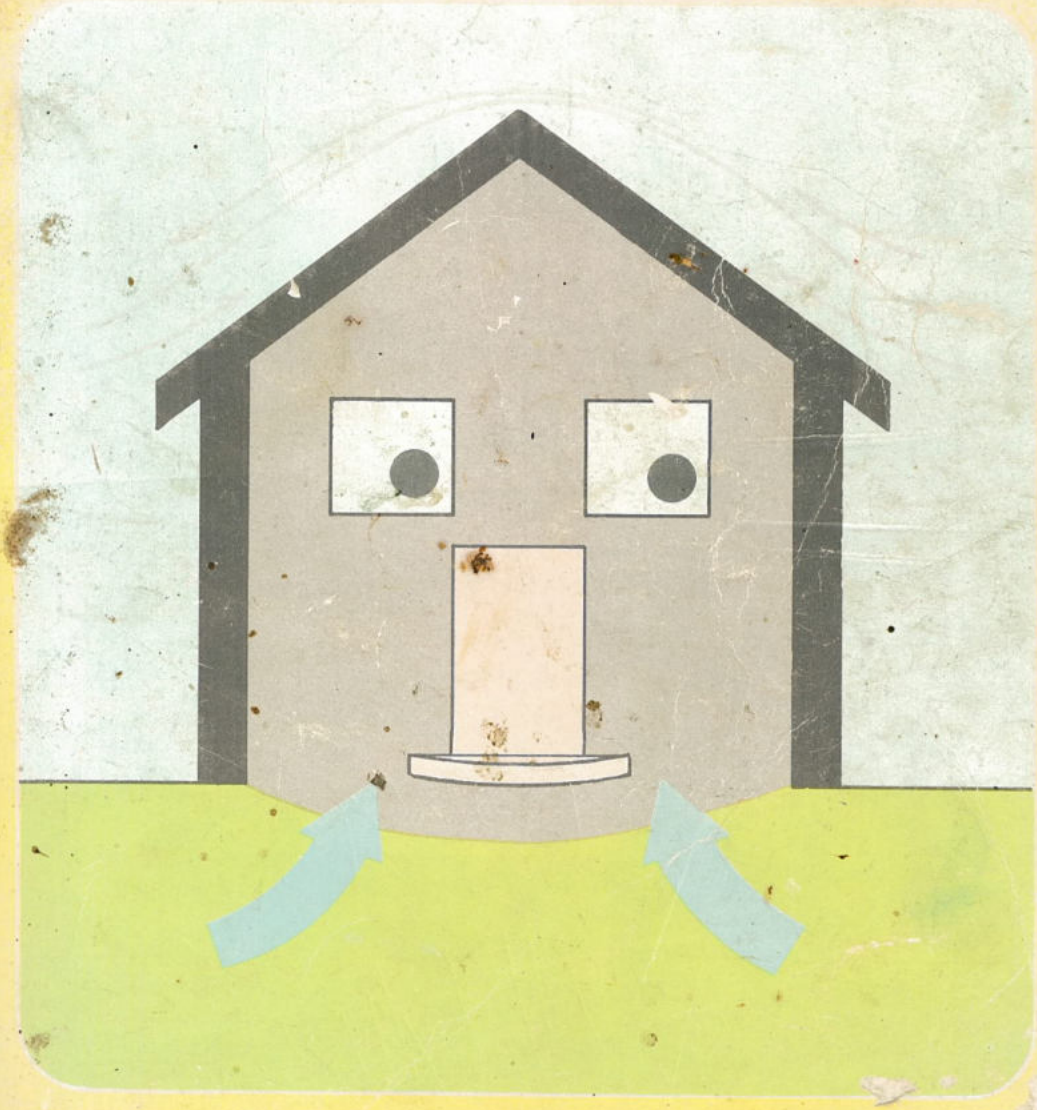
NATIONAL BUILDING CODE



for TUVALU

NATIONAL BUILDING CODE

TUVALU

CONTENTS

PREFACE

The work on the National Building Code was begun in response to the threat of death and destruction that cyclones pose for the people of Tuvalu every summer. The Government of Tuvalu readily agreed to participate in the Project. A Building Advisory Committee was formed to work with the Project office. The composition of the Committee reflected the widespread support that it had for its work. The members represented a wide range of interests and all of them worked on a voluntary basis. The principal aim of the Project was to incorporate in the Code appropriate preventive measures which will help to resist the harmful effects of cyclones, fires and other such natural hazards and forces. While achieving this aim it was also necessary to ensure that the provisions of the Code were within the economic and technical means of the country.

The Project was set up by the Australian Government in March 1988. Since then the Project staff have worked closely with the Committee. The first draft of the Code was revised a few times and the revisions made available to the members of the Committee for their comments. The feed-back from the members especially during personal meetings with them was of very great help in the preparation of this edition. Several overseas experts freely gave their time to help with crucial advice on specific aspects of the Code. A few dedicated members of the Committee worked very closely with the Project staff to oversee the detailed final work and thus ensure that the Code would technically and economically be relevant for use in Tuvalu.

The actual use of the Code will in course of time reveal the need for some modification or the other. It is only such periodic examination and suitable revision which will keep it up-to-date and relevant. The detailed involvement of the members of the Committee in the preparation of the Code will in the meantime ensure that in a real sense it is the National Building Code of Tuvalu.

Kris Ayyar
Project Manager
Pacific Building Standards Project

Suva : September 1990

ACKNOWLEDGEMENT

A very large number of people and the organisations that they represent have contributed to the successful preparation of the Code. It is not possible to acknowledge their help individually. Among those who were especially generous were:-

IN TUVALU

Tauaasa Taafaki, Secretary for Local Government and the first Chairman of the Building Advisory Committee. He gave the crucial initial encouragement to the Project which was very helpful.

Semu Taafaki, Secretary for Natural Resources and Home Affairs was the last Chairman of the Committee and contributed to the successful completion of the Project.

David Ballantyne, Attorney General and Tau Finikaso, Crown Solicitor were available for consultation during the early stages of the Project.

Saloa Tauia, Chief of Police gave a great deal of encouragement during the initial crucial stages.

Tom Krawcyzk and Vete Sakaio, the past and present Directors of Works took a leading role in organising committee meetings and in processing the technical reviews and comments.

Colin Reynolds, Water and Sewerage Engineer PWD made a comprehensive study of the drafts and gave several very valuable suggestions and improvements.

Mack McKamey, Architect, PWD and the current Secretary to the Committee made a significant contribution with his comments and suggestions.

Tony Prout, Construction Superintendent PWD showed me the details of many typical buildings and gave very helpful suggestions.

Poland Papua, Manager P K Constructions Limited, took an active role in the work of the Committee and represented the private sector interests.

Dr Kalaaki Laupepa, Medical Officer Princess Margaret Hospital was very helpful and provided details of sanitary facilities in use in Tuvalu.

Siniala Auega, Lands Officer gave me the details of the current building control practices in Funafuti.

Panapasi Nelesone, Planning Officer gave many helpful suggestions.

Tuisiga Saitala, Architectural Assistant, PWD took part in the initial discussions.

IN FIJI

Stefan Ali of Datacom gave excellent support service to our computer system.

Robert Austin, Printing and Design Consultant gave us professional advice on the cover design and printing of the Code.

IN AUSTRALIA

Robert Hogg, Director, Australian Uniform Building Regulations Co-ordinating Council and the members of its Executive Committee showed their great generosity in exempting us from the copyright requirements of the Building Code of Australia.

Dr George Walker, formerly Associate Professor of Civil Engineering at the James Cook University and currently Director National Building Technology Centre, Sydney was of immense help.

Stewart Horwood, Chief Executive, Peter Walsh, Director Standards and other officers of the Standards Association of Australia were very helpful with the supply of Australian Standards and relevant explanations.

Geoff Anderson, Associate Director, and Hugh Knox, Manager Regulations Accreditations and Standards of the National Building Technology Centre helped with the supply of references and technical advice.

Lawrence Reddaway, Director Irwin Johnston & Partners Melbourne and Dr Vaughan Beck Principal Lecturer Footscray Institute of Technology gave invaluable advice on fire engineering that gave me ideas for cost - reducing changes without any material reduction in life-safety.

Paul Smith, Assistant Director, Leo Blumkie Manager Building Services and Ron de Veer, Referee of the Queensland Department of Local Government, helped with their comments and explanations of building control practices in Queensland.

IN NEW ZEALAND

John Hunt, Executive Director, and Boyd Dunlop, Executive Officer of the Building Industry Commission. They provided valuable advice and kept us informed of their work on the production of the New Zealand Building Code. I have borrowed ideas and concepts from their work and reproduced with suitable alterations two diagrams and their acceptable solution for stairways and ramps in the Code.

Russell Cooney, Manager Building Industry Development, and Andrew King, Leader Structural Engineering Group of the Building Research Association of New Zealand. Russell and Andrew gave willingly their time and supplied us with reference documents.

Denys Pinfold and Denis Ferrier, the past and present Directors and other officers of the Standards Association of New Zealand, helped with the supply of New Zealand Standards and useful explanations.

John Fraser, Manager, Fire Protection Inspection Services Limited, Auckland gave us a lot of practical advice.

Dr Steve Reid, New Zealand Meteorological Service helped us with the supply of processed meteorological data.

IN THE UNITED STATES OF AMERICA

James Bihr, President International Conference of Building Officials, supplied us with their Uniform Building Code and other related documents which were very useful references.

The Council of American Building Officials: I have reproduced four diagrams after suitable alterations from their publication One and Two Family Dwelling Code in Section DF of the Code.

Elliot Stephenson, Structural and Fire Protection Engineer, spent considerable time with me during his holiday in Fiji and gave valuable advice on the Code.

AUSTRALIAN INTERNATIONAL DEVELOPMENT ASSISTANCE BUREAU

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Last but not least were the team in the project office. No words can express my gratitude for their sincerity and dedication. Most directly associated with the specific work on the Code were Saras Prasad for the bulk of the time and Sashi Lata Pal all of the time. In particular I owe Sashi a great deal for her excellent contribution. Wati Ledua, Raveena Dutt and Michael Arun Shankar helped with the many administrative tasks in the office, in particular the production of hundreds of bound copies of the several draft documents. Rohit Singh, Deputy Project Manager and Hem Rao, Project Engineer, were my sounding board for testing the practicality of many of the Code provisions.

Kris Ayyar

INTRODUCTION

About this Code

The basic objective of the Code is to ensure that acceptable standards of structural sufficiency, fire safety, health and amenity, are maintained for the benefit of the community now and in the future.

The requirements included in this Code are intended to extend no further than is necessary in the public interest, to be cost effective, not needlessly onerous in their application, and easily understood.

What is in the Code?

The Code sets down the Performance Requirements and corresponding Deemed-to-Satisfy Provisions which apply to the construction of buildings for all classes of occupancy.

It must be recognised that a building code cannot cover every issue concerned with the design and construction of buildings. In the case of innovative, complex or unusually hazardous building proposals, or other building work beyond the scope of the Code, legislation may provide for other suitable action.

Where appropriate the Code allows for variations in climate and geological conditions.

The Code covers those aspects of buildings which are controlled by Approval Authorities such as structure, fire resistance, access and egress, fire-fighting equipment, and certain aspects of health and amenity.

Performance Requirements

These are described in terms which would allow considerable scope for innovation and the development of new materials and methods of construction. The Requirements are in some cases separated into objectives and the required performance.

Objectives are broad statements of intent and are included at the beginning of each Section to identify the objectives that the provisions of the Section are intended to achieve. They are the basic concepts which apply generally to all buildings and structures.

Required Performance gives the fundamental requirements which will satisfy the objectives and are expressed in performance terms. Accreditation certificates, test reports, detailed calculations or other documentary evidence may be used as evidence that a particular material, design or construction method meets the performance requirements of this Code.

Deemed-to-satisfy Provisions

The Deemed-to-Satisfy Provisions have been drafted in sufficiently general terms to allow some flexibility without increasing the need to use administrative discretion. In the absence of national Standards for design, construction and materials, the Standards produced by the Standards Association of Australia and New Zealand have been called up. Detailed specifications have been given where necessary.

Professional Certification

The Code allows for certificates from professional consultants to be used as evidence of compliance with particular requirements or standards.

The enabling legislation will determine the extent of the use of professional certification and the procedures for the submission of certificates, reports or other documentation to Approval Authorities as evidence of compliance.

Layout of the Code

The numbering of Sections and Parts has been made on an alpha-numeric system for ease of reference. It provides flexibility to accommodate future additions or deletions and the future consolidation of building regulations presently contained in other legislation, without undue disruption to the layout.

Other than for common provisions contained in Sections A and B, the Code is divided into two areas - one which covers Class 1 and 10 buildings, and the other which covers all other Classes of buildings.

The pages containing the Performance Requirements are identified by the use of coloured paper. The Specifications relating to the Deemed-to-Satisfy Provisions have also been printed on coloured paper.

Administrative Arrangements

This Code is brought into effect by enabling building control legislation which prescribes or "calls up" the technical requirements which have to be satisfied in order to gain approval.

The enabling legislation consists of an Act of Parliament and subordinate legislation. It empowers the Administration to regulate certain aspects of the building process and contains the necessary administrative provisions for the work of the Approval Authority. The legislation also imposes responsibilities on the authorities or other persons or bodies, and describes particular administrative procedures.

The following administrative matters are covered in the enabling or subordinate legislation -

- Plan submission and approval procedures.
- Issue of building permits.
- Inspections during and after construction.
- Provision of evidentiary certificates.
- Issue of certificates of occupancy or compliance.
- Accreditation or approval of materials or components.
- Review and enforcement of standards.
- Fees and charges.

Administrative discretion

The Code is drafted with the object of reducing the need for the Approval Authority to make discretionary decisions.

However, in many cases it is not possible to draft a provision in purely technical terms and an informed judgement is required on the standard which would be suitable in particular circumstances.

Accordingly, in a number of clauses, the Code requires a particular material or construction method to be "suitable", meaning fit in all relevant respects for its intended purpose and use.

The Approval Authority responsible for the enforcement of building controls retains the right to question "suitability" and differences of opinion are open to appeal.

NATIONAL
BUILDING
CODE
1990

ALL BUILDINGS

SECTION **A**

GENERAL PROVISIONS

CONTENTS

INTERPRETATION

A1.1 Definitions

Some of the words and phrases used in the Code have specific defined meanings. Wherever such meaning is intended the words and phrases are printed in italics. The defined meanings are:

Alteration, in relation to a building, includes an addition or extension to a building.

Assembly building a building where people may assemble for -

(a) civic, theatrical, social, political or religious purposes;

(b) educational purposes in a *school, early childhood centre*, preschool, or the like;

(c) entertainment, recreational or sporting purposes; or

(d) transit purposes.

Automatic applied to a fire door, smoke door, fire shutter, smoke and-heat vent, *sprinkler system*, alarm system or the like, means designed to operate when activated by a heat, smoke or fire sensing device.

Certificate of Accreditation a certificate acceptable to the Approval Authority stating that the properties and performance of a building material or method of construction or design fulfil specific requirements of this Code.

Combustible -

(a) applied to a material - means *combustible* under AS1530.1

(b) applied to construction or part of a building - means constructed wholly or in part of *combustible* materials.

(See definition of *non-combustible*)

Common Wall a wall that is common to adjoining buildings.

Drain a line of pipes to carry *sewage* or *trade waste*, located within the property boundary, laid above or below ground, and includes all fittings and equipment such as inspection openings, traps and gullies.

It is a branch *drain* if it is intended to receive the discharge from fixture discharge pipes. Branch *drains* join a main *drain*.

The main *drain* collects the *waste water* from branch *drains* and/or from fixture discharge pipes and conveys them to the disposal system.

Early Childhood Centre a preschool, kindergarten or child-minding centre.

Effective height the height to the floor of the topmost *storey* (excluding the topmost *storey* if it contains only heating, ventilating, lift or other equipment, water tanks or similar service units) from the floor of the highest *storey* providing egress to a road or *open space*. The road or *open space* must be capable of providing unobstructed access to emergency vehicles.

The *effective height* of a stepped or terraced building is the maximum *effective height* of any segment of the building.

Exit :

(a) Any, or any combination of the following if they provide egress to a road or *open space*:

(i) An internal or external stairway.

(ii) A ramp complying with Section ND.

(iii) A *fire-isolated passageway*.

(iv) A doorway opening to a road or *open space*.

(b) A *horizontal exit* or a *fire-isolated passageway* leading to a *horizontal exit*.

External Wall an outer wall of a building which is not a *common wall*.

Fire Compartment a part of a building which is separated from the remainder in accordance with this Code to resist the spread of fire and smoke.

Fire-protective Covering inert material applied in such a manner that it protects other materials or building elements from the damaging effects of fire. Acceptable materials are:-

(a) 13 mm fire-protective grade plasterboard;

(b) 12 mm cellulose fibre reinforced sheeting;

(c) 12 mm mesh-reinforced fibrous plaster in which the mesh is 13 mm x 13 mm x 0.7 mm welded wire located not more than 6 mm from the exposed face; or

(d) other material not less fire-protective than 13 mm fire-protective grade plasterboard,

fixed in accordance with the normal trade practice for a *fire-protective covering*.

Fire-resistance Level (FRL) the grading periods in minutes determined in accordance with Specification A2.3, for-

(a) *structural adequacy*;

(b) *integrity*; and

(c) *insulation*,

and expressed in that order.

Fire-resisting Construction one of the Types of construction referred to in Part NC1.

Fire-separated Section a part of a building which is separated from the remainder by *fire walls* in accordance with Part NC2 and thereby regarded as a separate building.

Fire-source Feature -

(a) the far boundary of a road adjoining the allotment;

(b) a side or rear boundary of the allotment; or

(c) an *external wall* of another building on the allotment.

Fire Wall a wall that divides a *storey* or building to resist the spread of fire and smoke and has the FRL *required* under Specification NC1.1.

Fixture Unit a unit of measure based on the rate of discharge, time of operation and frequency and use of a sanitary fixture, that denotes the hydraulic load contributed by that fixture to the sanitary plumbing system.

Flammability Index the index number determined under AS 1530.2.

Floor Area -

(a) in relation to a *storey* - the area of that *storey* measured over the enclosing walls (if any) and that part of any *common wall* located within the allotment; and

(b) in relation to a room - the area of the room measured within the finished surfaces of the walls, and includes the area occupied by any cupboard or other built-in furniture, fixture or fitting.

Habitable Room a room used for normal domestic activities, and -

(a) includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room and sunroom ; but

(b) excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes-drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.

Health-care Building -

(a) a nursing home, hospital, convalescent home, infirmary or similar institution or home for sick or disabled persons needing full-time nursing care; or

(b) a clinic or day surgery unit where -

(i) prescribed surgical procedures are performed on people who do not require overnight care as in-patients in a hospital; and

(ii) the surgical procedures include a potential requirement for general anaesthesia, major regional anaesthesia or intravenous sedation.

Horizontal Exit a *required* doorway through a *required fire wall* separating two portions of a building with approximately the same floor level so as to establish an area of refuge affording safety from fire and/or smoke in the portion from which the escape is made.

Insulation, in relation to a FRL, means the ability to maintain a temperature on the surface not exposed to the furnace below the limits specified in AS 1530.4.

Integrity, in relation to a FRL, means the ability to resist the passage of flames and hot gases specified in AS 1530.4.

Internal Wall excludes a *common wall* or a party wall .

Junction a sanitary fitting used to connect one or more branch pipes or channels to a main pipe or channel.

A square *junction* connects the main pipe at right angles and has an airtight removable cap to facilitate inspection and cleaning.

An inspection branch is a *junction* with an airtight removable cap to facilitate inspection and cleaning.

Loadbearing intended to resist forces and moments additional to those due to its own weight.

Non-combustible -

(a) applied to a material - means not *combustible* except that the material may have a *combustible* surface finish if the finish is not more than 1 mm thick and the *Spread-of-Flame Index* of the assemblage is 0;

(b) applied to construction or part of a building - means constructed of *non-combustible* material on all exposed faces.

The following materials though *combustible* or containing *combustible* fibres may be used wherever *non-combustible* materials are *required*:-

(i) plasterboard

(ii) perforated gypsum lath with a normal paper finish

(iii) fibrous plaster sheet conforming to AS 2185

(iv) cellulose fibre cement sheeting

(v) any other material not less fire-protective than any of the materials from (i) to (iv)

Open Garage a carport or garage with 2 or more sides substantially open.

Open Space a space on an allotment, or a roof or similar part of a building complying with ND2.12, open to the sky and connected directly with a public road.

Open Spectator Stand a tiered stand substantially open at the front.

Panel Wall a non-*loadbearing external wall*, in frame or similar construction, that is wholly supported at each *storey*.

Pitch the maximum angle to the horizontal of a line connecting the nosings of stair treads in a single straight flight of a stairway.

Private Garage - any garage of a Class 1 building.

Professional Consultant a person with appropriate experience in the relevant field, being -

(a) if legislation so requires - a registered *professional consultant* in the relevant discipline; or

(b) a Corporate Member of a recognized professional institution.

Public Corridor an enclosed corridor, hallway or the like which -

(a) serves as a means of egress from 2 or more *sole-occupancy units* to a *required exit* from the *storey* concerned; or

(b) is *required* to be provided as a means of egress from any portion of a *storey* to a *required exit* .

Registered Testing Authority -

(a) National Building Technology Centre
P O Box 30
CHATSWOOD NSW 2067
AUSTRALIA;

(b) Commonwealth Scientific and Industrial Research Organisation; Division of Building Research
P O Box 56
HIGHETT VIC 3190
AUSTRALIA;

(c) An organisation registered by the National Association of Testing Authorities (NATA) to test in the relevant field;

(d) Building Research Association of New Zealand
Private Bag
PORIRUA
NEW ZEALAND;

(e) Testing laboratories registered by the Testing Laboratory Registration Council (TELARC) of New Zealand to test in the relevant field;

(f) An organisation recognized by NATA or TELARC through a mutual recognition agreement;

(g) Fire Insurers Research and Testing Organisation
Melrose Avenue
BOREHAMWOOD
LONDON (UK);

(h) National Institute of Standards and Technology
GAITHERSBURG, MD 20899
USA;

(i) Underwirters Laboratories Incorporated
333 Pfingsten Road
NORTHBROOK, IL 60062
USA; or

(j) National Research Council
Division of Building Research
75 Boul De Mortagne
Boucherville
Quebec
CANADA

Repairs action taken to restore the structural strength or appearance of a building without making any addition or extension to it.

Required *required* by this Code.

Resistance to the incipient spread of Fire in relation to a ceiling membrane, means the ability of a ceiling membrane to insulate the space between the ceiling and roof, or ceiling and floor above, to limit the temperature rise of *combustibles* in this space during the *Standard Fire Test* to 180°C.

Rise, in *storeys*, means the greatest number of *storeys* calculated in accordance with NC1.2 at any part of the *external walls* of the building -

(a) above the finished ground next to that part; or

(b) if part of the *external wall* is on the boundary of the allotment, above the natural ground level at the relevant part of the boundary.

Sanitary Compartment a room or space containing a toilet fixture, closet pan, soil pan, chemical toilet, or the like.

Sarking-type Material a material such as a reflective foil or other flexible membrane of a type normally used for a purpose such as water-proofing, vapour proofing or thermal reflectance.

School includes a primary or secondary *school*, college, university or similar educational establishment.

Self-closing, applied to a door or *window* means equipped with a devise which returns the door or *window* to the fully closed and latched position immediately after each manual opening.

Service Station a garage which is not a *private garage* and is for the servicing of vehicles, other than only washing, cleaning or polishing.

Sewage waterborne human waste from domestic and commercial premises including faeces and urine, and waste from kitchens, showers, baths, domestic laundries etc.

Site the part of the allotment of land on which a building stands or is to be erected.

Smoke-Developed Index the index number for smoke developed under AS 1530.3.

Soil Fixture a water closet pan, urinal, sanitary napkin disposal unit, slop hopper, bed pan washer or autopsy table.

Soil Pipe a pipe which conveys discharge from *soil fixtures.*

Sole-occupancy Unit a room or other portion of a building for occupation by one owner, lessee, tenant, or other occupier to the exclusion of any other owner, lessee, tenant, or other occupier.

Spread-of-Flame Index the index number for spread of flame under AS 1530.3.

Stack a vertical *drain* including offsets and extending to more than one *storey*.

Standard Fire Test the Fire-resistance Test of Structures under AS 1530.4.

Storey a space within a building which is situated between one floor level and the floor level next above, or if there is no floor above, the ceiling or roof above, but not -

(a) a stairway or meter room;

(b) a bathroom, shower room, water closet, or other *sanitary compartment*; or

(c) a combination of the above.

Structural Adequacy, in relation to a FRL means the ability to maintain stability and adequate *loadbearing* capacity under AS1530.4.

Structural Member a component or part of an assembly which provides vertical or lateral support to a building or structure.

Sweep Junction a long radius bend entering a main pipe at 45° or a 45° junction fitted with a 45° bend.

Trade Waste waterborne waste from business, trade or manufacturing process containing predominantly non-human waste, but not unpolluted water.

Ward Area that portion of a *storey* of a Class 9a building for residing patients and includes areas for sleeping, recreation and sanitary facilities, and nurses stations.

Waste Fixture a sanitary fixture other than a *soil fixture*. Examples are: basins, bidets, kitchen sink, laundry trough etc.

Waste Pipe a pipe which conveys the discharge from *waste fixtures.*

Waste Water dissolved and suspended waterborne waste which may consist of *sewage* and/or *trade waste*..

Window includes a roof light, glass panel, glass brick, glass louvre, glazed sash, glazed door, or other device which transmits natural light directly from outside a building to the room concerned when in the closed position.

A1.2 Adoption of Standards and other references

The adoption of a Standard, rule, specification or provision included in any document issued by the Standards Association of Australia, Standards Association of New Zealand or other body, does not include a provision -

(a) specifying the respective rights, responsibilities or obligations between that body and any manufacturer, supplier or purchaser;

(b) specifying the responsibilities of any tradesman or other building operative, architect, engineer, authority, or other person or body;

(c) requiring the submission for approval of any material, building component, form or method of construction, to any person, authority or other body;

(d) specifying that a material, building component, form or method of construction, must be submitted to the Standards Association of Australia, Standards Association of New Zealand or other body or a committee of either Association for expression of opinion; or

(e) permitting a departure from the Standard, rule, specification or provision at the sole discretion of the manufacturer or purchaser, or by arrangement or agreement between the manufacturer and purchaser.

A1.3 Referenced Standards, Etc.

A reference to a document under A1.2 refers to the latest edition or issue, together with any amendment, listed in Specification A1.3 and only so much as is relevant in the context in which the document is quoted.

A1.4 Differences between referenced documents and this Code

This Code overrules in any difference arising between it and any Standard, rule, specification or provision in a document listed in Specification A1.3. Further, references in this Code to any Standard or Code of Practice issued by the Standards Association of Australia or of New Zealand or such other body, exclude the need for:

(a) compliance with NZS 1900 wherever it is quoted in any standard;

(b) compliance with any laws and regulations that are not of this country; and

(c) recognition of the meaning of "Engineer".

Also, references to "FRR" in Standards issued by the Standards Association of New Zealand mean "*Fire resistance level*" as defined in this Code.

FRR (NZ) = FRL (This code).

A1.5 Mandatory provisions

(a) The following provisions of the Code are mandatory:

(i) all provisions of Section A; and

(ii) the Performance Requirements stated at the beginning of all the other Sections.

(b) The Deemed-to-Satisfy Provisions of the Code are one means of satisfying the Performance Requirements. The Performance Requirements can also be met by any other means. When this latter approach is taken, it must meet the final objectives and performance that would have been achieved had the Deemed-to-Satisfy Provisions been followed.

ACCEPTANCE OF DESIGN AND CONSTRUCTION

A2.1 Suitability of materials

Every part of a building must be constructed in a manner which will achieve the required level of performance, using materials and methods that are not faulty or unsuitable for the purpose for which they are intended.

A2.2 Evidence of suitability

Evidence to support the use of a material, method, form of construction or design may be -

(a) a report issued by a *Registered Testing Authority*, showing that the material or form of construction has been submitted to the tests listed in the report, and setting out the results of those tests and any other relevant information that demonstrates its suitability for use in the building;

(b) a current *Certificate of Accreditation;*

(c) a certificate from an appropriately qualified *professional consultant* which -

(i) certifies that a material, design or form of construction complies with the requirements of this Code; and

(ii) sets out the basis on which it is given and the extent to which relevant specifications, rules, codes of practice or other publications have been relied upon; or

(d) a Standards Mark Certificate issued by the Standards Association of Austrtalia or the Standards Association of New Zealand; or

(e) any other form of documentary evidence that correctly describes the properties and performance of the material or form of construction and adequately demonstrates its suitability for use in the building,

and any copy of documentary evidence submitted under this Code, must be a complete copy of the original report or document.

A2.3 Fire-resistance of building elements

The FRL of a *structural member* or other building element must be determined in accordance with Specification A2.3. Any relevant testing or certification must be by an appropriately qualified *professional consultant* or *Registered Testing Authority*.

A2.4 Early Fire Hazard Indices

The Early Fire Hazard Indices of a component or assembly must be determined in accordance with Specification A2.4.

CLASSIFICATION OF BUILDINGS AND STRUCTURES

A3.1 Principles of classification

The classification of a building or part of a building is determined by the purposes for which it is designed, constructed or adapted to be used.

A3.2 Classifications

Buildings are classified as follows:-

Class 1: a residence which may comprise one or more buildings including any outbuildings such as a *private garage* which in association constitute-

(a) a single dwelling-house; or

(b) a dwelling-house used as a boarding-house, hostel, or the like, in which not more than 12 persons would ordinarily be resident; or

(c) a building that contains -

(i) 2 or more *sole-occupancy units* where no such unit is located one above the other; or

(ii) only 2 *sole-occupancy units* located one above the other,

and each unit has direct egress to a road or *open space* .

Class 2: a residential building, other than a building of Class 1, which is a common place of living for a number of unrelated persons, including -

(a) a boarding-house, guest house, hostel, or lodging-house;

(b) a residential part of an hotel or motel;

(c) a residential part of a *school*;

(d) accommodation for the aged, disabled or children; and

(e) a residential part of a *health-care building* which accommodates members of staff.

(f) a dwelling in a building that is Class 3 if it is the only dwelling in the building.

Class 3: All other buildings. Examples are -

(a) office buildings

(b) shops

(c) restaurants, bars and other eating places

(d) warehouse or storage buildings

(e) *health-care buildings*

(f) *assembly buildings*.

A3.3 Multiple classification

Each part of a building must be classified separately, and where parts have different purposes - if not more than 10% of the *floor area* of *storey* which is not a laboratory is used for a purpose which is a different classification, the classification applying to the major use may apply to the whole *storey*.

UNITED BUILDINGS

A4.1 When buildings are united

Two or more buildings adjoining each other are considered to form one united building if they -

(a) are connected through openings in the walls dividing them; and

(b) together comply with all the requirements of this Code as though they are a single building.

A4.2 Alterations in a united building

After any *alteration* or any other action -

(a) a united building; or

(b) each building forming part of a united building; or

(c) each building if they cease to be connected through openings in the dividing walls,

must comply with all requirements for a single building.

STANDARDS ADOPTED BY REFERENCE

1. Schedule of referenced documents

The Standards and other documents listed in Table 1 are referred to in this Code. In order to reduce possible confusion/conflict, the Standards produced by the Standards Association of Australia or by the Standards Association of New Zealand as seen to be specifically relevant, have been called up. However the Code users are free to use any suitable mix of Australian and New Zealand Standards provided care is taken to follow consistent technical principles and prevalent practices. Where the Standards from either Australia or New Zealand do not cover any specific area, the relevant Standards issued by the British Standards Institution or the American Society for Testing and Materials may be used.

TABLE 1
SCHEDULE OF REFERENCED DOCUMENTS

No.	Title	Code Clause(s)
AS 1038	Methods for the analysis and testing of coal and coke	
Part 15	Fusibility of higher rank coal ash and coke ash	Spec NC3.10
AS 1170	Minimum design loads on structure (SAA Loading Code)	B1.2
Part 1	Dead and live loads and load combinations	
Part 2	Wind forces	
AS 1428	Design rules for access by the disabled	ND3.2, ND3.3
Part 1	Regulatory requirements	
AS 1530	Methods of fire tests on building materials components and structures	A1.1
Part 1	Combustibility test for materials	Spec A2.4
Part 2	Test for flammability of materials	Spec A2.4
Part 3	Test for early fire hazard properties of materials	Spec NC3.10
Part 4	Fire-resistance tests on elements of building construction	
AS 1657	Rules for fixed platforms, walkways, stairways and ladders	ND2.11, DF6.11.5
AS 1664	Rules for the use of aluminium in structures (SAA Aluminium Structures Code)	B1.3
AS 1694	Code of practice for physical barriers used in the protection of buildings against subterranean termites	B1.3
AS 1720	Rules for the use of timber in structures (SAA Timber Engineering Code)	B1.3 Spec A2.3

TABLE 1 Continued
SCHEDULE OF REFERENCED DOCUMENTS

No.	Title	Code - Clause(s)
AS 1736	Code of practice for pliable roof sarking	DF1.5, NF1.5
AS 1860	Code of practice for the installation of particleboard flooring	B1.3
AS 1903	Reflective foil laminate	DF1.5, NF1.5
AS 1904	Code of practice for installation of reflective foil laminate in buildings	DF1.5, NF1.5
AS 2057	Soil treatment of buildings under construction for protection against subterranean termites	B1.3
AS 2159	Rules for the design and installation of piles (SAA Piling Code)	B1.3
AS 2327	Composite construction in structural Steel and concrete (SAA Composite Construction Code)	Spec A2.3,
AS 2870	Residential slabs and footings	
Part 1-XXXX	Construction	B1.3, DF1.9, NF1.9
AS 2904	Damp-proof courses and flashings	DF1.8, NF1.8
AS 3000	SAA Wiring rules	DE1.1, NE3.1.1
NZS 3109	Specification for concrete construction	B1.3
NZS 3124	Specification for concrete construction for minor works	B1.3
AS 3500	Plumbing and drainage Code	
Part 0	Glossary of terms	
Part 1	Water supply	DF5.2, DF5.3, NF5.2, NF5.3
Part 2	Sanitary plumbing and sanitary drainage	DF6.2, NF6.2
Part 4	Hot water supply systems	DF5.2, DF5.3, DF5.4, NF5.2, NF5.3, NF5.4
AS 3600	Concrete Structures	B1.3, Spec A2.3

TABLE 1 Continued
SCHEDULE OF REFERENCED DOCUMENTS

No.	Title	Code Clause(s)
AS 3700	Masonry in building (SAA Masonry Code)	B1.3, Spec A2.3
AS 4100	Steel Structures	B1.3, Spec A2.3
NZS 4223	Code of practice for glazing in buildings	B1.3
NZS 4229	Code of practice for masonry buildings not requiring specific design	B1.3
NZS 4232	Performance criteria for fire resisting closures	Spec NC 3.2, NC3.6
NZS 4503	Hand operated fire fighting equipment	NE1.2
TR 440	NBTC Technical Record 440 - Guidelines for the testing and evaluation of Products for cyclone-prone areas	B1.3
AISC	Guidelines for assessment of fire resistance of structural steel members	Spec A2.3

FIRE-RESISTANCE OF BUILDING ELEMENTS

1. Scope

This Specification sets out the procedure for determining the FRL of *structural members* and other building elements.

2. Rating

A building element has a FRL if -

(a) it is listed in, and complies with Table 1 of this Specification;

(b) it is identical with a prototype that has been submitted to the *Standard Fire Test* and the FRL achieved by the prototype is confirmed in a report from a *Registered Testing Authority* which -

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

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

(c) it differs in only a minor degree from a prototype tested under (b) and the FRL attributed to the *structural member* is confirmed in a report from a *Registered Testing Authority* which -

(i) certifies that the structural member is capable of achieving the FRL despite the minor departures from the tested prototype; and

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

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

(i) AS 4100, AS 2327 and AISC *Guidelines for Assessment of Fire Resistance of Structural Steel Members* 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 solid or glued-laminated timber structure.

(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.

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; and

(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*; and

(iii) *insulation*; and

(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 profile, 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; and

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

4. Interchangeable materials

(a) Concrete and plaster - The 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 - The FRL achieved with either gypsum perlite plaster or gypsum-vermiculite plaster applies equally for both plasters.

5. Columns covered with lightweight construction

(a) Protection against injury - If the fire-resisting covering of a steel column is lightweight construction -

(i) the covering must be protected by metal or other suitable material if the column is liable to damage from the movement of vehicles, materials or equipment; and

(ii) the voids must be filled solid with non-combustible material to a height of not less than 1.2m above the floor to prevent indenting if the covering is not in continuous contact with the column; and

(b) Sealing at floor level - A plug of non-combustible material must seal all voids at each floor level, including voids between the column and its covering if -

(i) a steel column extends through 2 or more storeys; and

(ii) the fire-resisting covering is not in continuous contact with the column.

TABLE 1
FRLs DEEMED TO BE ACHIEVED BY CERTAIN BUILDING ELEMENTS

BUILDING ELEMENT	THICKNESS OF PRINCIPAL MATERIAL (mm)	ANNEXURE REFERENCE Clause No.
	60/60/60	
WALL		
Masonry -		
Concrete with material density in kg/m³ of -		
- 1600 or more	80	1,3,4,5
- less than 1600	70	1,3,4,5
Gypsum-perlite or Gypsum-vermiculite plaster on metal lath and channel	50	1,7,9
HOT-ROLLED STEEL COLUMN (Including a fabricated column) exposed on no up to 4 sides:		
Fire protection of-		
Concrete - Cast in-situ-		
- *loadbearing*	25	9,10
non-*loadbearing* -		
- unplastered	25	9,10
- plastered 13 mm	25	1,7,9
Gypsum-perlite or Gypsum vermiculite plaster-		
- sprayed to contour	25	1,9
- sprayed on metal lath	20	1,7,9

TABLE 1 Continued
FRLs DEEMED TO BE ACHIEVED BY CERTAIN BUILDING ELEMENTS

BUILDING ELEMENT	THICKNESS OF PRINCIPAL MATERIAL (mm)	ANNEXURE REFERENCE Clause No.
	60/60/60	
HOT-ROLLED STEEL COLUMN (including a fabricated column) exposed on no up to all 4 sides and withcolumn spaces filled or unfilled:		
Fire protection of -		
Solid concrete masonry	50	1, 3, 8, 9
HOT-ROLLED STEEL BEAM (including an open-web joist, girder, truss, etc) exposed on up to all 4 sides :		
Fire protection of -		
Concrete - Cast in -situ-	25	9
Gypsum-perlite or Gypsum vermiculite plaster		
- sprayed to contour	25	1, 9
- sprayed on metal lath	20	1, 7, 9

ANNEXURE TO TABLE 1

1. MORTAR, PLASTER AND PLASTER REINFORCEMENT

1.1 Mortar for Masonry

Masonry units of concrete must be laid in cement mortar or composition mortar complying with the relevant provisions of AS 3700.

1.2 Gypsum-perlite and Gypsum-vermiculite Plaster

Gypsum-perlite or gypsum-vermiculite plaster must be applied -

(a) in either one or 2 coats each in the proportions of 1 m^3 of perlite or vermiculite to 640 kg of gypsum if the *required* thickness of the plaster is not more than 25 mm; and

(b) in 2 coats if the *required* thickness is more than 25 mm, the first in the proportion of 1 m^3 of perlite or vermiculite to 800 kg of gypsum and the second in the proportion of 1 m^3 of perlite or vermiculite to 530 kg of gypsum.

1.3 Plaster of Cement and Sand or Cement, Lime and Sand

Plaster prescribed in Table 1 must consist of -

(a) cement and sand or cement, lime and sand; and

(b) may be finished with gypsum, gypsum-sand, gypsum-perlite or gypsum-vermiculite plaster or with lime putty.

1.4 Plaster Reinforcement

If plaster used as fire-protection on walls is more than 19 mm thick-

(a) it must be reinforced with expanded metal lath that-

(i) has a mass per unit area of not less than 1.84 kg/m^2;

(ii) has not fewer than 98 meshes/m; and

(iii) is protected against corrosion by galvanising or other suitable method; or

(b) 13 mm x 13 mm x 0.710 mm galvanised steel wire mesh; and

(c) the reinforcement must be securely fixed at a distance from the face of the wall of not less than 1/3 of the total thickness of the plaster.

2. DIMENSIONS OF MASONRY

The thickness of concrete masonry is calculated as follows:-

2.1 Solid Units

For masonry in which the amount of perforation or coring of the units does not exceed 25% by volume (based on the overall rectangular shape of the unit) the thickness of the wall must be calculated from the manufacturing dimensions of the units and the specified thickness of the joints between them as appropriate.

2.2 Hollow Units

For masonry in which the amount of perforation or coring of the units exceeds 25% by volume (based on the overall rectangular shape of the unit) the thickness of the wall must be calculated from the equipment thicknesses of the units and the specified thickness of the joints between them as appropriate.

2.3 Equivalent thickness

The equivalent thickness of a masonry unit is calculated by dividing the net volume by the area of one vertical face.

2.4 Cavity Walls

The thickness of a cavity wall is the sum of the thicknesses of the leaves determined in accordance with 2.1 and/or 2.2 as appropriate.

2.5 Cavity Walls of Different Materials

If the 2 leaves of a cavity wall are of units of different type, the thickness required is that listed for the less fire-resistant material (i.e. the greater thickness).

3. SLENDERNESS RATIO OF MASONRY

3.1 Maximum Value

The slenderness ratio of a masonry wall must not exceed the appropriate value in Table 3.1.

3.2 Calculation

The slenderness ratio of a masonry wall is calculated in accordance with AS 3700. In the case of cavity walls it is calculated for each leaf separately. Each leaf must satisfy 3.1.

TABLE 3.1
MAXIMUM SLENDERNESS RATIOS FOR MASONRY WALLS

TYPE OF UNIT	FRL
	60/60/60
Concrete in which the basalt content of the aggregate is	
less than 45%	15
45% or more	20
Reinforced masonry - all types of unit designed for-	
axial forces and flexure-	20
flexure-with super-imposed axial forcesless than 5% of load capacity-	30

4. PROTECTION TO MASONRY REINFORCEMENT

In a building element of reinforced masonry designed for fire-resistance, the distance from the surface of the element to the surface of the reinforcement must not be less than 30 mm for FRL 60/60/60.

5. INCREASE IN THICKNESS BY PLASTERING

5.1 General

The tabulated thicknesses are those of the principal material. They do not include the thickness of plaster which must be additional to the listed thickness of the material to which it is applied.

5.2 Walls

If a wall of concrete masonry is plastered on both sides to an equal thickness, the thickness of the wall for the purposes of Table 1 (but not for the purposes of Table 3.1) may be increased by the following proportions of the thickness of the plaster on one side:

(a) For concrete masonry in which the aggregate is of a density in excess of 1800 kg/m³ : 100%

(b) For concrete masonry in which the aggregate is of a density between 1600 and 1800 kg/m³ : 85%

(c) For concrete masonry in which the aggregate is of a density less than 1600 kg/m³ : 75%

6. CONCRETE SLABS BEAMS WALLS AND COLUMNS

The requirements to meet specific values of FRL are those contained in AS 3600. However for simple structures the following procedures may be adopted.

6.1 Structural Adequacy Criterion

Table 6.1A gives the minimum dimensions for meeting specific levels of structural adequacy for -

(a) Solid or hollow core plain slabs - the clear cover to the longitudinal reinforcement or tendons. A slab is continuous if it is flexurally continuous along at least one edge under the imposed loads.

(b) Ribbed slabs with ribs spaced at not more than 1200 mm centre to centre - the minimum width of the rib and the clear cover to the reinforcement or tendons of the ribs. The slabs spannning the ribs may be treated as plain slabs as at (a).

(c) Beams The upper surface of the beams must be integral with a slab or protected by one - the minimum width of we b (rectangular or uniformly tapering cross-section) and the clear cover to the reinforcement or tendons.

(d)	Solid or hollow-core vertical walls	the clear cover to the reinforcement or tendons. The effective thickness of the wall must be at least equal to that given in Table 6.3 for the FRL for the *insulation* criterion equal in period to the *required structural adequacy* criterion. In addition the slenderness ratio must not exceed the values given in Table 6.1B.
(e)	Columns which are -	
.	exposed on all sides of fire	
.	built into or form part of a wall that does not have a fire separatingfunction	the minimum cross-sectional dimension and the clear cover to the reinforcement.
.	built into or form part of a wall that has a lower value of structural adequacy than *required* for the column; or	
.	built into and protrude by a distance in excess of the value of the clear cover to the longitudinal reinforcement.	

6.2 Integrity Criterion

This criterion is relevant only for slabs and walls and not ribs, beams and columns. It is satisfied if the criteria structural adequacy and insulation are met for the peri equal to that *required* for the integrity of the slab or w as appropriate.

6.3 Insulation Criterion

This criterion is also relevant only for slabs and walls. It met by meeting the requirement for minimum effecti thickness as given in Table 6.3. The effective thickness solid slabs and walls is the actual thickness. The effecti thickness of hollow core slabs and walls is the value of th nett cross-sectional area divided by the width of the cross section. With hollow core slabs and walls the thickness concrete between voids and between any part of a void an the nearest surface must be not less than 25 mm or 20% the effective thickness of the slab.

TABLE 6.1A
FRL - REQUIREMENTS FOR STRUCLTURAL ADEQUACY CRITERION

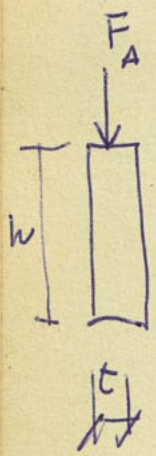
BUILDING ELEMENT	FRL (Minutes)	
	30	60
Plain Slabs		
- Simply supported one-way, clear cover (mm) to		
. reinforcement	15	20
. tendons	20	25
- Simply supported two way, clear cover (mm)to		
. reinforcement	10	15
. tendons	15	20

TABLE 6.1A Continued
FRL - REQUIREMENTS FOR STRUCLTURAL ADEQUACY CRITERION

BUILDING ELEMENT	FRL (Minutes)	
	30	60
Plain slabs continuous one-way and two-way, clear cover (mm) to		
. reinforcement	10	15
. tendons (← stirrups)	15	20
Ribs of plain slabs min. width x clear cover (mm) (mm)		
- simply supported one-way and two-way ribbed slabs		
. reinforcement	80x15	110x25
. tendons	80x25	110x35
- continuous one way and two-way ribbed slabs min. width x clear cover (mm) (mm)		
. reinforcement	70x15	75x20
. tendons	70x25	75x30
Beams min. width of web (mm) x clear cover (mm) reinforcement or tendon		
Simply supported -		
. reinforcement	75x20	120x30 or 150x25 or 240x20
. tendons	75x25	120x35 or 150x30 or 240x25
Continuous -		
. reinforcement	75x20	120x20
. tendons	75x25	120x25

TABLE 6.1A Continued
FRL - REQUIREMENTS FOR STRUCLTURAL ADEQUACY CRITERION

BUILDING ELEMENT	FRL (Minutes)	
	30	60
Vertical Walls clear cover in mm for		
. to reinforcement	20	20
. to tendons	30	30
Note:- Vertical walls must also satisfy the requirements of Table 6.1B		
Columns min. cross-sectional dimension x clear cover (mm) (mm)	150x10	200x20 or
. to reinforcement	240x15	300x25



$(x) = F_A/(A \times f_c)$

TABLE 6.1 B

MAXIMUM ALLOWABLE SLENDERNESS RATIO FOR CONCRETE WALLS

Ratio of design axial (F_A) force to the product of gross cross-sectional area and the characteristic compressive cylinder strength at 28 days	Corresponding maximum value of slenderness ratio (effective height/thickness) w/t
0.0	35
0.005	20
0.03	15
0.10	10

x

Notes:

1. values in between can be interpolated.
2. design axial force = 1.1 dead load +0.6 live load including impact .
3. the characteristic compressive strength in MPa is generally expressed as the grade of the concrete. f_c

TABLE 6.3

MINIMUM EFFECTIVE THICKNESS FOR INSULATION

FRL for *Insulation* criterion minutes	Effective thickness mm
30	60
60	80

7. GYPSUM-PERLITE OR GYPSUM-VERMICULITE PLASTER ON METAL LATH

7.1 Walls

In walls fabricated of gypsum-perlite or gypsum-vermiculite plaster on metal lath and channel -

(a) the lath must be securely wired to each side of 19 mm x 0.44 kg/m steel channels (used as studs) spaced at not more than 400 mm centres; and

(b) the gypsum-perlite or gypsum-vermiculite plaster must be applied symmetrically to each exposed side of the lath.

7.2 Columns

For the fire protection of steel columns with gypsum-perlite or gypsum-vermiculite on metal lath -

(a) the thickness of the plaster must be measured from the back of the lath;

(b) the lath must be fixed at not more than 600 mm centres vertically to steel furring channels, and -

(i) if the plaster is to be 35 mm thick or more - at least 12 mm clear of the column; or

(ii) if the plaster is to be less than 35 mm thick - at least 6 mm clear of the column; or

(c) the plaster may be applied to self-furring lath with furring dimples to hold it not less than 10 mm clear of the column.

7.3 Beams

For the fire protection of steel beams with gypsum-perlite or gypsum-vermiculite on metal lath -

(a) the lath must be fixed at not more than 600 mm centres to steel furring channels and at least 20 mm clear of the steel;

(b) the thickness of the plaster must be measured from the back of the lath.

8. EXPOSURE OF COLUMNS AND BEAMS

8.1 Columns

A column incorporated in or in contact on one or more sides with a wall of solid masonry or concrete at least 100 mm thick may be considered to be exposed to fire on no more than 3 sides.

8.2 Beams

A beam, open-web joist, girder or truss in direct and continuous contact with a concrete slab or a hollow block floor or roof may be considered to be exposed to fire on no more than 3 sides.

9. REINFORCEMENT FOR COLUMN AND BEAM PROTECTION

9.1 Masonry

Concrete masonry for the protection of steel columns must have steel-wire or mesh reinforcement in every second course and lapped at the corners.

9.2 Structural Concrete

If a steel column or a steel beam is to be protected with structural concrete -

(a) the concrete must be reinforced with steel-wire mesh or steel-wire binding placed about 20 mm from its outer surface; and

(b) for concrete less than 50 mm thick, the steel wire must be -

(i) at least 3.15 mm in diameter; and

(ii) spaced at not more than 100 mm vertically ; or

(c) for concrete not less than 50 mm thick, the steel wire must be either -

(i) of a diameter and spacing in accordance with (b); or

(ii) at least 5 mm in diameter and spaced at not more than 150 mm vertically.

9.3 Gypsum-perlite or Gypsum-vermiculite Plaster Sprayed to contour

(a) If a steel column or steel beam is protected with either gypsum-perlite or gypsum-vermiculite plaster sprayed to contour and the construction falls within the limits of Table 9.3, the plaster must be reinforced with -

(i) expanded metal lath complying with 1.6; or

(ii) galvanised steel mesh complying with 1.6.

(b) The reinforcement must be placed at a distance from the face of the plaster of at least 1/3 of the thickness of the plaster and must be securely fixed to the column or beam at intervals of not more than the relevant listing in Table 9.3.

(c) For the purposes of Table 9.3 -

(i) "vertical" includes a surface at not more than 10° to the vertical;

(ii) "horizontal" includes a surface at not more than 10° to the horizontal; and

(iii) "underside" means the underside of any horizontal or non-vertical surface.

10. THICKNESS OF COLUMN AND BEAM PROTECTION

10.1 Measurement of Thickness

The thickness of the fire-protection to steel columns and steel beams (other than fire protection of gypsum-perlite or gypsum-vermiculite plaster sprayed on metal lath or sprayed to contour) is to be measured from the face or edge of the steel, from the face of a splice plate or from the outer part of rivet or bolt, whichever is the closest to the outside of the fire-protective construction, except that-

(a) if the thickness of the fire-protection is 40 mm or more, rivet heads may be disregarded;

(b) if the thickness of the fire-protection is 50 mm or more -

(i) any part of a bolt (other than a high-tensile bolt) may be disregarded; and

(ii) a column splice plate within 900 mm of the floor may encroach upon the fire protection by up to a 1/4 of the thickness of the fire protection; and

(c) the flange of a column or beam may encroach by up to 12 mm upon the thickness of the fire protection at right angles to the web if-

(i) the flange projects 65 mm or more from the web; and

(ii) the thickness of the edge of the flange (inclusive of any splice plate) is not more than 40 mm.

TABLE 9.3
REINFORCEMENT OF GYPSUM-PERLITE OR GYPSUM-VERMICULITE PLASTER SPRAYED TO CONTOUR

SURFACE TO BE PROTECTED	REINFORCEMENT REQUIRED I F SMALLER DIMENSION OF SURFACE EXCEEDS (mm)	MAX SPACING OF FIXINGS OF THE MESH TO SURFACE (mm)
Members with H or I cross-section:		
Vertical-	450	450
Non-vertical-	300	300
Underside-	300	300
Upperside of a horizontal surface-	Not required	
Members with other shapes		
Vertical	Any size	450
Non-vertical-	Any size	300
Upperside of a horizontal surface-	Not required	

EARLY FIRE HAZARD TEST FOR ASSEMBLIES

1. Scope

This Specification sets out the procedures for determining the Early Fire Hazard Indices of components and assemblies. These tests classify building materials, their surface finishes and furnishings according to:-

(a) their tendencies to ignite;

(b) their tendencies to spread flame;

(c) the heat they develop once ignition has occurred; and

(d) their tendencies to produce smoke.

2. Form of test

Tests must be carried out in accordance with AS 1530.3 and AS 1530.4.

3. Test specimens

Test specimens must incorporate -

(a) all types of joints; and

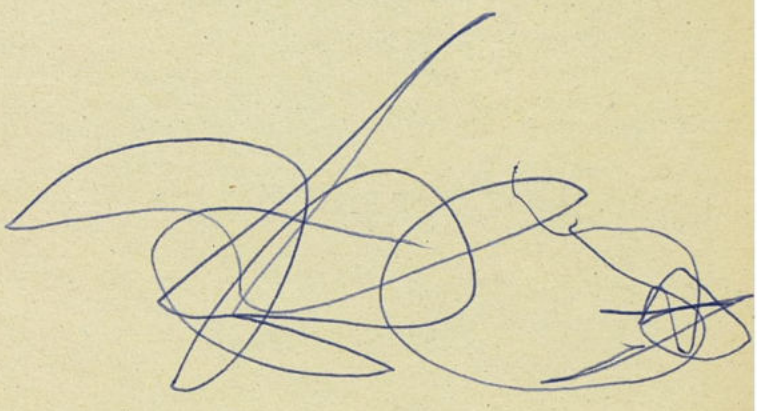
(b) all types of perforations, recesses or the like for pipes, light switches or other fittings, which are proposed to be used for the member or assembly of members in the building.

4. Concession

Clause 3 does not apply to joints, perforations, recesses or the like that are larger than those in the proposed application and have already been tested in the particular form of construction concerned and found to comply with the conditions of test.

5. Smaller specimen permitted

A testing laboratory may carry out the test at pilot scale if a specimen (which must be not less than 900 mm) will adequately represent the proposed construction in the building, but the results of that test do not apply to construction larger than limits defined by the laboratory conducting the pilot examination.



NATIONAL
BUILDING
CODE
1990

ALL BUILDINGS

SECTION B

STRUCTURE

Performance Requirements
Deemed-to-Satisfy Provisions

B1 Structural Provisions

1990

SECTION B

THIS SECTION APPLIES TO ALL BUILDINGS

CONTENTS

PERFORMANCE REQUIREMENTS

OBJECTIVES

BP1 A building must be designed and constructed to fulfil the following objectives:-

(a) prevent death and injury to people from structural failure

(b) avoid distress to occupants as a result of deflection vibration degradation or other similar causes

(c) avoid damage to neighbouring property

(d) the building must satisfy the intended use

REQUIRED PERFORMANCE

BP1.1 Design loads

Buildings and their elements must be designed and constructed in order to prevent structural failure during the expected life of the building and to avoid unacceptable deflections and vibrations during the normal use of the building, resulting from -

(a) combinations and frequency of all possible loads, dynamic responses and internal actions;

(b) the properties of the materials used in the building; and

(c) the foundation conditions.

BP1.1.1 The design and construction must take into account the loads resulting from the following acting either singly or in possible combinations -

(a) self weight

(b) imposed loads

(c) temperature variations

(d) earth pressure

(e) wind

(f) impact

(g) explosion/implosion

(h) fire

(i) water and other liquids

(j) fatigue resulting from fluctuating loads

(k) differential displacement

(l) any other expected loads

BP1.1.2 The design and construction must allow for -

(a) the consequences of failure;

(b) the quality of workmanship available;

(c) variations in material properties and site characteristics; and

(d) want of accuracy in the methods used to predict the structural performance of the building.

BP1.2 Site works

(a) site works as necessary must be carried out to ensure the stability of the building site during the expected life of the building;

(b) while carrying out site works any damage to existing structures or adjacent property must be avoided; and

(c) alterations to the ground water level resulting from site works must not be allowed to affect the stability of any building.

BP1.3 Design criteria

The following criteria must be satisfied -

(a) during the designed life of the building the probability of experiencing unacceptable deflections or vibrations of no more than 5%;

(b) a risk of structural failure of no more than 0.1% within the designed life of the building;

BP1.4 Allowable number of storeys

The maximum number of *storeys* must not exceed 3.

BP1.5 Corrosion protection of reinforcement and embedded steel

All steel reinforcement and other embedded steel must be suitably protected against corrosion.

DEEMED-TO-SATISFY PROVISIONS

STRUCTURAL PROVISIONS

B1.1 General requirements

Materials, components and methods of construction used in a buildng or structure must be capable of sustaining at an acceptable level of safety and serviceability -

(a) the most adverse combinations of loads (including combinations of loads that might result in a potential for progressive collapse); and

(b) other actions,

to which they may reasonably be subjected.

B1.2 Loads

The loading requirements of B1.1 are satisfied if the building or structure can resist loads determined in accordance with the following:

(a) **Dead, live, and wind loads:**

AS1170 Minimum design loads on structures (known as SAA Loading Code)

Part 1 - Dead and live loads and load combinations
Part 2 - Wind loads

When using Part 2 of the Standard the following provisions apply:

A limit state basic wind speed of 60 m/s to all areas. The equivalent basic wind speed for permissible stress methods of design is 49 m/s. The terrain and topographic features in Tuvalu are such that the design wind speed corresponding to the basic wind speed, is 45 m/s up to a height of 6 m. When the simplified procedure of AS 1170 part 2 is followed, the value of the factor B_1 to be applied is 1.5. The maps of Australia in the Standard are to be disregarded.

(b) **Other loads:** The principles of structural mechanics.

B1.3 Construction deemed-to-satisfy

The requirements of B1.1 for materials and forms of construction are satisfied if they comply with the following:

(a) **Masonry** : AS 3700 and NZS 4229.

(b) **Concrete construction** (including reinforced and prestressed concrete): AS 3600 or NZS 3109 and NZS 3124.

(c) **Steel construction-**

(i) Steel structures: AS 4100.

(ii) Cold formed steel structures: AS 1538.

(d) **Aluminium construction:** AS 1664.

(e) **Timber construction** - Design of timber structures: AS 1720.

(f) **Footings:** Footings for Class 1 buildings: AS 2870.1

(g) **Piling:** AS 2159.

(h) **Glass installations:** NZS 4223.

(i) **Protection from termites:** In areas subject to infestation by subterranean termites:

(i) Physical barriers: AS 1694.

(ii) Soil treatment: AS 2057.

(j) **Roof construction:**

TR 440 and manufacturer's recommendations.

(k) **Particleboard structural flooring:** AS 1860.

(l) **External wall cladding:** No structural damage when tested to TR 440 to withstand impact from a 4 kg piece of timber of nominal cross-section 100 mm x 50 mm striking end on at a velocity of 15 m/s.

B1.4 Allowable number of storeys

The maximum number of *storeys* must not exceed 3.

B1.5 Reinforcement and embedded steel to be protected

All steel reinforcement and other embedded items of steel, whether used in concrete or masonry must be:

(a) epoxy coated;

(b) hot dip galvanised; or

(c) otherwise protected against corrosion.

When galvanising is used as an option the cement used must be free of calcium hydroxide.

A patented chemical additive Z-12/C, is available for use with sea water and unwashed saline aggregate for making concrete of good quality and durability. Reinforcing bars do not easily corrode and destroy the concrete as would ordinarily be the case when using sea water and saline aggregates. The product is manufactured by Concrete Hitech (Holdings) Ltd., 15 Avenue Victor Hugo, 75116, Paris, France.

B1.6 Site mixed concrete and grout

When mixing concrete or grout at site the mix ratios corresponding to the *required* strength must be those given in Table B1.6

TABLE B1.6 MIX RATIOS FOR CEMENT AND GROUT

COMPRESSIVE STRENGTH	MIX RATIOS BY VOLUME			
	WATER	CEMENT	SAND	COARSE AGGREGATE
10 MPa concrete	1.0	1	2.5	3.0 of 20 mm agg.
17.5 MPa concrete	0.9	1	3.2	3.3 of 20 mm agg.
20 MPa concrete	0.8	1	2.7	3.0 of 20 mm agg.
25 MPa concrete	0.7	1	2.3	2.7 of 20 mm agg.
17.5 MPa grout	1.1	1	3.0	2.7 of 10 mm agg.

The quantity of water is the maximum allowable and must be reduced with increase in moisture content of sand or aggregate.

* SLUMP TEST MUST BE WITHIN THE RANGE OF 50-75 MM.

SLUM TEST RESULTS

CONSISTENCY	SLUMP (mm)	FLOW (%)	REMARKS
DRY	0-25	0-20	Crumbles & falls apart unless carefully handled; can be compacted into rigid mass under vigorous ramming, heavy pressure, or vibration, but unless care is used, exhibits voids or honeycomb.
STIFF	12-62	15-60	Pile tends to stand upright; holds together fairly well but crumbles if chuted; with care and effort can be tamped into solid dense mass; satisfactory for vibratory compaction.
MEDIUM	50-~~87~~ 125	50-100	Alternate terms: plastic, mushy, quaking; easily moulded, although some care required to secure complete compaction
WET	125-200	90-120	Pile flattens readily when dumped; can be poured into place
SLOPPY	175-250	110-150	Grout or mortar tends to run out of pile leaving coarser material behind

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DWELLINGS AND OUTBUILDINGS (CLASS 1 AND 10)

SECTION **DC**

FIRE RESISTANCE

Performance Requirements
Deemed-to-Satisfy Provisions

DC1 Fire Resistance and Stability

CONTENTS

PERFORMANCE REQUIREMENTS

OBJECTIVES

DCP1 A Class 1 building must be so designed and constructed that the following objectives are fulfilled:

(a) it is protected from fire in any other building; and

(b) materials used in the construction be such that if there is a fire in the building-

(i) the spread of fire and the generation of smoke and toxic gases will be minimised;

(ii) stability will be maintained for a period at least sufficient for the occupants to escape and to ensure the safety of fire-fighters; and

(iii) there will be little risk of collapse onto adjoining property.

REQUIRED PERFORMANCE

DCP1.1 *External walls* of class 1 buildings, located within 1m of the allotment boundary or 2m from other buildings on the same allotment must -

(a) remain stable and not allow the passage of destructive heat, flames, smoke or gases through them for an hour, in the event of a fire; and

(b) not allow the passage of flames, smoke or gases through *windows* for an hour and such *windows* must not be openable.

DCP 1.2 A *common wall* must if it separates a class 1 building from any other class, remain stable and prevent the passage of destructive heat, flames, smoke or gases for an hour, in the event of a fire.

DCP 1.3 The underside of a floor separating 2 *sole-occupancy units* each being a separate domicile must not be *combustible*.

DCP 1.4 Any *sarking-type material* used in a class 1 building must have a *flammability index* of less than 5.

DEEMED-TO-SATISFY PROVISIONS

FIRE RESISTANCE AND STABILITY

DC1.1 External walls of Class 1 buildings

Except as permitted by Clause DC1.3 or DC1.4, an *external wall* of a Class 1 building, and any openings in that wall, must be -

(a) set back not less than 1 m from an allotment boundary other than the boundary adjoining a road alignment or other public space; and

(b) not less than 2 m from another building on the same allotment.

DC1.2 Allowable encroachments

The distance from an allotment boundary or between buildings must be the shortest distance measured from the outermost point of the building or buildings concerned, except that-

(a) fascia, gutters, downpipes, *non-combustible* eaves lining, and the like;

(b) masonry chimney backs, flues, pipes, cooling appliances or other services;

(c) light fittings, electricity or gas meters, aerials or antennae;

(d) pergolas or sun blinds; and

(e) unroofed terraces, landings, steps or ramps, not more than 1 m in height,

may encroach into that distance if the distance to the boundary or between the buildings is not reduced to less than 500 mm or the distance between the buildings is not reduced to less than 1 m.

DC1.3 Exceptions

Clause DC1.1 does not apply to-

(a) an *external wall* that previously complied with this Part and is reclad, if the recladding does not reduce the distance to the boundary or building by more than 150 mm; or

(b) an *open garage*.

DC1.4 Common walls

A *common wall* must-

(a) be of masonry or concrete, or be fully lined with *fire-protective covering* and extend to the underside of a *non-combustible* roof or not less than 450 mm above a roof with a *combustible* lining;

(b) have a FRL of not less than 60/60/60 if it separates Class 1 buildings on different allotments.

DC1.5 Separating floors

The underside of a floor separating *sole-occupancy units*, each being a separate domicile and located one above the other, must be lined with material with a FRL of not less than 30/30/30.

DC1.6 Sarking-type materials

Any *sarking-type material* used in a Class 1 building must have a *Flammability Index* of not more than 5.

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DWELLINGS AND OUTBUILDINGS (CLASS 1 AND 10)

SECTION **DD**

ACCESS AND EGRESS

Performance Requirements
Deemed-to-Satisfy Provisions

CONTENTS

→ Residence (garage included).

PERFORMANCE REQUIREMENTS

OBJECTIVES AND REQUIRED PERFORMANCE

DDP 1 A Class 1 building must be so designed and constructed that the following are fulfilled:

(a) Stairways, ramps and passageways must be such as to provide safe passage for the users of the building.

(b) Stairways, ramps, floors and balconies, and any roof to which people normally have access, must have bounding walls, balustrades or other barriers where necessary to protect users from the risk of falling.

(c) Stairways must provide safe and reasonably comfortable dimensions for goings and risers. In any case the *pitch* of the stairway must be maintained within limits of 23° and 42°.

(d) If any ramp is used the slope must not exceed 1:8.

(e) A Class 1 building must have provision for fast *exit* during any emergency.

DEEMED-TO-SATISFY PROVISIONS

CONSTRUCTION OF EXITS

DD1.1 Treads and risers

(a) A stairway must be suitable to provide safe passage in relation to the nature, volume and frequency of likely usage.

(b) A stairway in any building satisfies (a) if it has:

(i) not more than 18 risers in each flight;

(ii) going and riser dimensions in accordance with Figure DD1.1 and Table DD1.1 that are constant throughout each flight;

(iii) risers which do not have any openings that would allow a 100 mm sphere to pass through between the treads; and

(iv) the tread must not exceed the going by more than 20 mm.

DD1.2 Curved stairs

Curved stairs must comply with the relevant requirements of DD1.1 as well as the following:

(a) For the purposes of satisfying Table DD1.1 the going must be measured:

(i) along half way across the width of the stair where the clear width is less than 900 mm; and

(ii) 300 mm from each side of the stair where the clear width is 900 mm or more.

(b) All steps must have the same uniform taper.

(c) The going at the narrow end of the steps must be not less than 75 mm.

(d) Winders are not permitted.

DD1.3 Balustrades

(a) A continuous balustrade must be provided along the side of any stairway or ramp, or any corridor, hallway, balcony, bridge or the like, if -

(i) it is not bounded by a wall; and

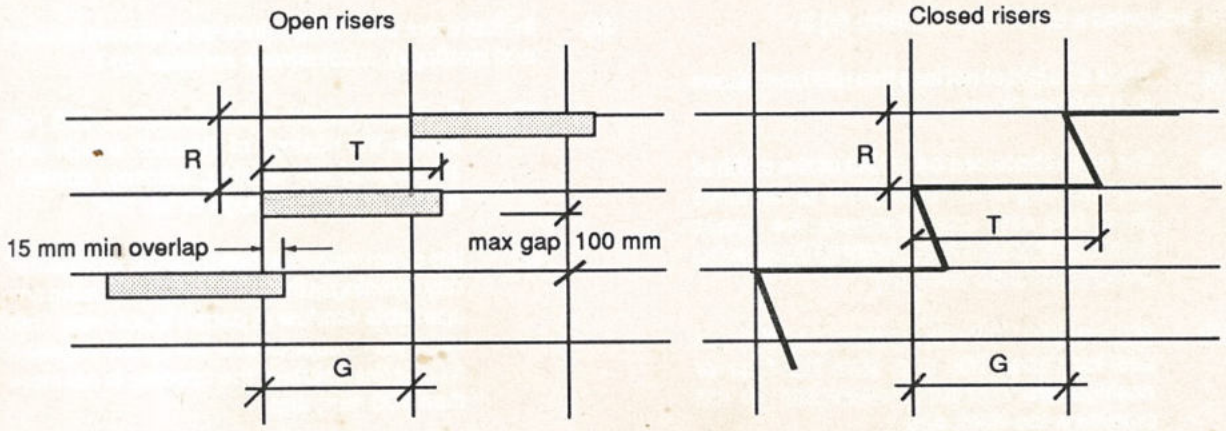
(ii) the change in level is more than 1 m.

(b) A balustrade must prevent, as far as practicable-

(i) children climbing over or through it;

(ii) persons accidentally falling from the floor; and

(iii) objects which might strike a person at a lower level accidentally falling from the floor surface.



Note: R = Riser
G = Going
T = Tread

FIGURE DD1.1 MEASUREMENT OF RISER GOING AND TREAD

TABLE DD1.1
RISER DIMENSIONS (mm) TO MATCH GOING

Pitch	GOING (mm)										
	230	240	250	260	270	280	290	300	310	320	330
42°											
41°	200										
40°	192	200									
39°	186	194	200								
38°	180	187	195	200							
37°	173	181	188	196	200						
36°	167	174	182	188	196	200					
35°	161	168	175	182	189	195	200				
34°	155	162	168	175	182	188	195	200			
33°	149	156	162	169	175	181	188	195	200		
32°		144	156	162	168	174	181	187	194	200	
31°			150	156	162	167	174	180	186	192	198
30°				150	156	161	167	173	179	185	190
29°					150	155	161	167	173	179	183
28°						150	155	160	165	170	175
27°							148	153	158	163	168
26°								146	151	156	161
25°										149	154
24°											147

Note:
Actual riser dimension may be selected to suit the inter landing height. However the value of the riser dimension must not be outside the maximum or minimum dimensions shown for each value of going.

(c) At balconies a balustrade satisfies (b) if -

(i) it has a height of not less than 930 mm above the balcony floor;

(ii) the space between balusters or the width of any opening in the balustrade is not more than 100 mm except where the space between the rails or the height of the opening is not more than 100 mm;

(iii) all parts of the balustrade more than 150 mm and less than 760 mm from the floor or nosings are vertical or otherwise do not provide a toe-hold; and

(iv) it does not have any openings more than 100 mm wide within 150 mm of the floor level.

(d) In stairways and ramps (including access bridges and landings) a balustrade satisfies (b) if -

(i) it has a height of not less than 865 mm above the nosings of the stair treads and the floor of the landing, balcony, corridor, hallway, access bridge or the like;

(ii) the space between balusters or the width of any opening in the balustrade (including any openable window or panel) is not more than 100 mm except where the space between rails or the height of the opening is not more than 100 mm; and

(iii) all parts of the balustrade more than 150 mm and less than 760 mm from the floor or nosings are vertical or otherwise do not provide a toe-hold.

DD 1.4 Parapets on flat roofs

Where a flat roof or other elevated place has regular access a parapet or balustrade of not less than 1 m height above the surface of the roof or elevated place must be provided. The width of any opening in the parapet or balustrade must not exceed 100 mm.

DD1.5 Number of exits

Every Class 1 building must have two *exits*. At least one of these *exits* must provide an easy means of egress in case of any emergency without reducing security to the building. Such emergency *exits* may take the form of a trap door on an elevated floor or some such arrangement. *Windows* and other such openings used as emergency *exits* must have a minimum clear dimension of 560 mm and a minimum clear area of opening of 0.6 m². The shutter must be capable of opening to 90° to the wall. The top of the *window* sill must be no more than 900 mm from the floor inside. The height of the *window* sill from the ground or floor outside must not exceed 1800 mm.

DD1.6 Ramp in exits

A ramp may be used in place of a stairway. The gradient of any such ramp must be no steeper than 1:8.

DD1.7 Dimensions of exits

The clear minimum width of a stairway or ramp must be 760 mm. The unobstructed height throughout must be not less than 2 m.

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DWELLINGS AND OUTBUILDINGS (CLASS 1 AND 10)

SECTION **DE**

ELECTRICITY

Performance Requirements
Deemed-to-Satisfy Provisions

CONTENTS

PERFORMANCE REQUIREMENTS

OBJECTIVES

All electrical work associated with a Class 1 building must meet the following objectives -

DEP1 Electrical Safety

It must prevent electrocution, burns or fire.

DEP2 Amenity

It must satisfy the reasonable expectations of the occupants by ensuring that it is adequate for their intended use, both current and anticipated.

REQUIRED REFORMANCE

DEP1.1 Electrical safety

The supply system must:

(a) have suitable devices of adequate interruptive duty to automatically shut off the supply in the event of a fault or overload. Such devices must allow easy reinstatement of the supply after interruption;

(b have devices which are clearly identified and easily reached to isolate live parts from the incoming supply;

(c) when the neutral of the supply is earthed, have socket outlet or plug - socket adaptor construction which would ensure that the live, neutral and earth conductors can only be connected to the corresponding live, neutral and earth conductors of the plug;

(d) be adequately protected against damage arising from exposure to weather, water or excessive dampness mechanical loads and other such agents expected under normal conditions of use; and

(e) ensure that the main switch is normally accessible only to the occupants.

DEP2.1 Amenity

The supply system must have an adequate number of plug sockets of minimum 10 Amperes capacity to serve the reasonable anticipated needs of the occupants.

DEEMED-TO-SATISFY PROVISIONS

ELECTRICAL SAFETY

DE1.1 General requirements

All electrical wiring and installations in or on any class 1 and 10 building must ensure safety from electric shock and fire. This requirement is satisfied if all electrical work associated with the building is done to comply with AS 3000 - Electrical installations - buildings, structures and premises (known as *the SAA Wiring Rules). The capacity of the system must* allow for the long term anticipated requirements of the occupants.

DE1.2 Plug sockets

Plug sockets must:

(a) have their individual switch;

(b) be located so that

(i) cords need not be taken across doorways;

(ii) trailing cords do not have to cross circulation routes;

(c) not be located behind door-swings; and

(d) in the kitchen be located 250 mm above worktops at the back of benches or on a return wall where it exists.

AMENITY

DE2.1 Light switch layout

The layout of light switches must follow the main night time circulation routes such as from the entrance hall to the living area to the bed-rooms to the bathroom and toilet. Crossing any major space in the dark must be avoided. The switches must be located close to door openings.

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DWELLINGS AND OUTBUILDINGS (CLASS 1 AND 10)

SECTION **DF**

HEALTH AND AMENITY

Performance Requirements
Deemed-to-Satisfy Provisions

CONTENTS

PERFORMANCE REQUIREMENTS

DAMP AND WEATHERPROOFING

OBJECTIVES

DFP1 The design and construction of a Class 1 building must meet the following objectives -

(a) freedom from unhealthy and uncomfortable damp and wet conditions;

(b) proper facilities for the preparation and cooking of food and the cleaning of utensils;

(c) adequate facilities for personal washing and the washing of clothes;

(d) hygienic toilet facilities with adequate privacy and which will not be a nuisance to anyone;

(e) sufficient living space for privacy and comfort;

(f) adequate light and ventilation consistent with the requirements of health hygiene and comfort;

REQUIRED PERFORMANCE

DFP 1.1 Damp and weatherproofing

Buildings must be so sited and suitable damp and weatherproofing provided where necessary to prevent-

(a) moisture or damp affecting the stability of the building;

(flooding may erode foundation)

(b) the creation of any unhealthy or dangerous condition;

(c) damage or defacement from moisture present at the completion of construction;

(d) causing undue damage to adjoining property; or

(e) the accumulation of surface water against the building or beneath the floor.

Visible water must not be allowed to remain under or around for more than 1 hour after 10 minutes of maximum rainfall resulting from a storm water with a return period of 5 years.

DFP1.2 Cooking and sanitary facilities

Adequate cooking toilet and washing facilities must be provided for the occupants to allow reasonable comfort, hygiene and privacy.

DFP1.3 Room sizes

The *floor area* , plan dimensions and ceiling heights of rooms and other spaces must be adequate for living purposes.

DFP1.4 Light and ventilation

The standard of light and ventilation within a building must be adequate for the occupants, having regard to health hygiene and comfort.

DFP1.5 Water supply plumbing

Plumbing for watersupply must use materials which do not react with the water and thereby make it unsuitable for domestic use. Suitable precautions must be taken to ensure that unsafe or unhygienic materials have no chance of entering the supply system. The installation of hot water systems must not impair the safety of the users. All concealed and difficult-to-access plumbing work must be suitably protected so that there is no liklihood of damage and leakage. The plumbing must take into account the current and anticipated needs of the users and allow for the simultaneous use of the connected system by others. Where rainwater from the roof run off is the source of supply care must be exercised to ensure that there is no reasonable chance for the water to become contaminated. Allowance must be made for lean years of rainfall.

DFP1.6 Sanitary plumbing and drainage

Sanitary plumbing must be be laid to self-cleansing grades consistent with their discharge loading, unless other suitable arrangements are made to ensure that the system is kept free of the accretion of sewage and other waste matter. The size of drains and the layout of their connections must reasonably ensure the current and anticipated needs of the users. The connections to sanitary installations must ensure that foul gases are not allowed to produce unhygienic conditions nor create any nuisance to anyone and are suitably vented.

DFP1.7 Roof drainage

Any roof drainage system provided must be capable of handling the reasonably expected peak intensities of rainfall.

* Hardies - Roof-A-Way (Rainbow) - check other roof drainage systems.

DEEMED-TO-SATISFY PROVISIONS

DAMP AND WEATHERPROOFING

DF1.1 Site drainage

The construction of a site drainage system and the position and manner of discharge of a stormwater drain must not-

(a) result in the entry of water into any building or other allotments;

(b) affect the stability of any building; or

(c) create any unhealthy or dangerous condition within or around any building.

DF1.2 Building on land subject to dampness or flooding

One or more of the following measures must be carried out if it is warranted by the dampness of the building *site* or proneness to flooding:

(a) The subsoil must be adequately drained.

(b) The ground under the building must be regraded or filled and provided with outlets to prevent accumulation of water.

(c) The surface of the ground under the building must be covered with a suitable damp-resisting material.

(d) The top of the floor must be kept at not less than 300 mm above the known flood level at the *site*.

DF1.3 Drainage of land external to building

A suitable system of drainage must be provided if paving, excavation or any other work on an allotment will cause undue interference with the existing drainage of rainwater falling on the allotment whether the existing drainage is natural or otherwise.

DF1.4 Weatherproofing of roofs and walls

Roofs and *external walls* must be constructed to prevent rain or dampness penetrating to the inner parts of a building.

DF1.5 Pliable roof sarking

Pliable roof *sarking- type material* used under roof or wall coverings must comply and be fixed in accordance with-

(a) AS 1736; or

(b) AS 1903 and AS 1904.

DF1.6 Water proofing of wet areas in buildings

The following parts of a building must be impervious to water:

(a) In any building - the floor surface or substrate in a shower enclosure, or within 1.5 m measured horizontally from a point vertically below the shower fitting, if there is no enclosure;

(b) The wall surface or substrate-

(i) of a shower enclosure, or if the shower is not enclosed, within 1.5 m and exposed to a shower fitting, to a height of 1.8 m above the floor;

(ii) immediately adjacent or behind a bath, trough, basin, sink, or similar fixture, to a height of 300 mm above the fixture if it is within 75 mm of the wall.

(c) The junction between the floor and wall if the wall and floor are *required* to be impervious to water.

(d) The junction between the wall and fixture if the wall is *required* to be impervious to water.

DF1.7 Damp-proof courses and mortars

Moisture from the ground must be prevented from reaching-

(a) the lowest floor timbers and the walls above the lowest floor joists;

(b) the walls above the damp-proof course; and

(c) the underside of a suspended floor constructed of a material other than timber, and the supporting beams or girders.

DF1.8 Acceptable damp-proof courses

A damp-proof course must consist of-

(a) a material that complies with AS 2904; or

(b) suitable termite shields placed on piers; or

(c) other suitable material.

DF1.9 Damp-proofing of floors on the ground

If a floor of a room is laid on the ground or on filling moisture from the ground must be prevented from reaching the upper surface of the floor and adjacent walls by-

(a) the insertion of a vapour barrier in accordance with AS 2870.1; or

(b) other suitable means.

COOKING AND SANITARY FACILITIES

DF2.1 Facilities required

Cooking and sanitary facilities must be provided as shown in Table DF2.1.

TABLE DF2.1
PROVISION OF COOKING AND SANITARY FACILITIES

	MINIMUM FACILITIES REQUIRED
In all cases	a) facilities for the preparation and cooking of food, and for the cleaning of utensils.
Where there is piped water supply to the kitchen and ablution areas	(b) a kitchen sink in a kitchen (c) a shower or other adequate personal washing facilities. (d) clothes washing facilities. (e) a closet pan and facilities for washing hands.
Where there is piped watersupply only to a tap in the kitchen or up to a stand- pipe in the vicinity of the building or where there is no piped water supply	(f) a paved raised platform with a paved area and drain around it. (g) a suitable type of privy as per Specification DF2.1.

NOTE:

i) If any of these facilities are detached from the main building, they must be set aside for the exclusive use of the occupants of the building.

ii) Where the layout allows it, facilities in (c), (d) and (e) can be in the same room.

ROOM SIZES AND HEIGHTS

DF3.1 Height of rooms

Minimum heights below the ceiling and any framing excluding minor projections such as cornices, are:

(i) *habitable room* - average 2.4 m and minimum of 2.1 m; and

(ii) bathroom, shower room, water closet, laundry, pantry, or the like - 2.1 m.

DF3.2 Reduced height permissible

These heights may be reduced if the reduction does not unduly interfere with the proper functioning of the room.

DF3.3 Ceiling fans

Ceiling fans and other such appliances must be at a minimum vertical clearance of 2.1 m.

LIGHT AND VENTILATION

DF4.1 Provision of natural light

Natural lighting must be provided to all *habitable rooms*.

DF4.2 Methods and extent of natural lighting

Direct natural lighting must be provided by *windows* that-

(a) have an aggregate light transmitting area measured excluding framing members, glazing bars or other obstructions of not less than 10% of the *floor area* of the room;

(b) face-

(i) a court or other space open to the sky; or

(ii) an open verandah, open carport, or the like;

(c) are not less than a horizontal distance of 1 m from any boundary of an adjoining allotment that they face.

DF4.3 Natural light borrowed from adjoining room

Natural lighting to a room may come through a glazed panel or opening from an adjoining room (including an enclosed verandah) if-

(a) the glazed panel or opening has an area of not less than 10% of the *floor area* of the room to which it provides light;

(b) the adjoining room has *windows* with an aggregate light transmitting area of not less than 10% of the combined *floor areas* of both rooms,

and the areas specified in (a) and (b) may be reduced as appropriate if direct natural light is provided from another source.

DF4.4 Artificial lighting

Artificial lighting must be provided to sanitary compartments, bathrooms, shower rooms, airlock and laundries, if natural lighting of a standard equivalent to that *required* by DF4.2 is not available and the periods of occupation, or use of the room or space will create undue hazard to occupants seeking egress in an emergency.

DF4.5 Ventilation of rooms

A *habitable room, sanitary compartment*, bathroom, shower room, laundry and any other room occupied by a person for any purpose must be provided with natural ventilation complying with DF4.6. Where it is not practical to provide natural ventilation for any *sanitary compartment*, bathroom, shower or laundry, it is permissible to substitute natural ventilation with a mechanical ventilation of equal effectiveness.

DF4.6 Natural ventilation

Required natural ventilation must be provided by permanent *windows*, openings, doors or other devices -

(a) with an aggregate opening or openable size which must be not less than the following percentages of the *floor area* of the room *required* to be ventilated;

(i) 15% for *habitable rooms*; and

(ii) 10% for all other rooms; and

(b) which open to-

(i) a court, or space open to the sky; or

(ii) an open verandah, open carport, or the like.

DF4.7 Ventilation borrowed from adjoining room

Natural ventilation to a room may come through a *window*, opening, ventilating door or other device from an adjoining room (including an enclosed verandah) if -

(i) the room to be ventilated or from which ventilation is borrowed is not a *sanitary compartment* ;

(ii) ventilation is not borrowed from one bedroom to another or between a bedroom and the kitchen;

(iii) the *window*, opening, door or other device has a ventilating area of not less than the *required* percentages of the *floor area* of the room to be ventilated; and

(iv) the adjoining room has a window, opening, door or other device with a ventilating area of not less than the *required* percentages of the combined *floor areas* of both rooms.

NOTE: The ventilating areas specified may be reduced as appropriate if direct natural ventilation is provided from another source.

DF4.8 Restriction on position of WCs and urinals

A room containing a closet pan or urinal must not open directly into-

(a) a kitchen; or

(b) a room for storage or consumption of food, except if it is in a building containing only one *habitable room*.

DF4.9 Airlocks

If a room containing a closet pan or urinal is prohibited under DF4.8 from opening directly to another room -

(i) access must be by an airlock, hallway or other room; or

(ii) the room containing the closet pan or urinal must be provided with an exhaust fan.

DF4.10 Sub-floor ventilation

(a) Suitable provision must be made to prevent undue deterioration of the lowest floor of a building because of dampness, other conditions on the allotment or the design of the building.

(b) The following would satisfy the requirements of (a) -

(i) where timber is used, the floor framing must be suspended with an absolute minimum of 250 mm and an average minimum of 400 mm clearance from the ground underneath, to the floor and the immediate surrounds of the building. The average clearance must be determined as the average of the clearances at the corners of a 3 m square grid covering the building plan. Subfloor ventilation must be provided with ventilation openings totalling not less than 3% of the peripheral vertical area between the ground and the boundary of the floor. These openings are to be spaced as evenly as practicable.

(ii) where other than timber is used the following must be provided -

- Subfloor ventilation if the floor is suspended;
- an impervious cover over the ground surface beneath the building; or
- the floor members suitably treated.

WATERSUPPLY PLUMBING

DF5.1 General requirements

The plumbing work for water supply must ensure -

(a) the appropriateness of the materials and products used;

(b) the correct sizing of water services for the intended use;

(c) the control of cross-connections and prevention of backflow;

(d) adequate care in the installation of the services;

(e) suitable provision of main and subsidiary storage as *required* ;

(f) adequate connections to sanitary services without endangering health and hygiene; and

(g) that the installation of hot water systems provide safe and adequate service.

DF5.2 Means of compliance

The requirements of DF5.1 are satisfied if all plumbing for watersupply is carried out to the relevant provisions of -

(a) AS 3500 - Part 1 for cold water service; and

(b) AS 3500 - Part 4 for hot water service.

DF5.3 Pipes which are not easy to access

Particular attention is drawn to the provisions in AS 3500 - Parts 1 and 4 which prohibit the installation of pipes and fittings of certain materials in locations which are concealed or difficult to access. These include pipes made of ABS, galvanised steel, polybutylene and UPVC. Pipes and fittings made of copper, copper alloy, stainless steel, ductile iron, cast iron and polyethylene when used in concealed or difficult to access locations must follow the special precautions specified in AS 3500 - Parts 1 and 4.

DF5.4 Access to domestic-type water heaters

(a) A household water heater which is installed in a building must-

(i) be supported on construction sufficient to carry its full capacity weight and any possible wind or other loads;

(ii) be positioned to enable adequate access for operation, maintenance and removal; and

(iii) provide suitably for any overflow, especially if installed in a concealed location.

(b) AS 3500 - Part 4 is the relevant standard for the installation of a household water heater.

DF5.5 Rainwater storage

Where rainwater is collected and stored, the storage and distribution must reasonably ensure that the water is not contaminated by unsafe or unsuitable materials. The capacity of the catchment and storage must be adequate to provide a continued supply of water during years of low rainfall.

The details given in Specification DF5.5 meet the requirements of this clause.

SANITARY PLUMBING AND DRAINAGE

DF6.1 General

DF6.1.1 Requirements

Sanitary plumbing and drainage must ensure -

(a) the appropriateness of the products and materials used;

(b) the correct sizing of drainage services for the intended use;

(c) adequate care in the installation of the services including the provision of appropriate grades; and

(d) that foul gases are not allowed to produce unhygienic conditions or any nuisance to anyone.

DF6.1.2 Some common terms

Apart from the defined terms given in A1.1 the following terms used in this Section are explained:

(a) Nominal size (DN)

While converting to metric dimensions some manufacturers of pipes and fittings have used hard conversion whereas others have used soft conversion. For these and other reasons it is impractical to specify exact pipe and fitting dimensions. All pipes and fittings in this Section are therefore specified by their nominal size. This is indicated by the letters "DN" followed by a number. Since this number is only an approximation of the actual size, it is not subject to exact measurement and must not be used in calculations. The nominal size is thus only a numerical designation of the size which is common to all components in a piping system (other than components such as steel tubes which are designated by their outside diameter and other components by their thread size). It is just a convenient round number for reference purposes and is only loosely related to the manufacturing dimensions.

(b) Trap

A trap is a device which retains a water seal for preventing the escape of sewer gases from sanitary plumbing. Figure DF6.1.2 shows two common types of fixture traps. There are also traps integral with gullies, water closet pans etc.

The water seal can be broken by self-siphonage or induced siphonage as well as by positive pressure of the gases breaking through the seal. It is also possible for the seal to be dried out by prolonged non-use of the associated part of the system.

The best means of preventing the loss of the seal by siphonage or by positive pressure is to vent the trap to the outside air.

(c) Fixture discharge pipe

This is the discharge pipe to which any single sanitary fixture is connected.

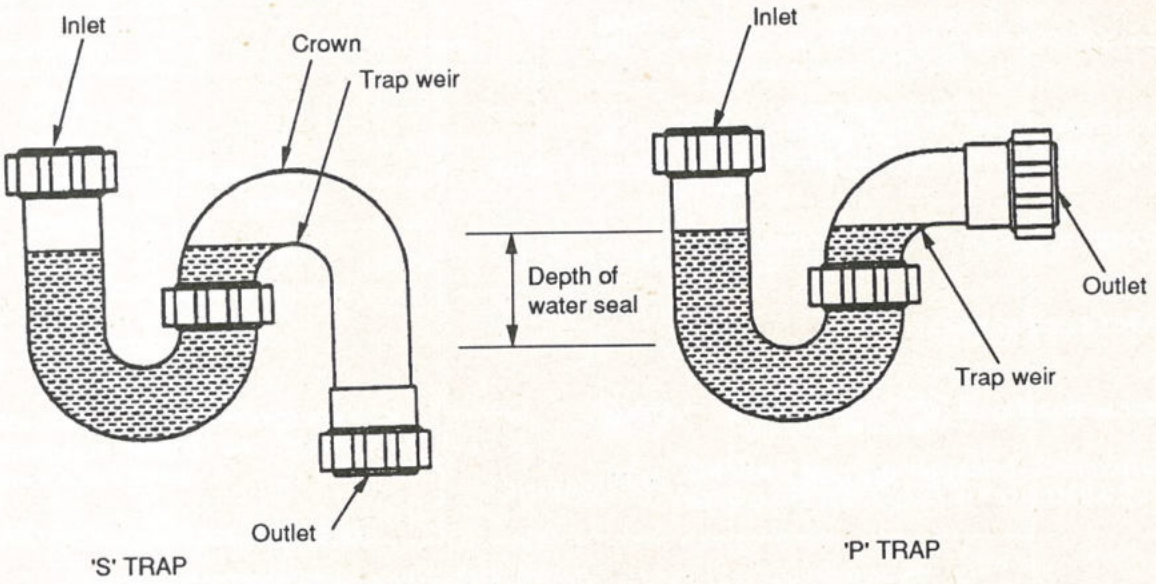


FIGURE DF6.1.2 EXAMPLES OF FIXTURE TRAPS

(d) Gullies

A gully is an assembly used for providing a water seal when handling the discharge from only *waste fixtures* and not any *soil fixture*. The water seal prevents the escape of foul gases into the building or into the atmosphere in the vicinity of the assembly.

It is a disconnector gully when it provides a separation through the water seal, between the discharge from *waste fixtures* and the rest of the sanitary system.

A floor waste gully is a disconnector gully used inside a building with a floor grating or waste outlet fitting on a riser pipe. Discharge pipes from *waste fixtures* may also connect to a floor waste gully.

An overflow relief gully functions as a self-cleaning trap and is provided with a loosely fitted grating. This allows for the relief of any possible surcharge or overflow from the *drain*. The riser of the gully may have inlets for discharge from *waste fixtures*.

DF6.2 Means of compliance

The requirements of DF6.1.1 are satisfied if all sanitary plumbing and drainage works are carried out to the relevant provisions of AS 3500 - Part 2 - Sanitary plumbing and sanitary drainage, as well as this part of the Code.

DF6.3 Fixture unit ratings

In the design of discharge pipes and *drains* the *fixture unit* ratings shown in Table DF6.3 must be used. For the fixtures listed in the Table the maximum unvented length of the associated fixture discharge pipe must not exceed 2.5 m except that this may be 6 m for a water closet pan with a DN100 trap and discharge pipe. The length of the pipe is measured along the centre line from the weir of the trap to the point of connection to a graded discharge pipe, *drain*, *stack* or other drainage trap.

TABLE DF6.3
FIXTURE UNIT RATINGS

Fixture	Nominal size of trap outlet and fixture discharge pipe	*Fixture unit* rating
Basin	DN30 or DN40	1
Bath (with or without shower)	DN40	4
Bidet	DN40	1
* Clothes washing machine	DN40	5
* Dishwashing machine	DN40	3
Floor waste gully		
- without fixture	DN50	0
- with fixture	DN40 or DN 50	as per fixture rating
Laundry trough	DN40 or DN 50	5
Shower	DN40 or DN50	2
Sink		
- less than 45 litres	DN40	2
- more than 45 litres	DN50	3
Water closet pan	DN80 or DN100	5

* (i) When a clothes washing machine connects to a trough trap, only the trough unit fixture rating is considered.
(ii) When a dishwashing machine connects to a sink trap only the sink *fixture unit* rating is considered.

DF6.4 Trapping of fixtures and appliances

DF6.4.1 The discharge from all sanitary fixtures and appliances must pass through traps before entering the *drain*, *soil pipe* or *waste pipe*. The fixture trap must retain a water seal of:

(a) 50 mm for traps of size DN50 or less

(b) 75 mm for traps of size greater than DN50

The traps must be located as close as possible to the fixture and not farther than 600 mm from the fixture outlet, except in case of permitted fixture pairs and floor waste gullies.

DF6.4.2 The flollowing fixtures may be connected in pairs to a single fixture trap:

(a) Wash basins

(b) Sinks

(c) Laundry troughs

(d) Showers

The fixture pairs must be connected so that the centre to centre distance between their outlets is no more than 1.2 m.

DF6.5 Fixture discharge pipes

DF6.5.1 Minimum grades

Discharge pipes must be laid to the minimum grades shown in Table DF6.5.1

TABLE DF6.5.1
MINIMUM GRADES OF DISCHARGE PIPES

Nominal size	Minimum grade
DN30	1 in 30
DN40	1 in 40
DN65	1 in 40
DN80	1 in 60
DN100	1 in 60

DF6.5.2 Connections

The connection of any fixture discharge pipe to a graded discharge pipe or between two graded discharge pipes must be made as follows:

(a) With 45° or *sweep junction* fittings;

(b) Where the pipes are of different sizes-

(i) the soffits of both must be in continuous alignment, and

(ii) where an unequal junction fitting is used, the soffit of the branch pipe must be at the same level or higher than the soffit of the pipe to which it connects; and

(c) The level of the trap or floor waste gully weir must be at a higher level than the soffit of the graded discharge pipe to which it connects.

DF6.5.3 Cleaning eyes

Fixture discharge pipes must have accessible cleaning eyes at all bends.

DF6.6 Unvented branch drains

Where the risk of escape of dangerous and unpleasant gases into occupied premises is minimal the venting of branch *drains* is not *required*. However all of the limitations given in the following sub-clauses and illustrated in figure DF6.6 must be met in such cases. (For limitation of length of fixture discharge pipes, see DF6.3.)

DF6.6.1 Limitations on location or nature of connection

(a) The connection of any unvented branch *drain* to a vented *drain* must be located at the ground floor level and the vented *drain* installed on grade below or above ground;

(b) In the case of an unvented *drain* receiving discharge from only *waste fixtures*, it must connect to a gully;

(c) An unvented *drain* other than in (b) must connect to a disconnector gully; or

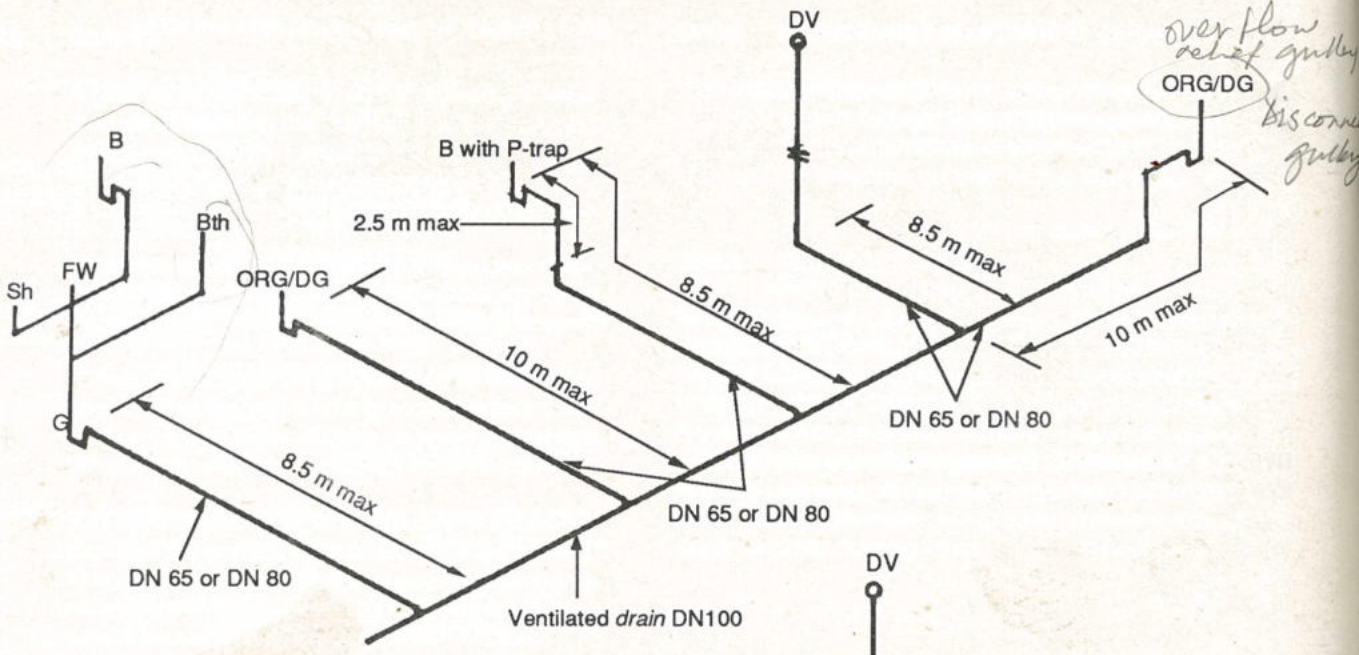
(d) The connection must be from a discharge pipe serving a single fixture and the length of the discharge pipe is-

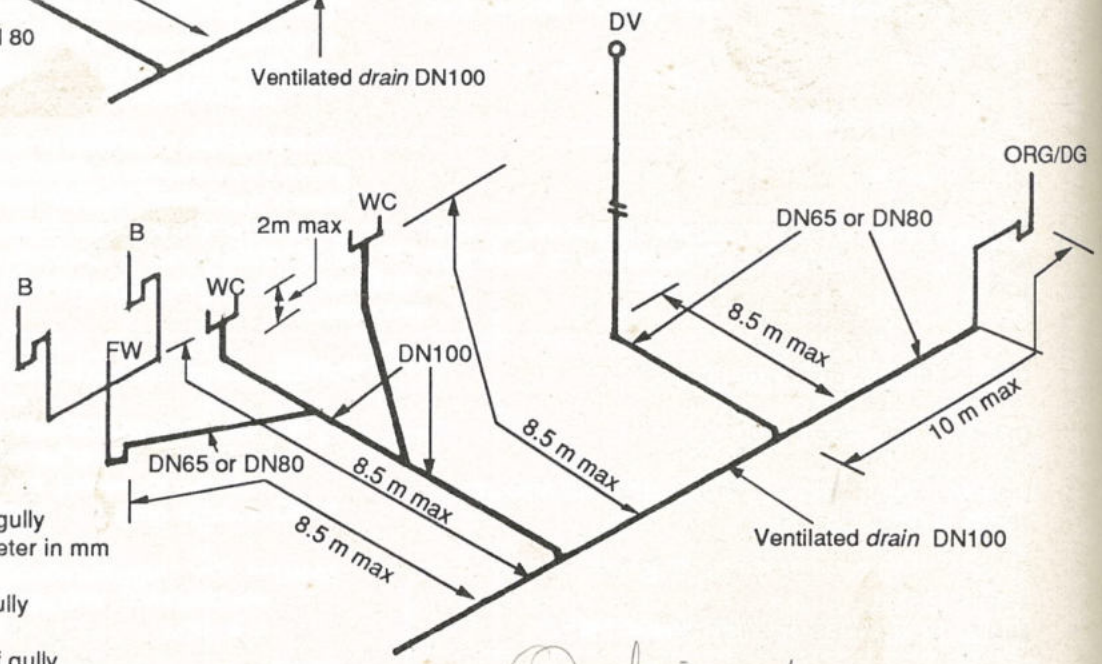
(i) less than 3.5 m when serving a *waste fixture*; or

(ii) less than 3.0 m when serving a *soil fixture*.

DF6.6.2 Limitations on size, length and bends

(a) The size of any unvented branch *drain* must comply with the limitations given in Table DF6.6.2





B = Basin
Bth = Bath
DG = Disconnector gully
DN = Nominal diameter in mm
DV = Drain vent
FW = Floor waste gully
G = Gully
ORG = Overflow relief gully
Sh = Shower
WC = Water closet pan

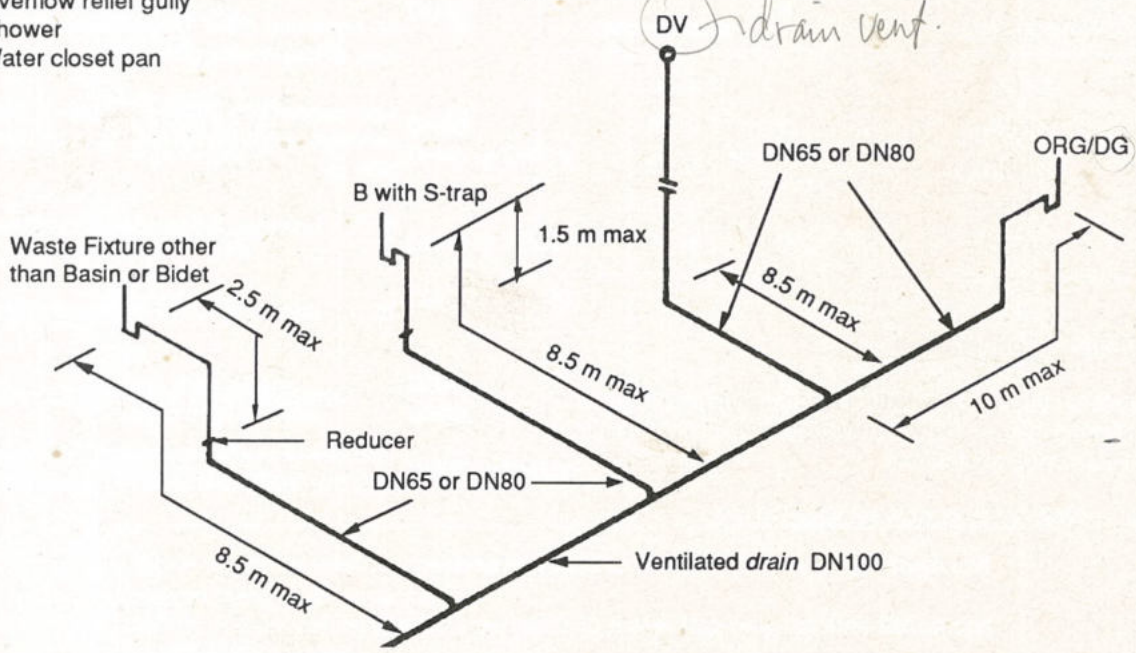


FIGURE DF6.6 LIMITATIONS ON UNVENTED BRANCH DRAINS

TABLE DF6.6.2
SIZE OF UNVENTED BRANCH DRAINS

Nominal size	Maximum sum of *fixture unit* loadings discharging into the branch *drain*
DN65	5 (but not from a water closet pan) or 8 from one floor waste gully
DN80	12 (no more than 1 water closet pan connected)
DN100	30 (no more than 2 water closet pan connected)

(b) The length of an unvented branch *drain* together with that of the fixture discharge pipe must not exceed -

(i) 8.5 m from the weir of the fixture trap;

(ii) 10 m to a disconnector gully; and

(iii) 2.5 m from the reducer to the weir of the trap, where the fixture discharge pipe is of smaller size than the unvented branch *drain*.

(c) The maximum vertical drop from the crown of the trap to the top of the vented *drain* to which the unvented branch *drain* connects must not exceed -

(i) 1.5 m in the case of basins and bidets; and

(ii) 2.5 m in the case of all other fixtures.

(d) The total combined number of long bends in a fixture discharge pipe and branch *drain*, up to the connection with a vented *drain* must be limited to:

(i) 2 horizontal and 2 vertical with basins and bidets; and

(ii) 2 horizontal and 3 vertical with all other fixtures. The distance between any adjacent horizontal bends must be not less than 300 mm and the vertical drop between two adjacent vertical bends must not exceed 2 m.

Note: A bend of 45° or less is not considered to be a bend for the purposes of this clause.

DF6.7 Venting

In order to prevent the escape of dangerous and unpleasant gases into occupied premises and to ensure that water seals in traps are not destroyed by siphonage, adequate venting must be provided for all fixture discharge pipes and *drains* except as allowed by DF6.6.

DF6.7.1 Trap vents

The minimum size of a trap vent must be related to the nominal size of the fixture trap as follows:

Size of fixture trap	Size of trap vent
DN30 or DN40	DN30
DN50 to DN100	DN40

Every trap vent must be extended upward at least 50 mm above the flood level rim of the fixture. This may be accomplished in one of the following ways:

(a) As a vertical vent to open air, the outlet of which is no closer than 900 mm from any opening to the building;

(b) On an ascending grade of at least 1: 80 and then:

(i) as a vertical vent to the open air; or

(ii) to a connection with a vertical or branch vent.

(c) Take the vent above the flood level rim of the fixture, then loop it down either vertically or on a downward grade of 1: 80 and connect to a vertical or branch vent.

Trap vents must be located no closer than 75 mm and no farther than 1500 mm from the crown of the trap.

DF6.7.2 Drain vents

(a) General

Vents in *drains* must be provided -

(i) at the upstream end of any *drain*;

(ii) at the upstream end of any branch *drain* to which a fixture trap or floor waste gully is connected and if the distance from the weir of the trap to the vented *drain* exceeds 8.5 m;

(iii) at the upstream end of any DN100 branch *drain* to which 3 or more water closet pans are connected; and

(iv) at the upstream end of any DN80 branch *drain* to which no more than 2 water closet pans are connected.

(b) Location

The upstream vent of any *drain* must be connected-

(i) at or close to the end of the *drain*; or

(ii) at the vent extension of a *stack* located at or near the upstream end of the *drain*.

In either case it is permissible to have an unvented length of *drain* upstream of the vent connection if the unvented length complies with DF6.6.

(c) Size of vents

The minimum size of an upstream vent of any *drain* is DN50. Subject to this, the vent must be sized by using the ratings given in Table D6.7.2.

TABLE DF6.7.2
SIZE AND RATING OF DRAIN VENTS

Fixture units discharging into drain	Vent rating	Vent size
1 to 10 (incl)	0.5	DN40
10 (excl) to 30 (incl)	1	DN50
30 (excl) to 175 (incl)	2	DN65
175 (excl) to 400 (incl)	3	DN80

When two or more vents are directly connected to the *drain* these can take the place of a single vent provided the sum of their ratings is not less than the rating *required* for venting the *drain*.

DF6.7.3 Termination of vents

(a) Vent pipes from waste fixtures discharging into disconnector gullies and from gullies located within buildings must be vented independently and not be interconnected to any other system vent. Such vents must terminate in the open air:

(i) at a height of at least 50 mm above the overflow level of the associated fixture;

(ii) at least 900 mm from any opening to the building which is within a horizontal distance of 3 m from the vent; and

(ii) not less than 150 mm above its point of penetration through any roof covering.

(b) Vents other than in (a) must terminate in the open air:

(i) not less than 600 mm above any opening into any building which is within a horizontal distance of 3 m from the vent;

(ii) not less than 150 mm above its point of penetration through any roof covering;

(iii) not less than 3 m above any trafficable roof deck which is within a horizontal distance of 3 m from the vent;

(iv) not less than 2 m above or 600 mm below any chimney or similar opening within a horizotal distance of 3 m from the vent;

(v) not less than 5 m from any air intake; and

(vi) not less than 600 mm above any eave, coping or parapet which is within a horizontal distance of 600 mm from the vent.

DF6.8 Design of pipes and drains

DF6.8.1 Sizing of disharge pipes

Discharge pipes must be not less than the size of the fixture traps to which they are connected. The size must be determined from Table DF6.3 and take into consideration:

(i) the sum of the *fixture unit* rating of all fixtures connected to the pipe;

(ii) the proposed pipe gradient; and

(iii) the maximum *fixture unit* loadings given in Table DF6.8.1

TABLE DF6.8.1
MAXIMUM FIXTURE UNIT LOADINGS FOR GRADED DISCHARGE PIPES

Grade	Nominal pipe size (mm)				
	40	50	65	80	100
1 in 20	6	15	51	65	376
1 in 30	5	10	29	39	248
1 in 40	4	8	21	27	182
1 in 50	x	x	x	20	142
1 in 60	x	x	x	16	115

Note

(i) x indicates that the combination of pipe size and gradient is not permitted.

(ii) Not more than 2 w.c. pans are to be connected to any 80 mm pipe

DF6.8.2 Sizing of drains

The size of a vented *drain* must be determined by taking into account the total number of *fixture units* (obtained from Table DF6.3) discharging into the drain.

(a) Normal grades

The minimum normal grade of *drains* must be as given in Table DF6.8.2A

TABLE DF6.8.2 A
MINIMUM GRADIENT OF DRAINS

Nominal size (mm)	Minimum grade
80	1 in 60
100	1 in 60
125	1 in 80
150	1 in 100

(b) Maximum *fixture unit* loadings for vented *drains*

The *fixture unit* loadings for vented *drains* must not exceed the values given in Table DF6.8.2 B for the size and grade of the *drain* shown.

TABLE DF6.8.2 B
MAXIMUM FIXTURE UNIT LOADINGS FOR VENTED DRAINS

Grade	Nominal pipe size (mm)			
	80	100	125	150
1 in 20	215	515	1450	2920
1 in 30	140	345	1040	2200
1 in 40	100	255	815	1790
1 in 50	76	205	665	1510
1 in 60	61	185	560	1310
1 in 70	50	140	485	1180
1 in 80	42	120	425	1040
1 in 90	x	x	380	935
1 in 100	x	x	340	855
1 in 120	x	x	x	725
1 in 150	x	x	x	595

Note: x indicates that the combination of nominal size and grade is not permitted.

(c) Reduced grades

Where the minimum grades given in Table DF6.8.2A are not achievable *drains* may be laid at the reduced grades given in Table DF6.8.2 C. In such a case the minimum *fixture unit* loadings given in the Table must be connected in advance of the top end of the reduced grade. Where even these reduced grades cannot be achieved provision must be made for regular and automatic flushing of the *drain*.

TABLE DF6.8.2 C
MINIMUM FIXTURE UNIT LOADINGS FOR REDUCED GRADE DRAINS

Reduced grade	Nominal pipe size (mm)			
	80	100	125	150
	Minimum *fixture unit* loading			
1 in 70	9	10	See Table DF6.8.2A	
1 in 80	10	18	"	"
1 in 90	x	x	27	"
1 in 100	x	x	38	"
1 in 120	x	x	x	75
1 in 150	x	x	x	160

Note: x means that the grade is not permitted unless special automatic flushing arrangements are made.

(d) A *drain* must not be oversized for the only purpose of using a lower gradient than the minimum gradient given in Table DF6.8.2A. The size of a *drain* must not reduce in the direction of flow.

DF6.8.3 Cover over drains

(a) *Drains* must be protected against any mechanical damage and deformation resulting from the loads over them. Adequate cover must be provided to comply with Table DF6.8.3 unless exempted under (b).

TABLE DF6.8.3
MINIMUM DEPTH OF COVER OVER DRAINS

Location	Minimum cover from top of pipe socket to ground surface (mm)	
	Pipes of cast iron or ductile iron	Pipes of other materials
Household driveways	300	450
Other locations where no vehicular loadings are expected	Nil	300

(b) Where it is not practical to provide the minimum cover to Table DF6.8.3, *drains* must be covered by a sandy overlay of at least 50 mm and provided with-

(i) 75 mm thick concrete paving where light vehicular traffic may be expected; and

(ii) 50 mm thick concrete paving at other locations where vehicular traffic is not expected.

The paving must be symmetric to the *drain* alignment and must have a minimum width equal to the depth of the base of the drain from the top of the paving plus 300 mm.

DF6.8.4 Drains close to buildings

(a) *Drains* under buildings

Where it cannot reasonably be avoided *drains* may be laid below ground under buildings in which case-

(i) inspection openings must be provided at both ends of the *drain* adjacent to the building; and

(ii) a minimum of 50 mm of sandy overlay provided over the pipe and below a reinforced concrete floor slab; or

(iii) the *drain* must be protected from damage.

(b) Proximity of buildings

(i) where a *drain* is to be laid parallel to a footing the excavation for it must clear a line at 45° from the extremity of the footing. (See Figure 6.8.4)

(ii) where a *drain* crosses a strip footing, the angle of crossing must be not less than 45° and the top of the *drain* must clear the bottom of the footing by not less than 50 mm.

(c) Building over *drains*

Where it is not practical to divert *drains* in order to avoid erecting buildings over them -

(i) the restrictions listed in (a) and (b) must be observed; and

(ii) other appropriate engineering precautions taken against damage.

DF6.9 Gully traps other than floor waste gullies.

Gully traps may be used;

(a) as overflow relief gullies to provide in the event of sewage surcharge; or

(b) to provide disconnection between waste discharges and the remainder of the sewerage installation (disconnector gullies).

DF9.1 General

(a) A gully must be installed such that -

(i) it is supported on a minimum 75 mm thickness of concrete of 17.5 MPa grade; and

(ii) it is protected from damage at floor level by a concrete surround of minimum width and depth of 75 mm.

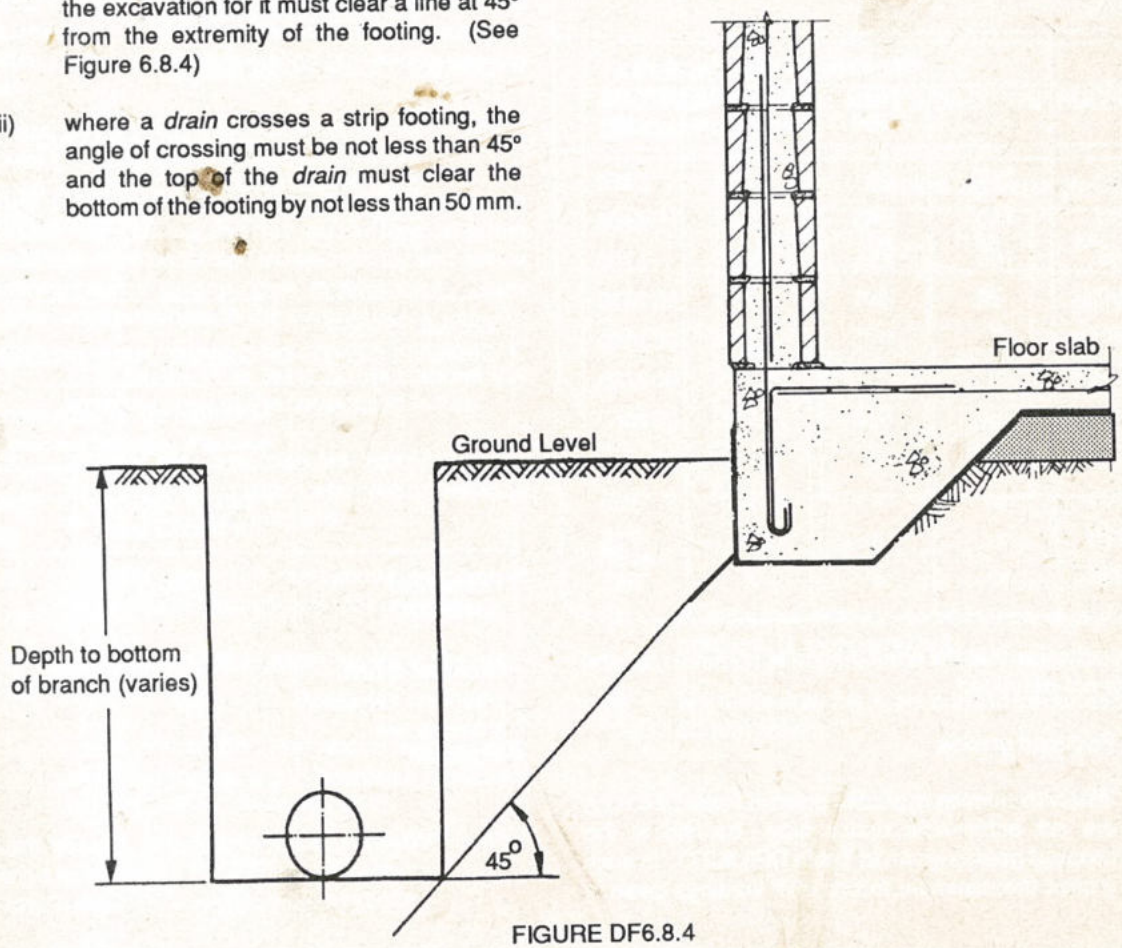


FIGURE DF6.8.4

(b) The following discharges must not be allowed into a gully:

(i) from any *soil fixture*; and

(ii) any rain water drainage from the roof or ground.

(c) The gully must have its water seal maintained from a *waste fixture* or floor waste gully. The maximum length of unvented waste pipe discharging into the gully must be 2.5 m from basins or bidets, 6 m from all other waste gullies and fixtures with DN50 or smaller pipes, and 8.5 m from floor waste gullies and fixtures with DN65 or larger pipes.

DF6.9.2 Overflow relief gullies

At least one overflow relief gully must be installed in a *drain* which is connected to a public *sewer*.

(a) Size

The size of the overflow relief gully is related to the size of the main *drain*. For a size of main *drain* of DN80 the gully must also be DN80. For main *drains* of DN100 to 150 size, the gully must be DN100.

(b) Location

An overflow relief gully must be located within the property, external to the building, as far as practicable from the downstream end of the *drain*, and so that the top of the gully is accessible and positioned where any overflow can be easily noticed.

(c) Height

A minimum height of 150 mm must be kept between the top of the overflow gully riser and the lowest fixture connected to the *drain*. The point of measurement on fixtures is given in Table DF6.9.2.

TABLE DF6.9.2
POINT OF MEASUREMENT OF FIXTURES FOR HEIGHT ABOVE OVERFLOW LEVEL OF GULLY

Fixture	Point of measurement
Soil fixture with integral trap	Level of water seal surface
Floor waste gully or shower outlet	Top surface level of grate
Other fixtures	Top surface level of fixture outlet

DF6.9.3 Disconnector gully traps

Where installed within a building these must:

(a) have the gully riser extend to floor level and be sealed with an airtight removable cover; and

(b) a DN50 vent pipe must branch from the riser at an upward grade of not less than 1 in 80 and terminate with a grating at an external wall of the building above any likely flood level. Alternately the vent pipe can terminate as in DF6.7.3(a). No other fixture or appliance must be connected to the vent pipe.

DF6.10 Floor waste gullies

Floor waste gullies are functionally similar to fixture water traps. Shower outlets may be used as floor waste gullies. Any *waste fixture* may be connected to a floor waste gully. No trap is *required* other than for discharge outlets from basins. For other than basins the maximum length of the untrapped waste pipe must not exceed 1.2 m. If any of the fixtures is trapped, the maxium length of the waste pipe is allowed to be up to 2.5 m. However, the traps must not be vented. With the exception of allowed fixture pairs, each fixture must connect individually with the gully at a grade of not less than 1 in 40.

DF6.10.1 Size

The outlet size of a floor waste gully trap is based on the total *fixture units* of the fixtures and appliances discharging into it. The outlet size must be:

(a) DN50 for a total *fixture unit* rating of 3 units or less; and

(b) DN65 to DN100 for a total *fixture unit* rating of 10 or less.

A DN50 outlet and a DN50 riser may be used if the sole function of the gully is to dispose of water spillage and washdown water. All other gullies must have a minimum riser size of DN80 at floor level. A floor waste gully must have an accessible, removable grate.

DF6.10.2 Height of gully riser

The minimum height of the gully riser from the top of the water seal to the floor surface must comply with Table DF6.10.2. The maxium height must not exceed 600 mm.

TABLE DF6.10.2
MINIMUM HEIGHT OF FLOOR WASTE GULLY RISERS

Fixture connected	Minimum height from water seal to floor level (mm)	
	Waste pipe entry at 88.5°	Waste pipe entry at 45°
Shower	150	100
Bath (only one)	250	200
Clothes washing machine	300	250
Other waste fixtures	250	150

DF6.10.3 Maintenance of water seal

At least one *waste fixture* must be connected to any floor waste gully in order to maintain the water seal. For this reason the minimum depth of water seal must be 65 mm or the values in DF6.4.1, whichever is more.

DF6.11 Inspection openings

DF6.11.1 General

Inspection openings comprise:

(a) inspection branches or square *junctions*; or

(b) inspection chambers.

DF6.11.2 Location

Inspection openings must be provided:

(a) outside the building on each branch connecting one or more water closet pans;

(b) at intervals of not more than 30 m;

(c) downstream and upstream ends of any section of *drain* that passes under a building;

(d) where any new section of *drain* is connected to an existing *drain*; and

(e) at the connection to the public *sewer*.

Appropriate locations are illustrated in Figure DF6.11.2.

DF6.11.3 Size

(a) The size of inspection branches or square junctions must be:

(i) the same size as the *drain* for drains up to DN150; and

(ii) not less than DN150 for larger *drains*.

(b) The dimensions of inspection chambers must comply with Table DF6.11.3.

TABLE DF6.11.3
SIZE OF INSPECTION CHAMBERS

Depth to floor of chamber	Minimum internal measurement (mm)		
	Rectangular		Circular
	Length	Width	Diameter
Less than 600	600	450	600
600 to 900	900	600	900
More than 900	1200	750	1050

DF6.11.4 Access for inspection branches and square junctions

Inspection branches and square *junctions* must be so located that it is possible to use them for inspection and for clearing obstructions in the associated sections of the *drain*. When located inside buildings inspection branches and square *junctions* must have their openings readily accessible. Such openings must have airtight removable caps or plugs with gaskets, rubber rings or such other accessories to maintain tightness. When the caps or plugs are removed for inspection/maintenance, the gasket/rubber ring must be replaced with a new one.

DF6.11.5 Construction of inspection chambers

(a) Where *required*

An inspection chamber is *required* where an inspection branch or square junction:

(i) cannot accommodate all the convergent *drains*; or

(ii) will not permit proper inspection or the clearing of obstructions.

(b) Conduits and channels

The conduits in inspection chambers may be open channnels of size and shape equal to the associated *drains*. The floor in inspection chambers must slope at a grade of between 1 in 10 and 1 in 15 towards the channel. Any formed junction must have a centre line radius of not less than 300 mm. A fall of at least 30 mm must be provided in the invert of any charnel that curves through 45° or more.

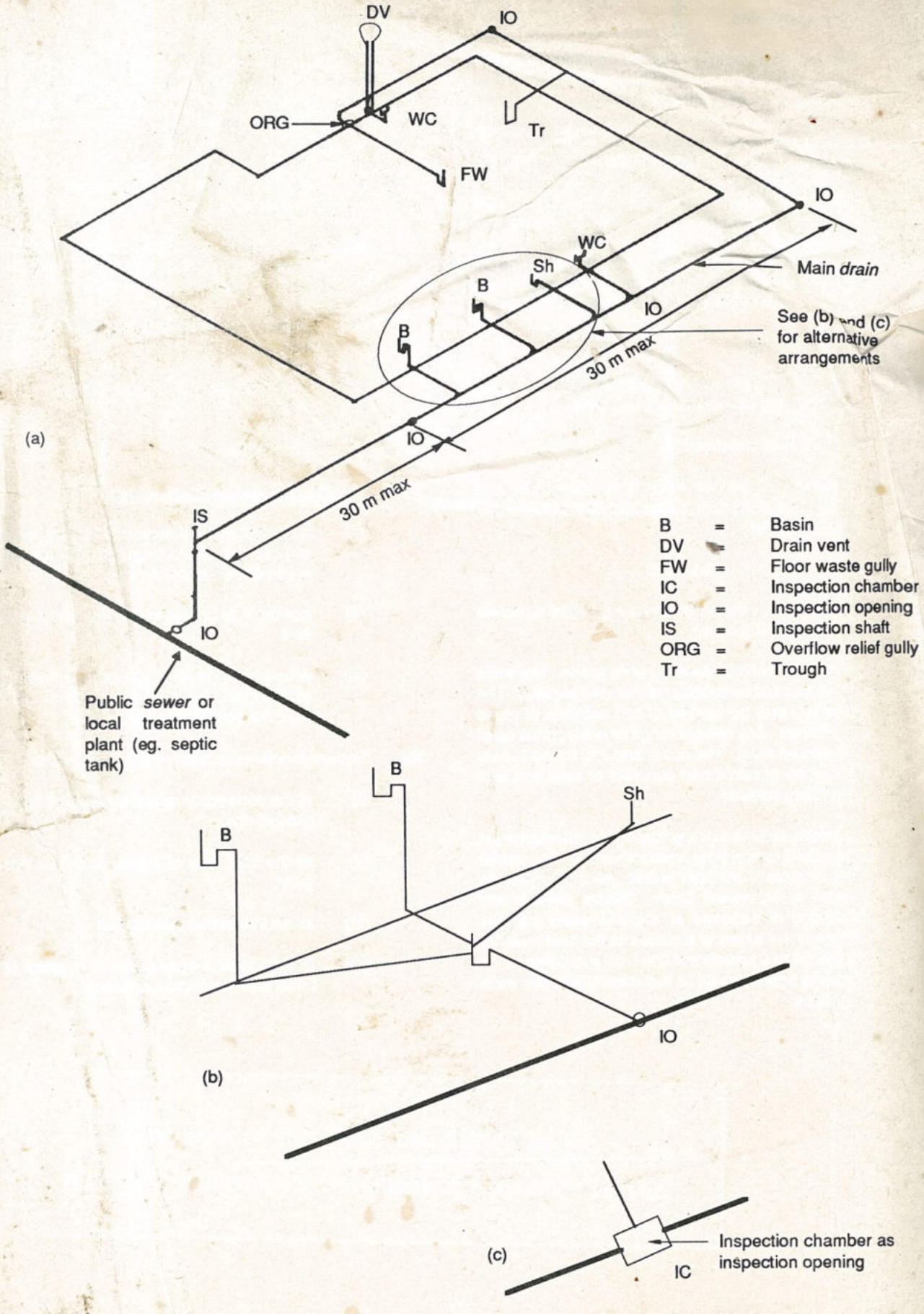


FIGURE DF6.11.2 LOCATION OF INSPECTION OPENINGS

(c) Access opening

A circular or rectangular access opening of 530 mm minimum dimension and fitted with a removable water tight cover must be provided at surface level. The cover must have been designed and installed to take any likely load on it. Where the size of the inspection chamber is larger than the size of the access opening, the top section of the chamber may be suitably tapered. Where this is done the full dimensions of the chamber must be maintained for a height from the chamber floor of at least 1.5 m, and the depth of the narrower shaft at the top not exceed 350 mm. The minimum dimension of the shaft except at the opening must be 600 mm.

(d) Access ladder

Where the depth of the chamber exceeds 1.2 m rungs or rung ladders must be provided to AS 1657.

(e) Materials of construction

Inspection chambers must have their base and walls of a minimum thickness of 150 mm and constructed of :

(i) base - concrete; and

(ii) walls - concrete or fully grouted concrete block masonry.

The concrete must be of 20 MPa grade. The walls and base must be suitably reinforced if *required*. The channels may be formed of half sections of pipes and fittings. Any access rungs or ladder must be of galvanised steel. The cover and any frame to seal it must be of reinforced concrete or cast iron with safe lifting devices.

The walls and base of any inspection chamber must be cement rendered to a smooth finish. The render may contain a suitable water proofing agent to ensure a waterproof finish. Where there is any likelihood of seepage of sub-soil water into the manhole the external surfaces of the wall must be plastered to a waterproof finish or a suitable water proofing agent added to the concrete in the walls and base.

(f) Inserts

The contact area between pipes or fittings and the walls formed around them, as well as holes broken into or formed in the walls of inspection chambers for insertion of pipes or fittings must be made water tight by -

(i) the application of a suitable bonding agent around the pipes;

(ii) caulking the annular space between the wall and the pipe or fitting with a stiff mix of one part cement and 2 parts sand;

(iii) sealing with an epoxy based or other suitable sealant; or

(iv) a combination of these methods.

DF6.11.6 Junctions

(a) *Junctions* of *drains* must -

(i) be swept in the direction of flow or have an oblique *junction* fitting with an upstream angle of no more than 60°;

(ii) not be Y *junctions* in the horizontal plane; and

(iii) where unequal *junctions* are used have the soffit of the branch in level with or higher than the soffit of the larger size.

(b) Square *junctions* in *drains* must only be used:

(i) at the connection of an inspection shaft to a graded *drain*;

(ii) as the inlet riser of a gully or a floor waste gully;

(iii) as an inspection opening; or

(iv) at the top of a drop *junction* in place of a bend and inspection opening.

ROOF DRAINAGE

DF7.1 Design of roof gutters

(a) Roof gutters where provided must be sized using the information given in Table DF7.1.

TABLE DF7.1
GUTTER SIZES

Type of gutter	Roof catchment area (m^2)			
	10	20	50	100
	Required cross-sectional area of gutter (mm^2)			
Eaves gutter	1400	2500	5180	9100
Internal box and valley gutter	1600	2750	5700	10000

Notes:

(1) The roof catchment area is the area of the roof drained by one downpipe. It is taken as the area of the roof from ridge to gutter between two adjacent downpipes.

(2) Values can be interpolated for catchment areas falling between the given figures.

(3) The gutter sizes do not include any allowance for freeboard. A freeboard of 25 mm for eaves gutters and 35 mm for internal box gutters must be added to the cross-sections derived from the table. No freeboard allowance need be added to valley gutters.

(b) Gutters must have a minimum slope of:

(i) 1 in 500 for eaves gutters; and

(ii) 1 in 200 for internal box gutters.

These slopes must be increased where there is any material risk of clogging of the gutters and downpipes with leaves and other such matter.

Note:

With high fronted eaves with facia boards there could be overflow from the back of the gutter into the building if the downpipes or gutters are blocked. One method of preventing such overflow is by providing drainage slots along the front of the gutter at a level lower than the back edge. Another method would be to provide sumps and weirs at the ends of the gutter or where the downpipes take off. The risk of overflow into the building from any internal box gutter can be reduced by providing sumps and weirs at the ends of the gutter.

DF7.2 Design of downpipes

The minimum area of cross-section of a downpipe must be the greater of:

(a) half the area of cross-section of the gutter it serves; or

(b) the area calculated for each 10 m^2 of the roof area drained by it at the rate of:

(i) 650 mm^2 for eaves gutters; and

(ii) 930 mm^2 for internal box gutters.

DF7.3 Incompatible metals for gutters

Direct contact between the following metals must be avoided in order to prevent corrosion:

Zinc or aluminium and alloys of either } and { copper or copper alloys and some grades of stainless steel.

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 flies 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 or 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 pit latrines, aqua privies, 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).

4.1 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.

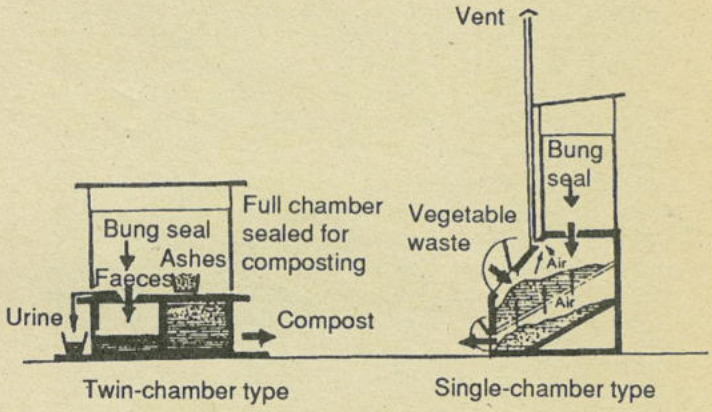


FIGURE 4.1 COMPOSTING LATRINES

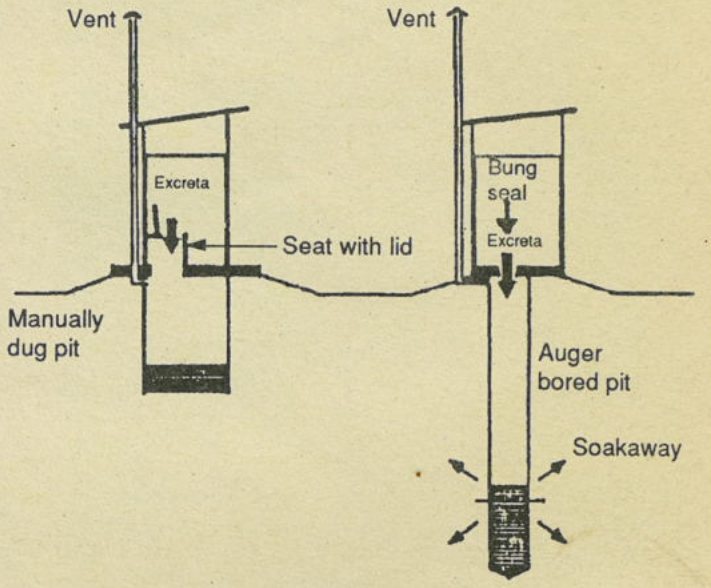


FIGURE 4.2 DRY (NONFLUSH) PIT LATRINES

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.

4.2 Dry Pit Latrines have no flushing facility (Fig 4.2). They are manually dug pits 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.

4.3 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 a tall pipe.

For more details of dry pit and wet pit latrines see Annexure 1 to this Specification.

4.4 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 enters the tank through a short pipe that penetrates below the surface of the liquid in the tank to minimise odours. Alternately,

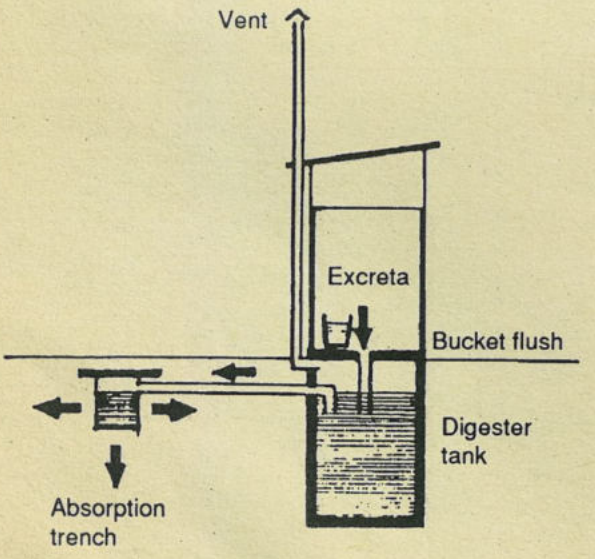


FIGURE 4.4 AQUA PRIVY

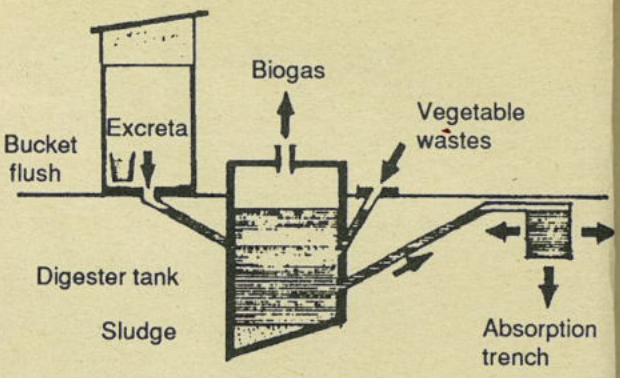


FIGURE 4.6 BIOGAS DIGESTER

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 this process of decomposition are vented through a tall vent pipe. Excess effluent from the tank is drained to absorption trenches.

4.5 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.

4.6 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 contents of the digester tank should have a carbon: nitrogen ratio of approximately 30:1. Vegetable wastes are usually added 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.

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 30m 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 than where a potable source of water is located;

(f) such that it is accessible to the household at all times; and

(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 pit 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 or 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 600mm, 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 700mm diameter the depth of the pit would be 3.8m for a 5 year life) or the depth reduced to cater for a shorter life for the pit.

A cover slab of 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 bored circular pit of 600 to 700 mm diameter.

4 Construction

4.1 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 or 1 part cement, 2 parts clean sand and 4 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.

4.2 Foundation

The foundation provides a sealed support for the cover slab and raises it above the surrounding ground. The foundation may be cast in 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.

4.3 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.

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 seat the slab over the foundation. The finished surface of the slab must be at least 150 mm above the immediate surrounds.

4.4 Vent pipe

A 100mm 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 4.4A. 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 mosquitoes from entering the pit (Figure 4.4B).

Mosquitoe breeding inside the pit is not a 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.

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 of the 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 in the slab rather than through the vent).

4.5 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 less hot in summer and thereby reduce the chances of foul gases escaping through the hole in the cover slab. The interior of the shed must be shaded from too much light as flies are attracted to light.

5 Maintenance

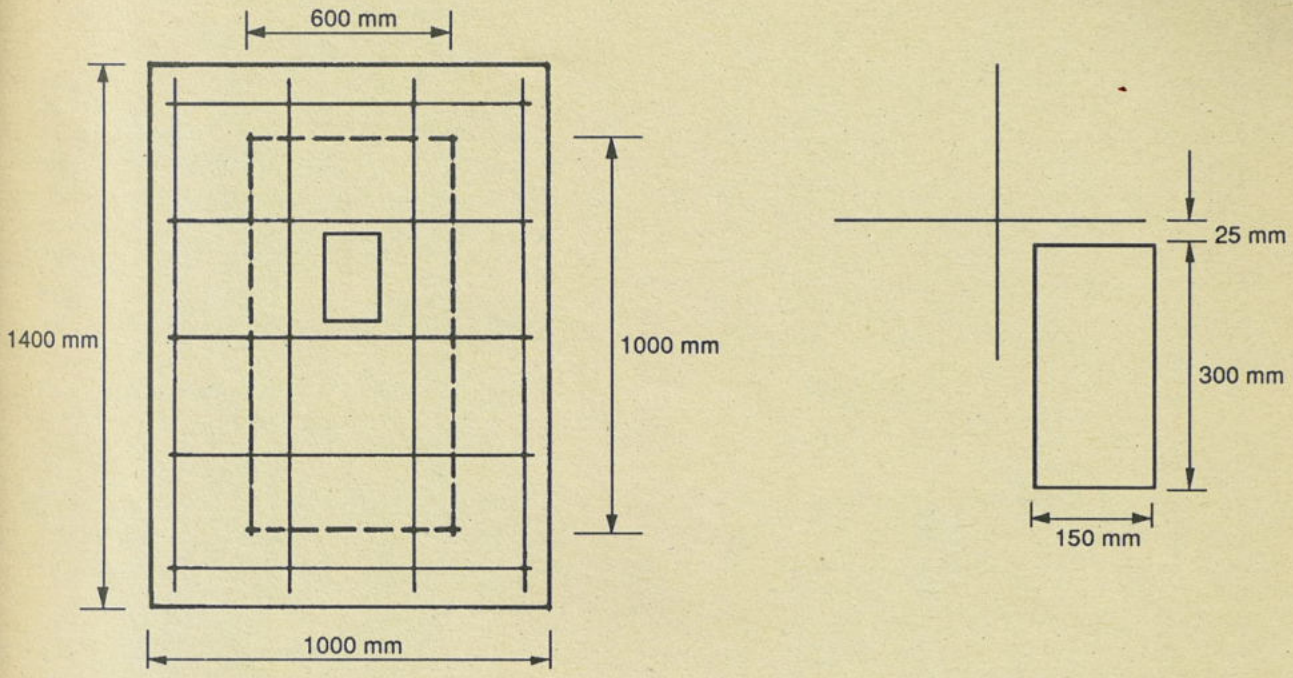
The pit latrine must be kept clean at all times. However do not use strong disinfectants in large quantities. It is best to use a wet mop or wet rag soaked in diluted disinfectant or cleaning agent to clean the cover slab and seat. If chemicals and cleaning agents are allowed inside the pit, they would drastically affect the bacterial degradation of the waste matter and there could be problems with 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.

6 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 (the 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 surples earth is available when the material subsides with decomposition. The pit can be dug out after a minimum period of one year and the material safely used as a fertiliser.



Note: All reinforcement 10 mm bars with 20 mm cover

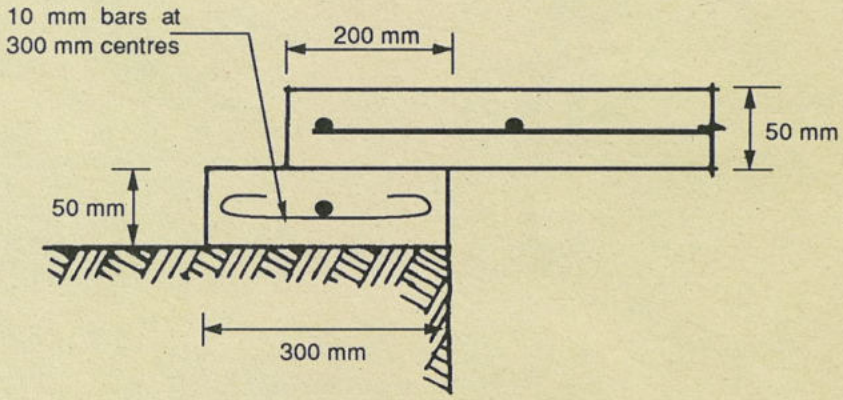
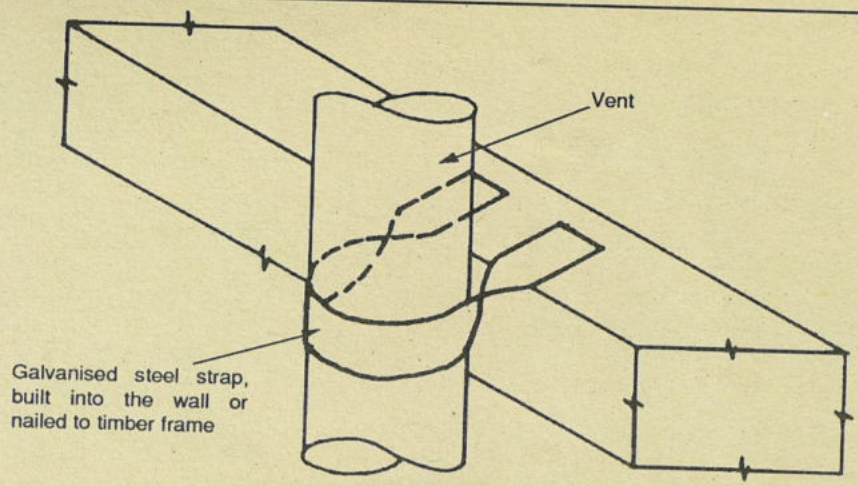


FIGURE 4.3A DETAILS OF SQUAT TYPE COVER SLAB



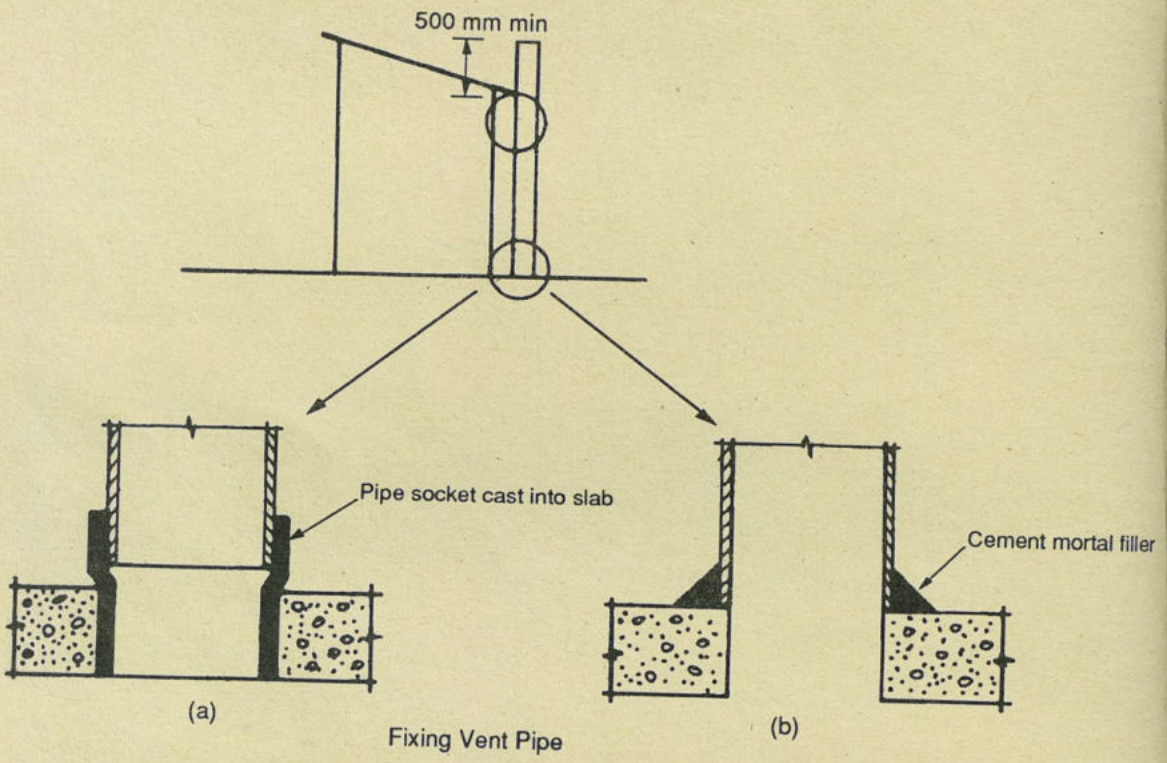


FIGURE 4.4A METHODS OF FIXING THE VENT PIPE

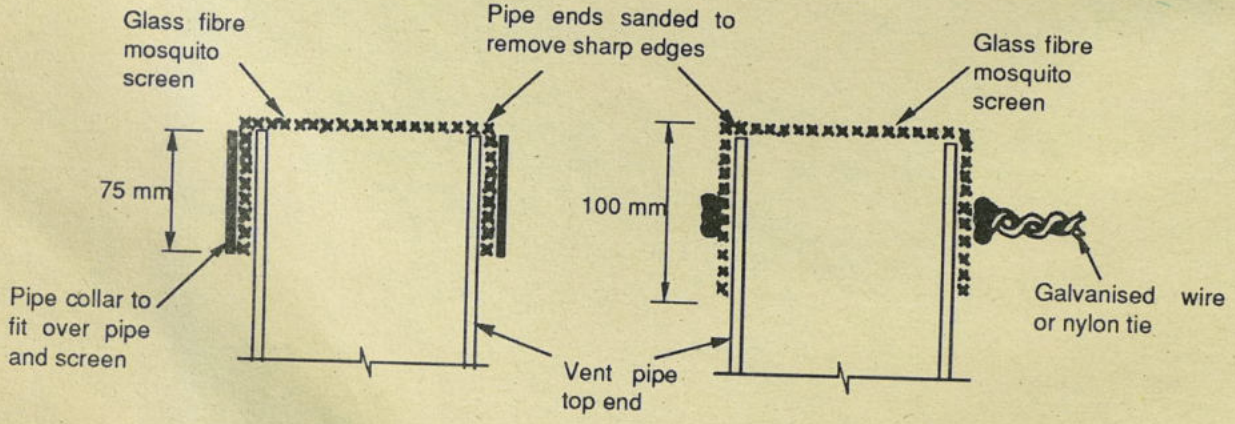
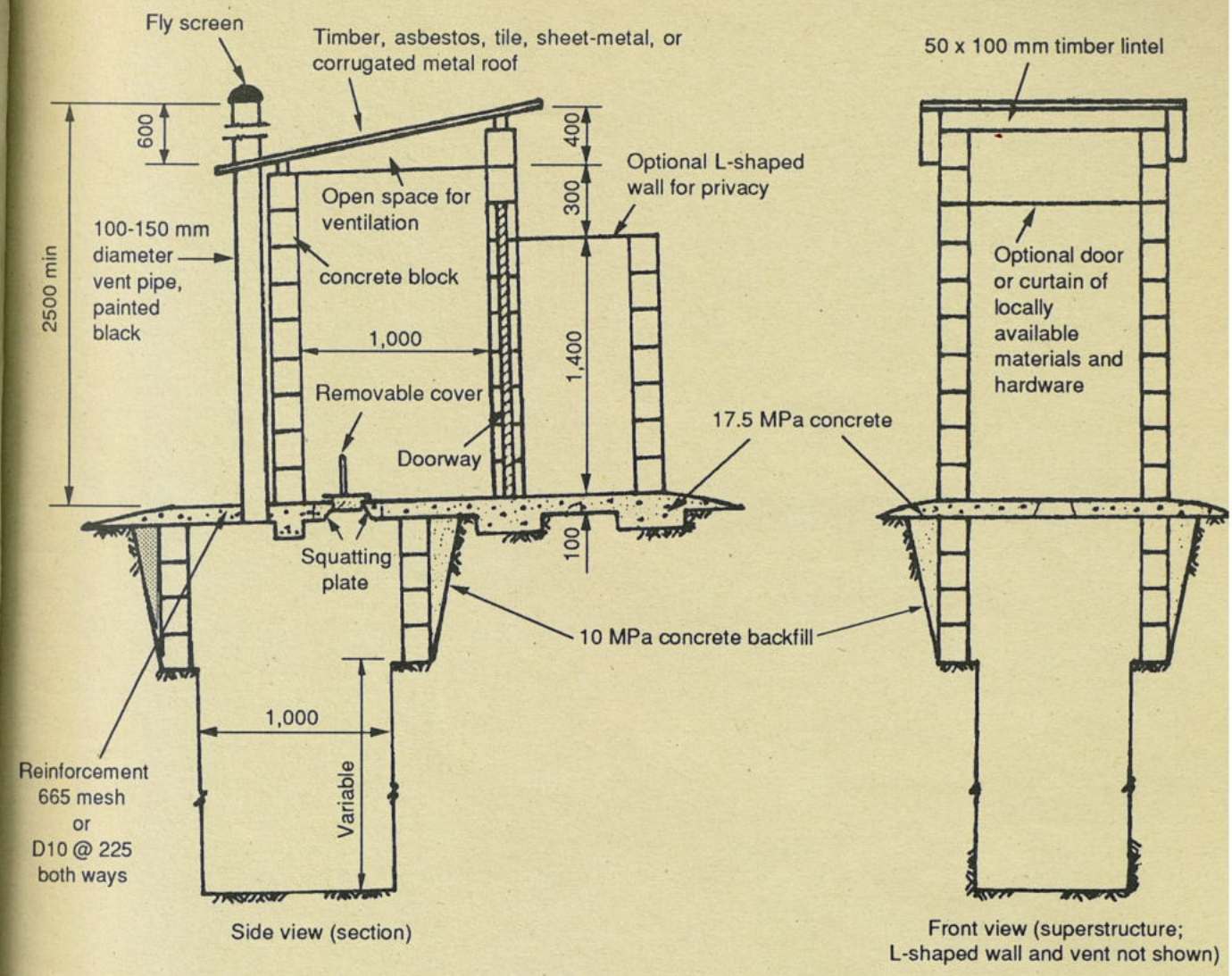
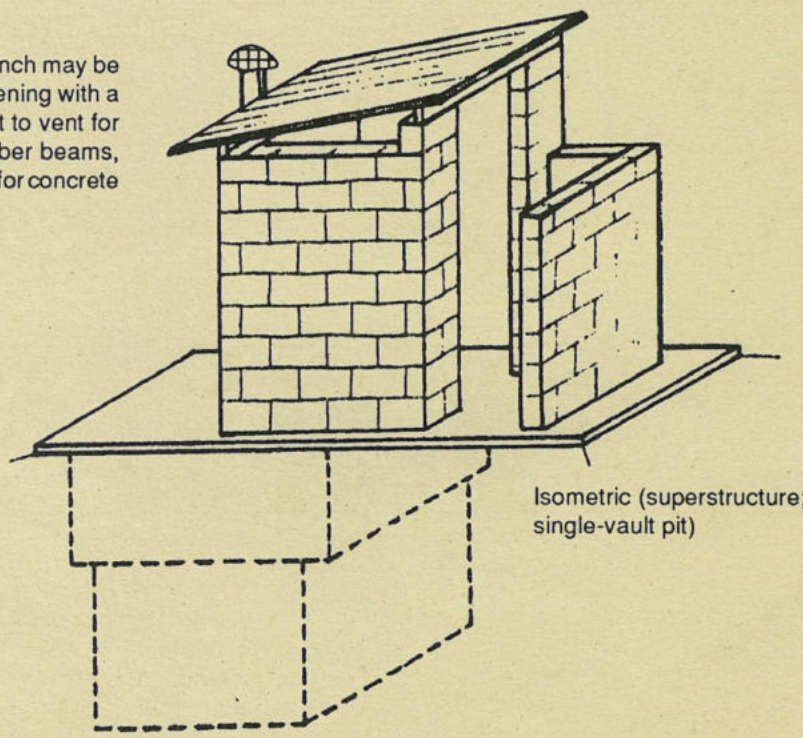


FIGURE 4.4B FIXING OF INSECT SCREEN OVER VENT PIPE



Note: Side view. Pedestal seat or bench may be substituted for squatting plate. An opening with a cover slab or seal to be provided next to vent for desludging. Preservative treated timber beams, flooring, and siding may be substituted for concrete block walls and substructure.



Isometric (superstructure; single-vault pit)

FIGURE 4.5 GENERAL ARRANGEMENT

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 day's 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 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

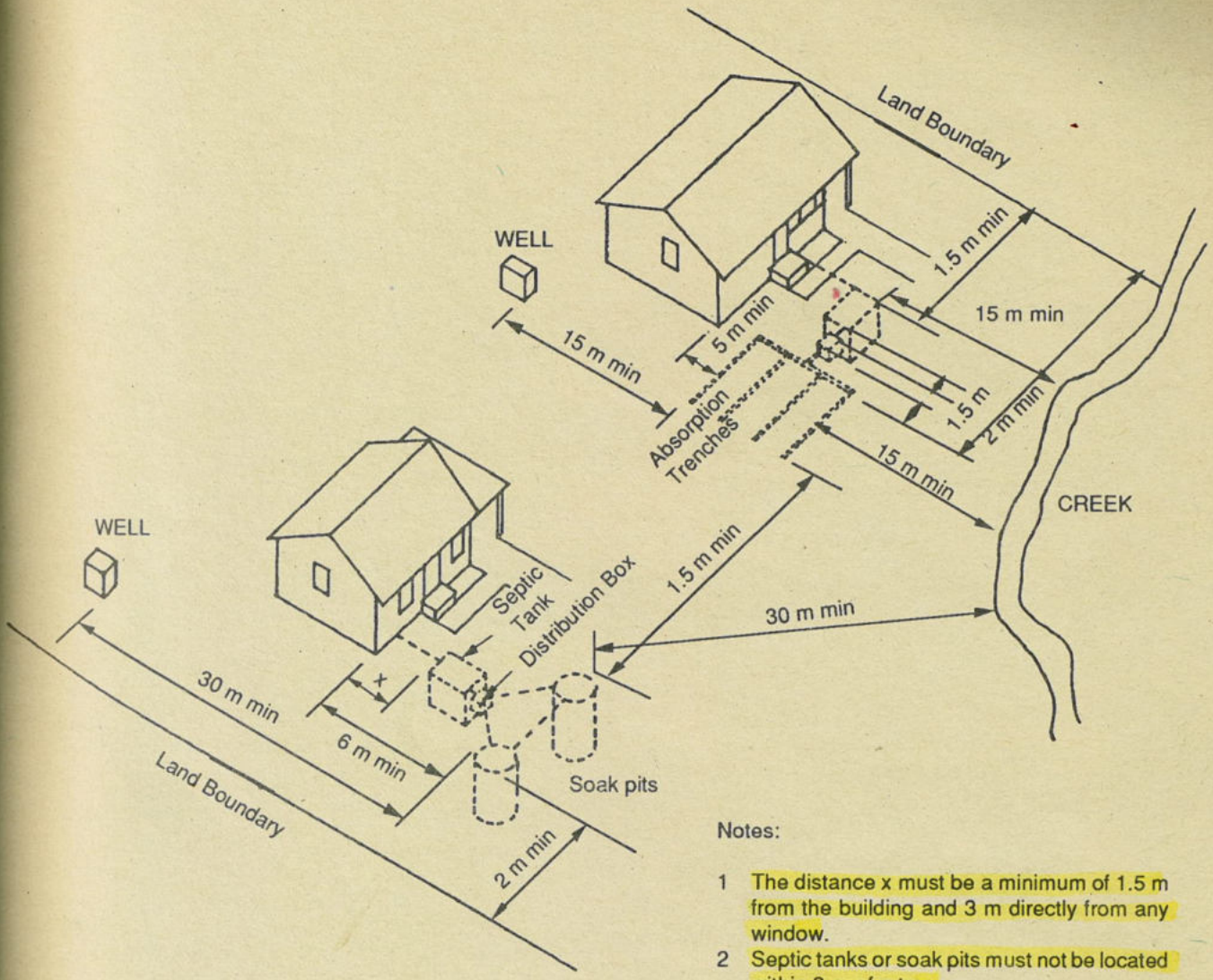
3.1 Septic tanks may be of reinforced concrete or of reinforced block masonry walls over a reinforced concrete base. Tanks of precast concrete construction may be made from rectangular slabs which are assembled on the site, or be of cylindrical construction, either as a single cylinder open at the top, or a stack of short, open-ended cylinders. There are also prefabricated septic tanks made of fibre glass.

3.2 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.

3.3 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.

3.4 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 the results of the percolation test discussed in clauses 5.2 and 5.3. Where the soil is of a suitable type and is sufficiently absorbent, and where the absorption area is sufficiently large to dispose of the final effluent, a single treatment septic tank



Notes:

1 The distance x must be a minimum of 1.5 m from the building and 3 m directly from any window.
2 Septic tanks or soak pits must not be located within 3 m of a tree.

FIGURE 2 TYPICAL LOCATION OF SEPTIC TANK SYSTEMS WITH MINIMUM REQUIRED SEPARATION DISTANCES

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.

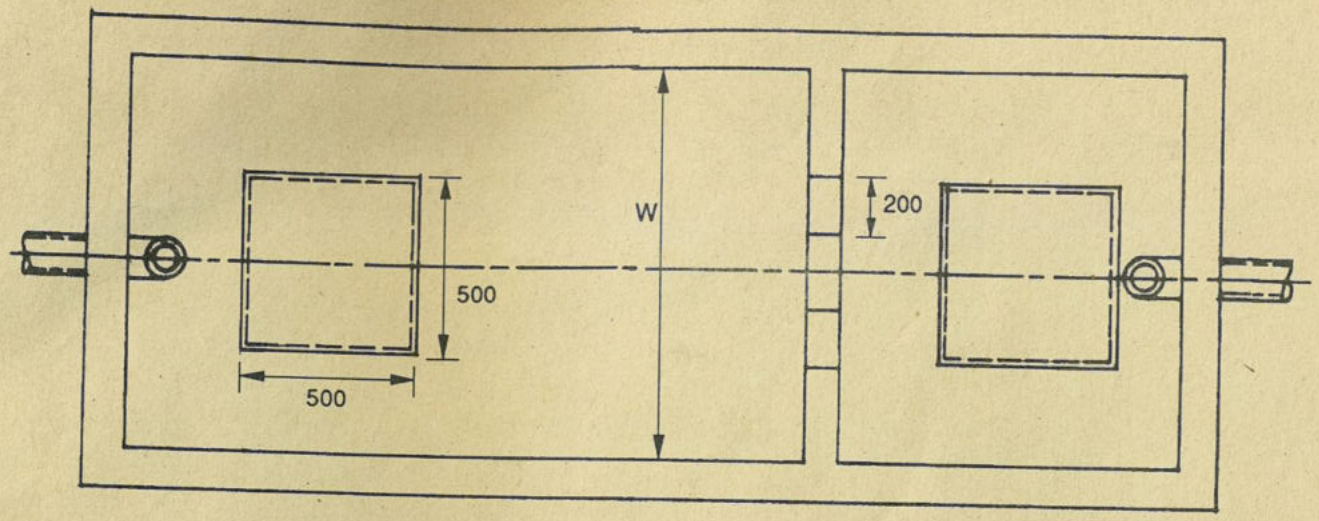
Figures 3.4A, B and C and Tables 3.4A and B give details of the dimension required of built-in-situ septic tanks. Table 3.4A also gives the volume of 60-75 mm stones for any aerobic filter that may be provided.

3.5 Figure 3.5 shows an arrangement for aerobic filters. The filter chamber can also serve as a distribution box for the absorption trenches.

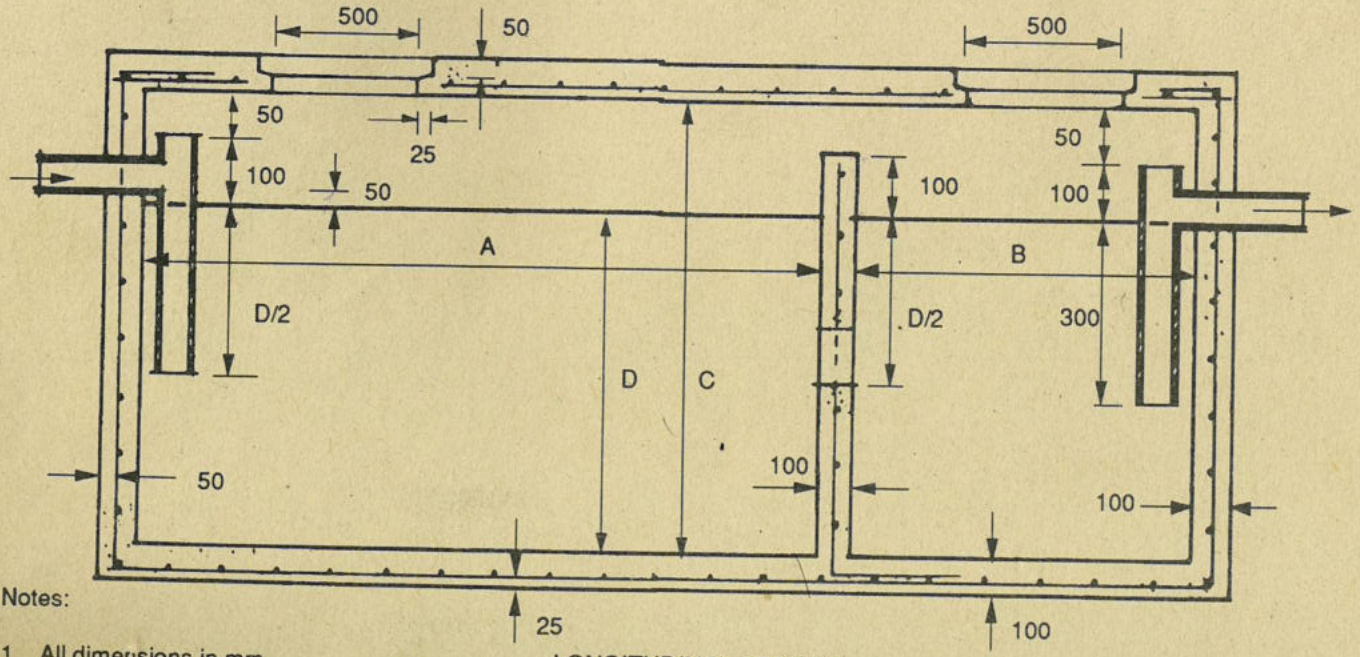
4 Grease traps

4.1 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 difficulty 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 exculded from it. A grease trap constructed as shown in Flg. 4.1 has been found effective in arresting grease. Alternatively, a smaller precast concrete or other type of grease trap may be installed.

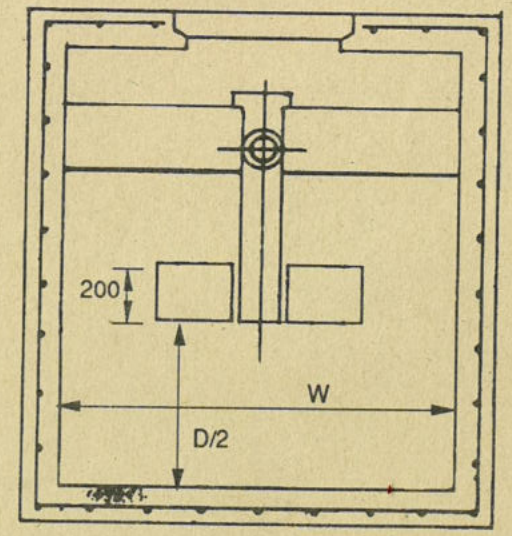
The capacity of the grease trap below the level of the invert of the outlet must be not less than the total capacity of the sinks and dishwashers served. The cover over the trap should be removable to facilitate the cleaning of the trap.



PLAN



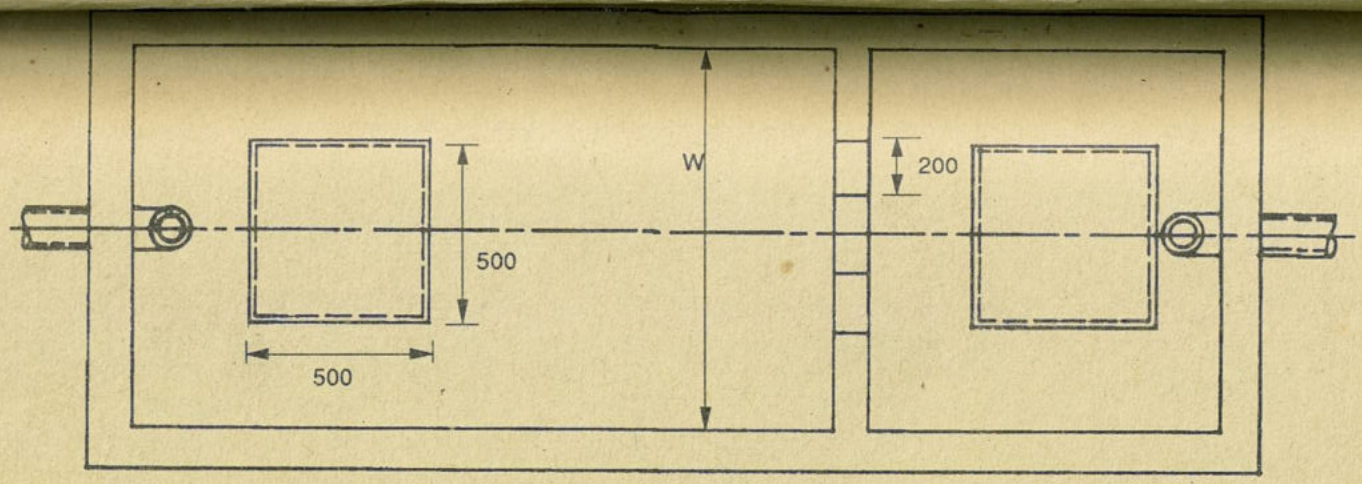
LONGITUDINAL SECTION



CROSS SECTION
Not to scale)

Notes:

1 All dimensions in mm.
2 Concrete to be 20 MPa grade.
3 Reinforcement - 665 mesh or D10 at 250 crs both ways all around.



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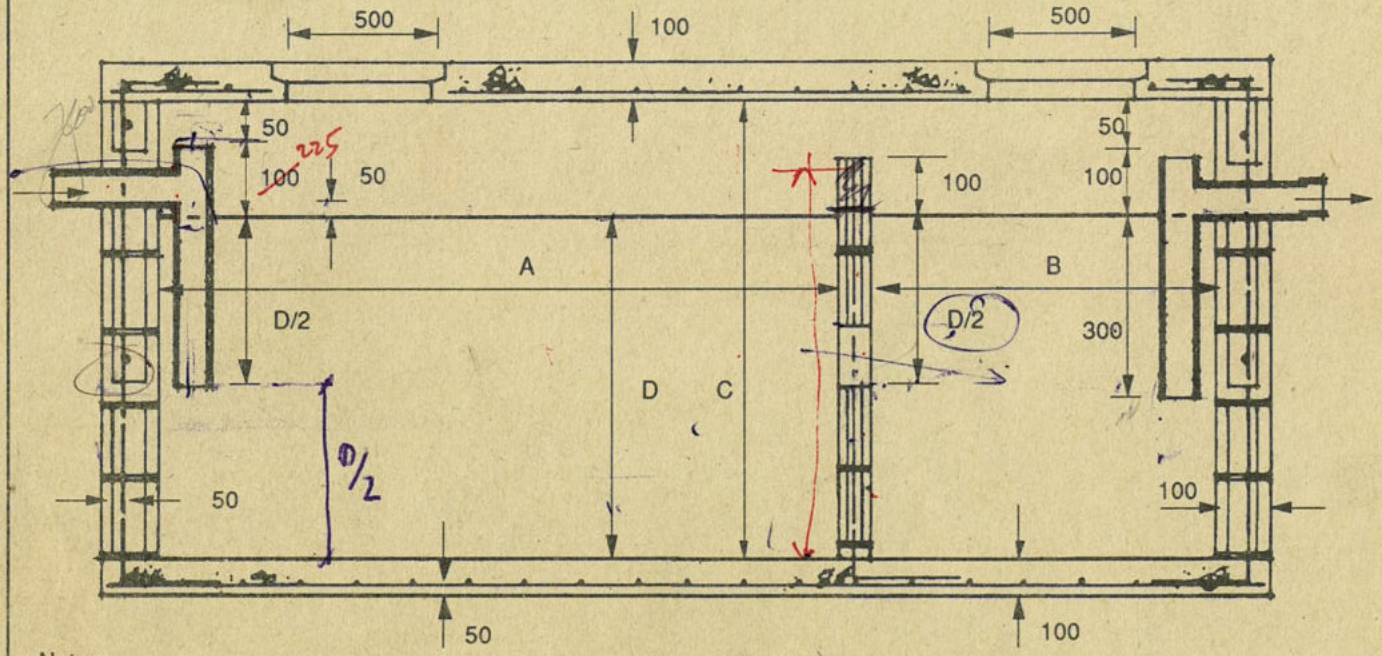

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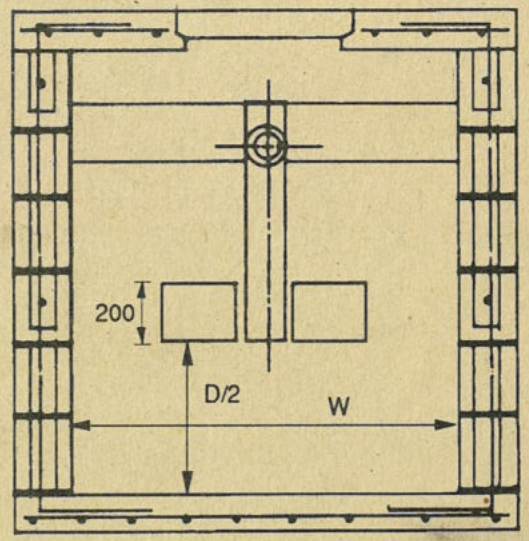
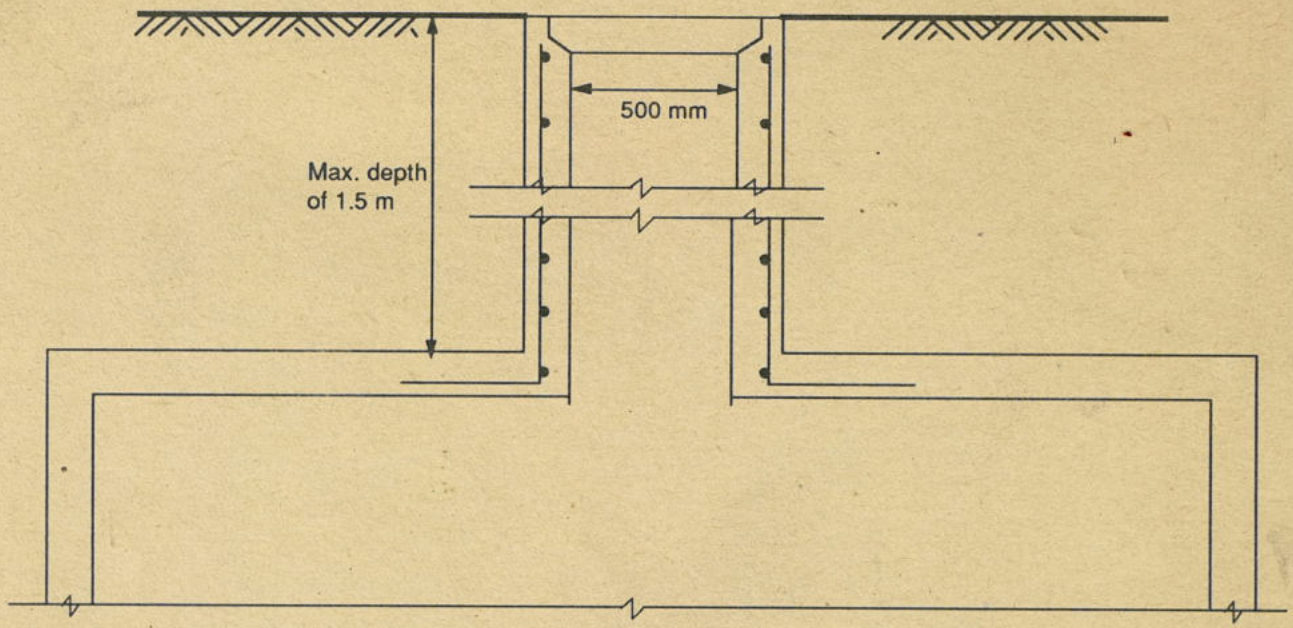


CROSS SECTION
(Not to scale)

Notes:

1 All dimensions in mm.
2 Concrete to be 20 MPa grade.
3 Reinforcement - 665 mesh or D10 at 250 crs both ways all around.

FIGURE 3.4B DETAILS OF REINFORCED BLOCK MASONRY SEPTIC TANK



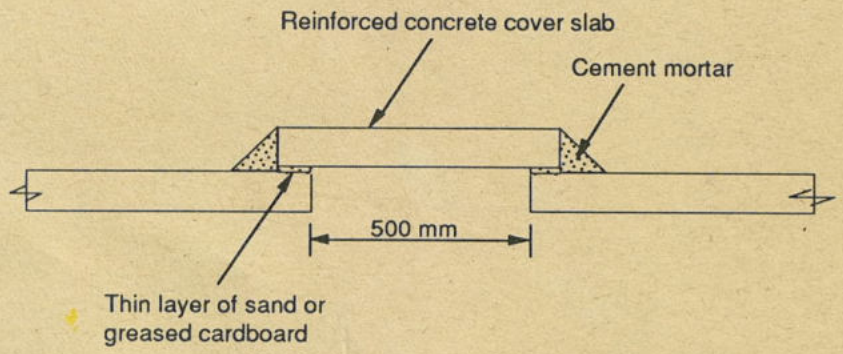


FIGURE 3.4C TWO ALTERNATIVE METHODS OF PROVIDING MANHOLE COVERS

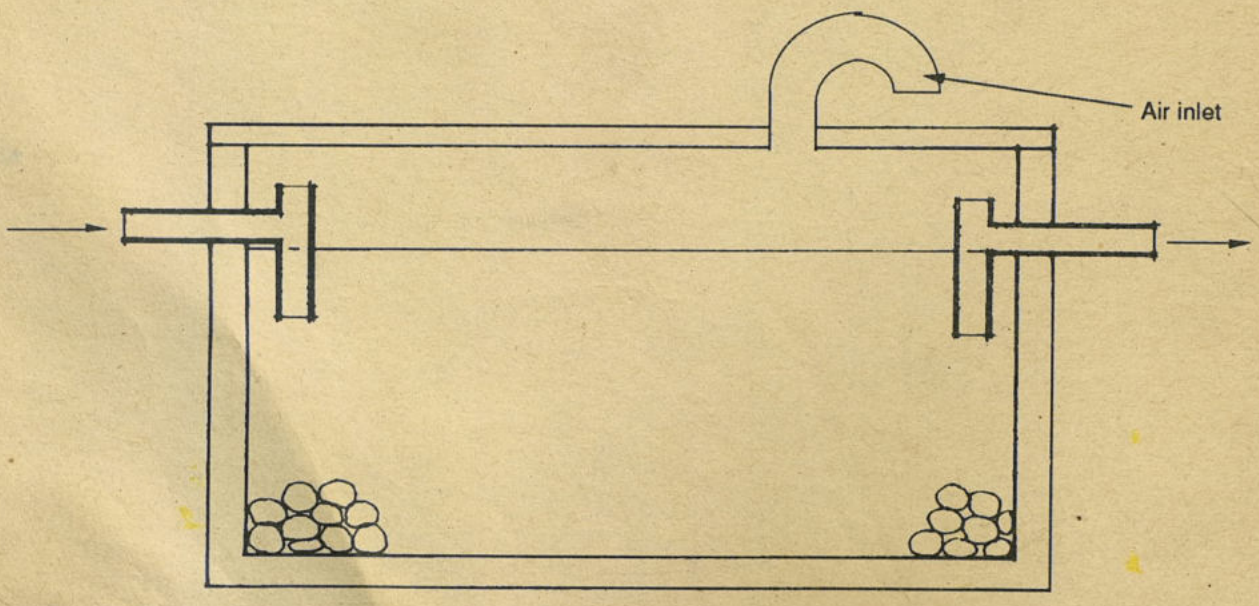


FIGURE 3.5 AEROBIC FILTER

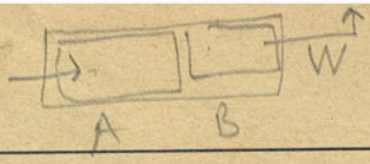


TABLE 3.4A

SEPTIC TANK DIMENSIONS AND VOLUMES OF AEROBIC FILTER

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

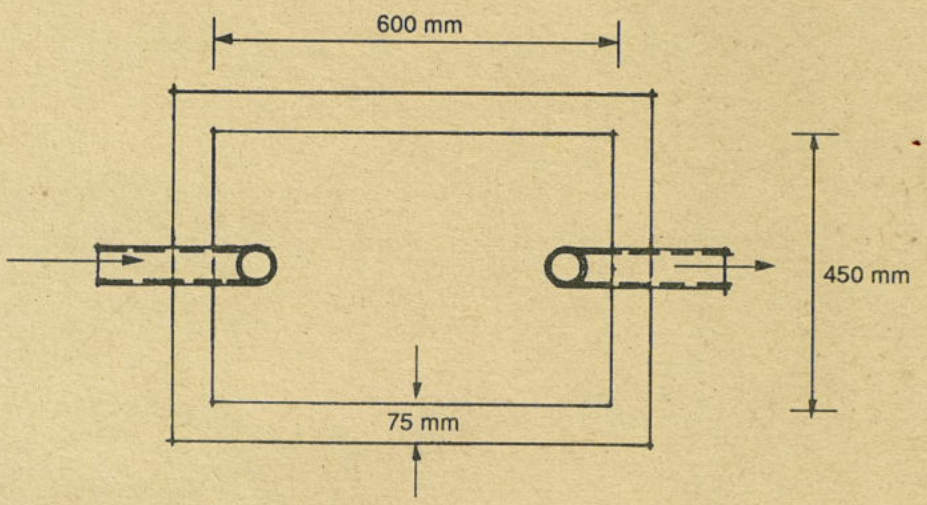
No. of Persons	ALL DOMESTIC WASTE						
	A	B	C	D	W	V (m^3)	F (m^3)
8	1400	800	1000	850	1000	1.87	0.04
10	1400	800	1200	1050	1000	2.31	0.05
12	1800	800	1200	1050	1000	2.73	0.06
15	1800	800	1200	1050	1200	3.28	0.07
25	2000	1200	1400	1250	1400	5.60	0.11
50	3200	1600	1600	1450	1600	11.14	0.22
100	4000	2000	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	4800	4000	1850	5200	132.76	2.66

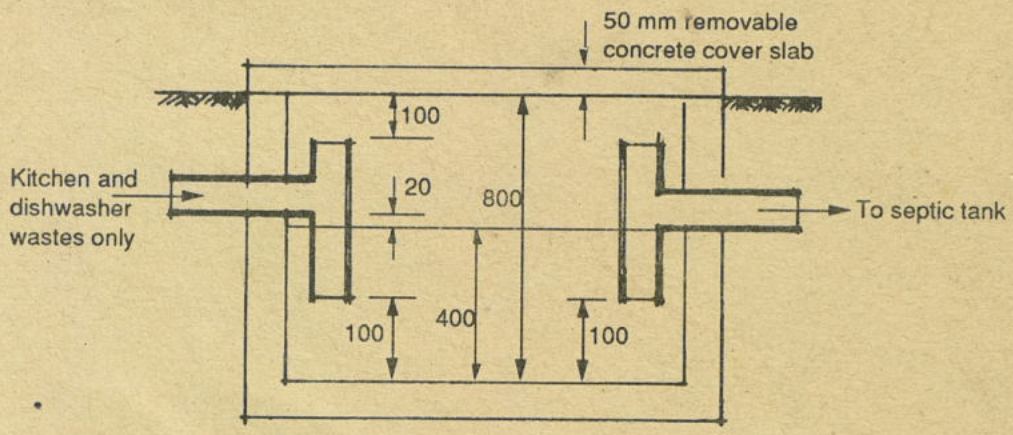
V = Volume of Septic Tank; F = Volume of Aerobic Filter; For details of A, B, C, D and W see Figures 3, 4A and B

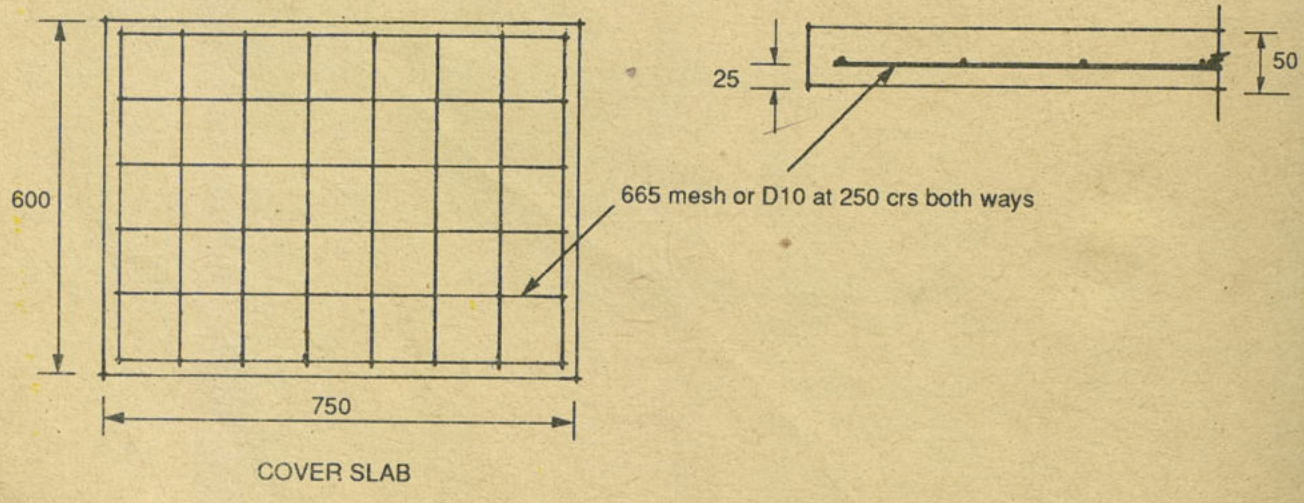
TABLE 3.4 B

REINFORCEMENT FOR MASONRY SEPTIC TANKS

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 @ 600







COVER SLAB

Notes:

1 All dimensions in mm.
2 Concrete to be 20 MPa grade
3 Reinforcement - 665 mesh or D10 at 250 crs both ways all around.

FIGURE 4.1 DETAILS OF A GREASE TRAP

4.2 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

5.1 An important factor when considering the installation of a septic tank is 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 loam, 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.

5.2 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.

5.3 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 3.4A.

(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

6.1 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 or 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.

6.2 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.

6.3 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 themselves be covered by soil or turf.

6.4 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. 6.4 A and their general layout in Fig6.4 B.

6.5 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 .

L C V

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 the ends removed are shown arranged in tiers. The drums are pierced at about 200 mm centres with a pick or so. They are surrounded 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 effluent.

In general a soak pit is not as effective or desirable a means of disposal as absorption trenches.

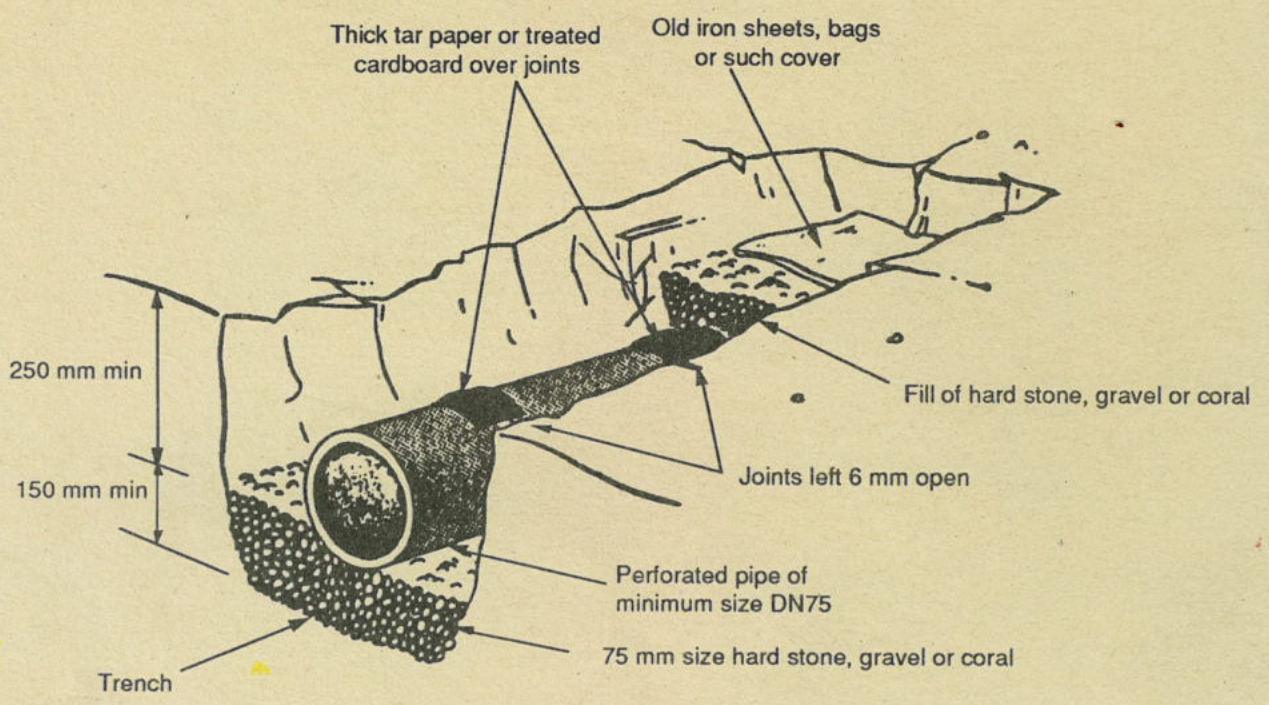
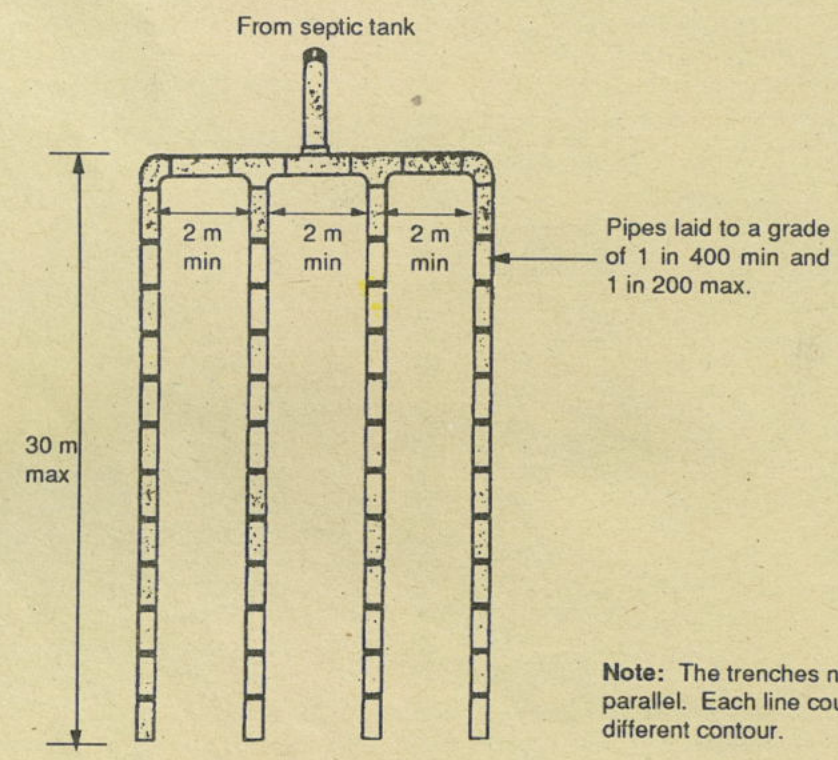


FIGURE 6.4A EXAMPLE OF AN ABSORPTION TRENCH



Note: The trenches need not be parallel. Each line could follow a different contour.

FIGURE 6.4B GENERAL LAYOUT OF ABSORPTION TRENCH

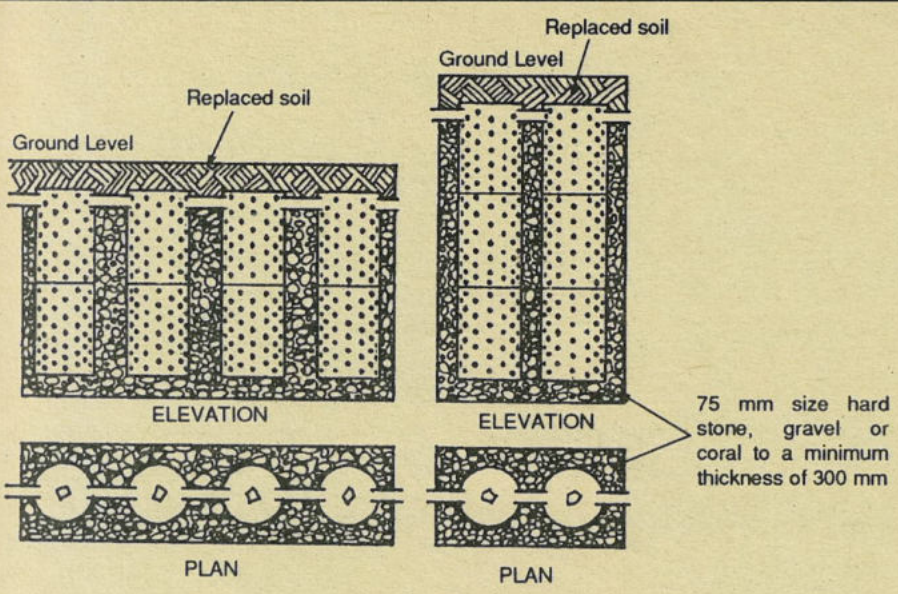


FIGURE 7 TWO ARRANGEMENTS OF DRUMS USED IN SOAK PITS

8 Special circumstances

8.1 Site conditions can necessitate 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 locate the absorption area up-hill 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.

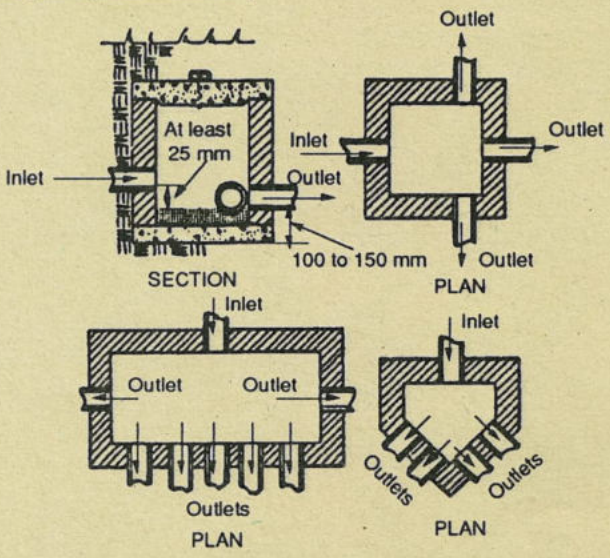


FIGURE 8.1 EXAMPLES OF DISTRIBUTION BOXES

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; and

(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, and

R, the average annual rainfall in millimetres

However, for the reasons stated earlier the practical value of the roof catchment is:

$$A = 2 \times 365 \times C/R = 730\ C/R$$

The average annual rainfall in Funafuti is 3514 mm. This is spread fairly uniformly through the year. Taking these features to be representative of the whole country, it is enough to allow for storage capacity equal to 50 days consumption. This would provide for an average risk of failure of no more than once in any five year period.

Taking an average family size of 5 members, each consuming no more than 30 litres of the stored water per day, the storage volume

$= 50 \times 30 \times 5 = 7500$ litres
$= 7.5$ kilolitres $= 1700$ gallons

The minmum roof area required to feed the storage tanks
$= 730 \times 150/3514 = 32\ m^2$

If a risk of failure of once a year is acceptable the tank size can be reduced by 30% . If the rate of consumption or average rainfall is different from what has been used in the calculations, the storage capacity and the roof area required can eacily be calculated.

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 micro-organisms 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 fibre glass. Whereas suitable fibre glass would be inert and therefore not affected by the rainwater, galavnised 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 kilolitres (1000 gallons).

NATIONAL
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1990

DWELLINGS AND OUTBUILDINGS (CLASS 1 AND 10)

SECTION **DG**

ANCILLARY PROVISIONS

Performance Requirements
Deemed-to-Satisfy Provisions

CONTENTS

PERFORMANCE REQUIREMENTS

OBJECTIVES AND REQURIED PERFORMANCE

This Section contains more specific requirements for particuar parts of class 1 buildings.

Parts of buildings and structures must be so designed and constructed that the following requirements **In addition** to those listed for Sections B, DC, and DF where relevant, are fulfilled:

DGP1 Minor Structures and Components

DGP1.1 Domestic-type water heaters

Household water heaters must be adequately supported, drained, and accessible.

DGP1.2 Aesthetics

Any minor structure such as fencing, awnings and the like must be suited to the general surroundings as well as the occupancy of the building and the neighbourhood.

DGP1.3 Animal houses

Accommodation for animals and poultry must not lead to insanitary conditions for the occupier or neighbours and the public.

DGP2 Fireplaces, Chimneys and Flues

Fireplaces, chimneys and flues must be adequately constructed or separated to prevent-

(a) ignition of nearby parts of the building; or

(b) escape or discharge of smoke to the inside of the building or to adjacent *windows*, ventilation inlets, or the like.

DEEMED-TO-SATISFY PROVISIONS

MINOR STRUCTURES AND COMPONENTS

DG1.1 Access to domestic-type water heaters

(a) A household water heater which is installed in a building must-

(i) be supported on construction sufficient to carry its full capacity weight and any possible wind or earthquake loads;

(ii) be positioned to enable adequate access for operation, maintenance and removal; and

(iii) provide suitably for any overflow, especially if installed in a concealed location.

(b) AS 1529 is the relevant standard for the installation of a household water heater.

DG1.2 Fences

Any fencing or free standing wall must be suited to the occupancy of the building within. It must not detract from the general aesthetic appearance of the surroundings. If any barbed wire or other such is used it must be at a height of not less than 2 m above the finished level of any existing or intended adjacent footpath.

DG1.3 Poultry and other Domestic Animal Houses

A building used for keeping domestic birds or animals must be not less than:

(a) 15 m from any other building or source of potable water; and

(b) 10 m from any boundary adjoining a public road or other public space.

The floor of the building must be constructed of suitable material. Suitable arrangements must be made for the collection and disposal of animal wastes, so that they do not create a nuisance or encourage the breeding of flies and other pests.

FIREPLACES, CHIMNEYS AND FLUES

DG2.1 General requirements

A chimney or flue must be constructed-

(a) to withstand the temperatures likely to be generated by the appliance to which it is connected;

(b) so that the temperature of the exposed faces will not exceed a level that would cause damage to nearby parts of the building;

(c) so that hot products of combustion will not-

(i) escape through the walls of the chimney or flue; or

(ii) discharge in a position that will cause fire to spread to nearby *combustible* materials or allow smoke to penetrate through nearby *windows*, ventilation inlets, or the like;

(d) in such a manner as to prevent rainwater penetrating to any part of the interior of the building;

(e) such that its termination is not less than;

(i) 600 mm above any point of penetration of or contact with the roof; and

(ii) 900 mm above any opening or openable part in any building, within 3 m horizontal distance of the chimney or flue; and

(f) so that it is accessible for cleaning.

DG2.2 Open fireplaces deemed-to-satisfy

An open fireplace, or solid-fuel burning appliance in which the fuel-burning compartment is not enclosed, satisfies DG2.1 if it has-

(a) a hearth constructed of stone, concrete, masonry or similar *non-combustible* material so that-

(i) it extends not less than 300 mm beyond the front of the fireplace opening and not less than 150 mm beyond each side of that opening;

(ii) it extends beyond the limits of the fireplace or appliance not less that 300 mm if the fireplace or appliance is free-standing from any wall of the room;

(iii) its upper surface does not slope away from the grate or appliance; and

(iv) *combustible* material situated below the hearth (but not below that part *required* to extend beyond the fireplace opening or the limits of the fireplace) is not less than 155 mm from the upper surface of the hearth;

(b) walls forming the sides and back of the fireplace up to not less than 300 mm above the underside of the arch or lintel which-

(i) are constructed in 2 separate leaves of solid masonry not less than 180 mm thick, excluding any cavity; and

(ii) do not consist of concrete block masonry in the construction of the inner leaf;

(c) walls of the chimney above the level referred to in (b)-

(i) constructed of masonry units with a net volume, excluding cored and similar holes, not less than 75% of their gross volume, measured on the overall rectangular shape of the units, and with an actual thickness of not less than 90 mm; and

(ii) lined internally to a thickness of not less than 12 mm with rendering consisting of 1 part cement, 3 parts lime, and 10 parts sand by volume, or other suitable material; and

(d) suitable damp-proof courses or flashing to maintain weatherproofing.

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PUBLIC BUILDINGS AND GROUP DWELLINGS (CLASS 2 TO 9)

SECTION **NC**

FIRE RESISTANCE

Performance Requirements
Deemed-to-Satisfy Provisions

CONTENTS

PERFORMANCE REQUIREMENTS

OBJECTIVES

The design and construction of building must fulfill the following objectives -

NCP1 Fire Resistance and Stability

(a) A building must be constructed so that it is protected from fire in any other building.

(b) Materials used in the construction must be such that if there is a fire in the building -

(i) the spread of fire and the generation of smoke and toxic gases will be minimised;

(ii) stability will be maintained for a period at least sufficient for the occupants to escape and to ensure the safety of fire-fighters; and

(iii) there will be little risk of collapse onto adjoining property.

NCP2 Compartmentation and Separation

Buildings must be constructed to localise the effects of fire to the areas of origin. Adequate levels of passive fire protection must be provided so that sufficient time is available for the users and others to escape from the effects of fire and as an alternative, to allow the users to stay safely within unaffected compartments for the duration reasonably required to put out the fire by active means.

NCP3 Protection of Openings

Openings must be protected and service penetrations must be fire-stopped to maintain separation and compartmentation.

REQUIRED PERFORMANCE

NCP 1.1 In order to maintain the *structural adequacy* and stability of any building for a sufficient time for the safety of the users, those who fight fires and others, the following must be ensured -

(a) the load bearing elements must have the FRL appropriate to their function in the building, the expected fire load density, the fire risk, the height of the building, its location with reference to the availability of external fire fighting resources, and the fire control measures available within the building;

(b) the FRL of structural elements must be at least equal to that of other elements to which they provide support; and

(c) the collapse of elements with a lower FRL must not result in the collapse of elements with a higher FRL.

NCP2.1 The size of fire compartment must also be consistent with the fire severity of the fire load density it contains and the likely spread of fire between it and any other compartment, *storey* or building.

Building compartment size and separating construction must be such that the potential size of a fire and the spread of fire and smoke are limited in order to -

(a) protect the occupants of one part of a building from the effects of fire elsewhere in the building.

(b) control the spread of fire or smoke to adjoining buildings; and

(c) facilitate access to the building by fire-fighters.

NCP 3.1 Openings of any nature in the envelope surrounding *fire compartments* must be so protected that they do not allow the passage of dangerous amounts of heat, flames, smoke and gases in the event of a fire within or outside the compartment and for a period sufficient to -

(a) allow the safe evacuation of all affected people; and

(b) allow fire fighters to fight the fire.

The sufficiency of the duration allowed must take into account the nature of occupancy of the buidlig as well as the proximity of other buildings and their occupancy.

DEEMED-TO-SATISFY PROVISIONS

FIRE RESISTANCE AND STABILITY

NC1.1 Type of construction required

(a) The minimum level of *fire-resisting construction* of a building must be that given in Specification NC1.1

NC1.2 Calculation of rise in storeys

In a building of Class 2 or 3, a *storey* that has an average height of more than 6 m is counted as -

(i) one *storey* if it is the only *storey* above the ground; or

(ii) 2 *storeys* in any other case.

NC1.3 Lightweight construction

Lightweight construction must be of such material and such construction that it is not easily damaged by the ordinary use of the building.

NC1.4 Early Fire Hazard Indices

The Early Fire Hazard Indices of materials and assemblies inside Class 2 and 3 buildings must comply with Specification NC1.4.

COMPARTMENTATION AND SEPARATION

NC2.1 Application

This Part applies to all Class 2 and 3 buildings.

NC2.2 General floor area limitations

(a) Subject to NC2.3 the size of any *fire compartment* in a building must not exceed the relevant maximum *floor area* and volume set out in Table NC2.2.

(b) A part of a building which contains only water tanks or similar service units is not counted in the *floor area* or volume of a *fire compartment* if it is situated at the top of the building.

TABLE NC 2.2
MAXIMUM SIZE OF FIRE COMPARTMENTS

	Max *floor area*	Max volume
Class 2	500 m²	2000 m³
Class 3	1000 m²	4000 m³

NC2.3 Health-care buildings

A *health-care building* must be divided into *fire compartments* with a *floor area* of not more than 500 m²; and further subdivided with walls of minimum FRL of 30/30/30 into *floor areas* of not more than 250 m². *Fire compartments* must be separated from the remainder of the building by *fire walls* with a FRL of not less than 60/60/60.

NC2.4 Separation by fire walls

A part of a building separated from the remainder of the building by a *fire wall* is treated as a separate building if -

(a) the *fire wall* -

(i) extends through all *storeys* and spaces in the nature of *storeys* that are common to that part and any adjoining part of the building;

(ii) is carried through to the underside of the roof covering; and

(iii) has the relevant FRL prescribed by Specification NC1.1 for each of the adjoining parts, and if these are different, the greater FRL;

(b) any openings in a *fire wall* comply with Part NC3;

(c) timber purlins or other *combustible* material do n pass through or cross the *fire wall*; and

(d) where the roof of one of the adjoining parts is low than the roof of the other part the design of t building must restrict the spread of fire from t lower part to the higher part.

NC2.5 Separation of classifications in the same stor

If a building has parts of different classifications locat alongside one another in the same *storey* -

(a) each building element in that *storey* must have t higher FRL prescribed in Specification NC1.1 f that element for the classifications concerned;

(b) the parts must be separated in that storey by a f *wall* with whichever is the greater of the higher FR prescribed in Specification NC1.1 for t classifications concerned.

NC2.6 Separation of classifications in different storey

If one of the adjoining parts is of Class 2 and if parts different classification are situated one above the other adjoining *storeys* they must be separated as follows: -

- the underside of the floor (including the sides a underside of any floor beams) must have a *fi protective covering*.

NC2.7 Electricity substations

If an electricity substation is situated within a building -

(a) it must be separated from any other part of t building by construction having a FRL of not le than 60/60/60;

(b) doors, windows and any other openings on a *external wall* need not have a FRL if such openin are no closer to a *fire souce feature* or *exit* than 3 Any other doorway including those opening to a other part of the building must be protected with se *closing* - /60/30 fire doors;

(c) electricity supply cables between a main and t substation, and between the substation and t main switchboard, must be enclosed or otherwis protected by construction having a FRL of not le than 60/60/60; and

(d) any openings, fans or grilles for natural or mechanic ventilation must be located only on an *external* wa unless protected with an *automatic* -/60/30 fi shutter.

PROTECTION OF OPENINGS

NC3.1 Application of Part

(a) This Part does not apply to -

(i) control joints, weep holes, and the like, in masonry construction, and joints between pre-cast concrete panels, if they are not larger than necessary for the purpose; or

(ii) *non-combustible* ventilators for sub-floor or cavity ventilation, if each does not exceed 45×10^3 mm² in face area and is spaced not less than 2 m from any other ventilator in the same wall.

(b) This Part applies to openings in building elements *required* to be fire-resisting, including doorways, *windows* (including any associated fanlight or infill panel) and other fixed or openable glazed areas that does not have have the *required* FRL.

NC3.2 Openings in external walls

(a) Openings in an *external wall* must be not less distant than 1.5 m from any *fire source feature.*

(b) Where openings *require* protection such as fire doors, fire *windows* etc, these must comply with Specification NC3.2.

NC3.3 Separation of openings in different fire compartments

The distance between openings in *external walls* in compartments separated by a *fire wall* must not be less than that set out in Table NC3.3.

TABLE NC3.3
DISTANCE BETWEEN OPENINGS IN DIFFERENT COMPARTMENTS

ANGLE BETWEEN WALLS	MIN. DISTANCE BETWEEN OPENINGS
from 0° to 45°	5 m
more than 45° to 90°	4 m
more than 90° to 135°	3 m
more than 135° to 180°	2 m

NC3.4 Doorways in fire walls

The aggregate width of openings for doorways in a *fire wall* which are not part of a *horizontal exit* must not exceed 1/2 of the length of the *fire wall,* and each doorway must be protected by a single fire door or a non-metallic fire shutter, which -

(i) has a FRL of not less than that *required* by Specification NC1.1 for the *fire wall*; and

(ii) is *self-closing* or *automatic* if the *automatic* closing device is designed to operate if there is smoke in the part of the building on either side of the *fire wall.*

NC3.5 Protection of doorways in horizontal exits

A doorway that is part of a *horizontal exit* must be protected by a single fire door which has a FRL of not less than that *required* by Specification NC1.1 for the *fire wall.*

NC3.6 Openings in exits

(a) A doorway that does not open to a road or *open space* must be protected by a *self-closing* or *automatic* -/60/30 fire door if it opens to a stairway, passageway or ramp.

(b) A *window* must not be located in an *external wall* of a stairway, passageway or ramp if it is within 6 m of, and exposed to -

(i) a *fire-source feature*; or

(ii) another *window* or other opening in a wall of the same building, unless they both serve the same fire-isolated enclosure.

NC3.7 Services in exits

Exits must not be have any services other than-

(a) electrical wiring associated with a lighting system serving the *exit*; or

(b) water supply pipes for fire services and domestic use.

NC3.8 Bounding construction: Class 2 and 3 buildings

(a) A doorway in a Class 2 or 3 building must be protected if it provides access from a *sole-occupancy unit* to-

(i) a *public corridor*, public hallway, or the like;

(ii) a room not within a *sole-occupancy unit*;

(iii) the landing of an internal stairway that serves as a *required exit*; or

(iv) another *sole-occupancy unit*.

(b) Protection for a doorway must be at least a *self-closing*, tight fitting, solid core door, not less than 35 mm thick.

(c) Other openings in *internal walls* which are *required* to have a FRL to inhibit the lateral spread of fire must not reduce the *fire-resisting* performance of the wall.

NC3.9 Openings for service installations

An electrical, electronic, plumbing, mechanical ventilation or air-conditioning, or other service that penetrates a building element (other than an *external wall* or roof) that is *required* to have a FRL or a *resistance to the incipient spread of fire*, must be installed so that the *fire-resisting* performance of the building element is not impaired.

NC3.10 Installation deemed-to-satisfy

Installation satisfies NC3.9 if -

(a) the method and materials used are identical with a prototype assembly of the service and building element which has achieved the *required* FRL or *resistance to the incipient spread of fire*;

(b) it complies with (a) except for the *insulation* criterion relating to the service when -

(i) the service is farther than 100 mm from any *combustible* material; and

(ii) it is not located in a *required exit;*

(c) the service is a metal pipe installed in accordance with Specification NC3.10 and it penetrates a wall, floor or ceiling, but not a ceiling *required* to have a *resistance to the incipient spread of fire* ;

(d) the service is sanitary plumbing installed in accordance with Specification NC3.10 and it -

(i) is of metal or UPVC pipe; and

(ii) is in sanitary compartments which are separated from other parts of the building by walls with the FRL *required* by Specification NC1.1 for a stair *shaft* in the building and a *self-closing* - /60/30 fire door;

(e) the service is a wire or cable, or a cluster of wires or cables installed in accordance with Specification NC3.10 and it penetrates a wall, floor or ceiling, but not a ceiling *required* to have a *resistance to the incipient spread of fire* ;

(f) the service is an electrical switch, outlet, or the like and it is installed in accordance with Specification NC3.10.

FIRE-RESISTING CONSTRUCTION

1. Scope

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

2. GENERAL REQUIREMENTS

2.1 Exposure to fire-source features

(a) A part of a building element is exposed to a *fire-source feature* if there is no obstruction to any horizontal line between that part and the *fire-source feature* or a vertical projection of the feature. Where another part of the building obstructs any such horizontal line, the part under consideration will still be considered exposed if the obstruction has -

(i) a FRL of not less than 30/-/-; or

(ii) is transparent or translucent.

(b) 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.

2.2 Fire protection for a support of another part

A part of a building that gives direct vertical or lateral support to another part *required* to have a FRL, must have a FRL in respect of *structural adequacy* not less than the greater of -

(a) that *required* for the part it supports; or

(b) that *required* for the part itself,

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

2.3 Lintels

A lintel must have the FRL *required* for the part of building in which it is situated. It need not have the FRL if 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*;

(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 one of the leaves of a cavity wall.

2.4 Attachments not to impair fire-resistance

(a) A *combustible* material may be used as a finish or lining to a wall or roof, or in a sign, sunscreen or blind, awning, or other attachment to a building element which has the *required* FRL if-

(i) the material is exempt under clause 5 of Specification NC1.4 or complies with the Early Fire Hazard Indices prescribed in clause 2 of the same Specification.

(ii) it is not located near or directly above a *required exit* so as to make the *exit* unusable in a fire; and

(iii) it does not otherwise constitute an undue risk of fire spread via the facade of the building.

(b) The attachment of a facing or finish, or the installation of ducting or any other service, to a part of a building *required* to have a FRL must not impair the *required* FRL of that part.

2.5 General concessions

(a) Steel columns - Except in a *fire wall* or *common wall*, a steel column need not have a FRL in a building that contains only one *storey* .

(b) Timber Columns - In a building that contains only one storey, a timber column may be used in a building provided:

(i) in a *fire wall* or *common wall* the column has the *required* FRL.

(ii) in all other cases, the column has a 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 one or more of the following:

(i) Hot water or other water tanks.

(ii) Other service units that are *non-combustible* and do not contain *combustible* fluids.

3. TYPE OF FIRE-RESISTING CONSTRUCTION

3.1 Fire-resistance of building elements

In a building *required* to be of fire-resisting construction -

(a) a building element listed in Table 3, and any beam or column incorporated in it, must have a 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 3 to have a FRL may be considered to have a FRL if the outer part of the wall has the *required* FRL;

(c) a *fire wall* or an internal wall bounding a *sole occupancy unit* or separating adjoining units, if it is of lightweight construction, must comply with Specification NC1.3.

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

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

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

(iii) to the underside of the roof covering if it is *non-combustible*, or 450 mm above the adjoining roof covering if it is *combustible*, and must not be crossed by timber purlins or other *combustible* material,

unless the wall bounds a *sole-occupancy unit* in the topmost (or only) *storey* and there is only one unit in the *storey*, and

(e) All *external walls* and *fire walls* within 1.5 m of a boundary, excluding a boundary adjoining a public road or stream or other open water channel, must be extended to not less than 450 mm above the adjoining roof line to form a parapet.

TABLE 3
FIRE-RESISTANCE LEVEL OF BUILDING ELEMENTS

BUILDING ELEMENT	FRL: (in minutes) Structural Adequacy / Integrity / Insulation CLASS OF BUILDING 2	3
EXTERNAL WALL or other external building element excluding a roof, where the distance from any *fire-source feature* to which it is exposed is -		
less than 1.5 m	60/60/60	60/60/60
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	60/ - / -	60/ - / -
COMMON WALLS AND FIRE WALLS	60/60/60	60/60/60
INTERNAL WALLS -		
Bounding *public corridors*, public hallways and the like	30/30/30	30/30/30
Between or bounding *sole-occupancy units*	30/30/30	- / - / -
Bounding a stair	30/30/30	30/30/30
FLOORS	30/30/30	30/30/30

EARLY FIRE HAZARD INDICES

1. Scope

This Specification sets out requirements in relation to the Early Fire Hazard Indices of materials, linings and surface finishes inside buildings.

2. Class 2 and 3 buildings: General requirements

Except where superseded by clause 3 or 4, any material or component used in a building must -

(a) in the case of a *sarking-type material*, have a *Flammability Index* not more than 5;

(b) in the case of other materials, have -

(i) a *Spread-of-Flame Index* not more than 9; and

(ii) a *Smoke-Developed Index* not more than 8 if the *Spread-of-Flame Index* is more than 5;

(c) be completely covered on all faces by concrete or masonry not less than 50 mm thick; or

(d) in the case of a composite member or assembly, be constructed so that when assembled as proposed in a building-

(i) any material which does not comply with (a) or (b) is protected on all sides and edges from exposure to the air;

(ii) the member or assembly, when tested in accordance with Specification A2.4, has a *Smoke-Developed Index* and a *Spread-of-Flame Index* not exceeding those prescribed in (b); and

(iii) 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.

3. Acceptable materials

A material complies with clause 2 if it is -

(a) plaster, cement render, concrete. terrazzo, ceramic tile or the like; or

(b) a *fire-protective covering*.

4. Fire-retardant coatings

When paint or fire-retardant coatings are used in order to make a substrate comply with a *required Spread-of-Flame Index, Smoke-Developed Index* or *Flammability Index*, this fact must be clearly marked on an easily visible label or labels and permanently fixed to the building element that the coating will not be scraped off or otherwise ma ineffective, without re-coating to preserve the fire-retard properties. If any coating used will retain the *required* fi retardant properties for only a limited period, it must replaced before the expiry of such period so that t *required* properties are not diminished.

5. Exempted building parts and materials

The requirements in this Specification for a *Spread-of-Fla Index, Smoke-Developed Index* or *Flammability Index* not apply to -

(a) timber-framed windows;

(b) solid timber handrails or skirtings;

(c) timber-faced solid-core or fire doors;

(d) electrical switches, outlets, cover plates or the li

(e) materials used for -

(i) roof covering or membranes, or ro insulating material, applied in continuo contact with a substrate;

(ii) adhesives; or

(iii) damp-proof courses, flashings, caulki sealing, ground moisture barriers, or t like;

(f) paint, varnish, lacquer or similar finish, other th nitro-cellulose lacquer;

(g) a clear or translucent rooflight of glass fibre reinforc polyester if-

(i) the roof in which it is installed forms part a building in fire-resisting construction;

(ii) the material is used as part of the ro covering;

(iii) it is not prohibited by any other clause of th Code;

(iv) it is not closer than 1.5 m from anoth rooflight of the same type;

(v) each rooflight is not more than 14 m² in are and

(vi) the area of the rooflights is not more th 20% of the roof surface; or

(h) any other material which does not significan increase the hazards of fire.

FIRE, 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 comply with NZS 4232, except that -

(a) it may be fully glazed or incorporate glazing if the tested prototype was similarly glazed;

(b) the radiation level at a distance of 365 mm from the face of the glazing must not exceed 10 kW/m² during the period corresponding to that for *integrity* in the *required* FRL;

(c) the rise in average temperature on the side of the tested prototype remote from the furnace must not exceed 140°C (except in any glazed part) during the first 30 minutes of the fire test.

3. Smoke doors

A *required* smoke door -

(a) may have one or 2 door leaves;

(b) must swing -

(i) in the direction of egress; or

(ii) in both directions if the path of travel to *exits* is in either direction;

(c) must be *self-closing* and may be fitted with an *automatic* release device; and

(d) must be constructed of -

(i) solid-core at least 35 mm thick, glazed panels in a timber frame at least 35 mm thick, or a metal frame, with a mid-rail or suitable crash bar; or

(ii) PVC, or other suitable material;

and if necessary, be fitted with smoke seals.

4. Fire shutters

A *required* fire shutter must be a shutter that -

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

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

(c) did not have a rise in average temperature on the side remote from the furnace of more than 140°C during the first 30 minutes of the test.

5. Fire windows

A *required* fire *window* must be -

(a) identical in construction with a prototype that has achieved the *required* FRL; and

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

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 a FRL.

2. Application

(a) This Specification applies to installations permitted under this Code as alternatives to systems that have been demonstrated by test to fulfil the requirements of NC3.10.

(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 pipes

(a) A metal pipe that is not normally filled with liquid must not penetrate a wall, floor or ceiling within 100 mm of any *combustible* material unless wrapped or fire stopped to satisfy the requirements of Clause 7, 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 metal pipe must -

(i) be neatly formed, cut or drilled;

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

(iii) accommodate only one pipe.

(c) A metal pipe 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 NC3.10(e) of this Code -

(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 opening; and

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

(i) 2000 mm² 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 mm² in any other case; and

(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 nor 600 mm vertically of any opening or recess on the opposite side of the wall; nor

(ii) extend beyond half the thickness of the wall and

(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 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 AS 1038.15, and must have -

(i) demonstrated in a system tested in accordance with NC3.10(a) of this Code 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 7(a)(i) or (ii).

(c) **Hollow construction**: If a pipe penetrated 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 the material is -

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

(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 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 a fire-resistance of 60/60/60 or better.

NATIONAL BUILDING CODE 1990

PUBLIC BUILDINGS AND GROUP DWELLINGS (CLASS 2 TO 9)

SECTION **ND**

ACCESS AND EGRESS

Performance Requirements Deemed-to-Satisfy Provisions

CONTENTS

PERFORMANCE REQUIREMENTS

OBJECTIVES

A building must be so designed and constructed that the following objectives are fulfilled:

NDP1 Provision for Escape

There must be adequate means of escape in case of fire or other emergency from all parts of the building to a place of safety.

NDP2 Construction of Exits

(a) Stairways, ramps and passageways must be such as to provide safe passage for the users of the building.

(b) Stairways, ramps, floors and balconies, and any roof to which people normally have access, must have bounding walls, balustrades or other barriers where necessary to protect users from the risk of falling.

(c) Vehicle ramps and any floor to which vehicles have access must have kerbs or other barriers where necessary to provide protection to pedestrians and to the structure of the building.

NDP3 Access for People with Disabilities

Reasonable provision must be made in the design of a building, having regard to its use and location, to facilitate access and circulation by people with disabilities.

REQUIRED PERFORMANCE

NDP1.1 The design and construction of buildings must allow all occupants in any or all *fire compartments* to get to-

(a) any one of more than one *exit* within 2.5 minutes; or

(b) a single *exit* within 1 minute.

NDP2.1 The design and construction of *exits* must allow for the following optimum conditions during evacuation in any emergency -

(a) a density in the *exit* of 2.0 persons/m^2 of *exit floor area* ;

(b) a speed of movement along the slope of the *exit* of 0.5 m/s; and

(c) an average flow of 1.18 persons per second per metre effective width of *exit* .

In the case of occupancies such as *health-care buildings* where evacuation needs the assistance of others and/or of equipment, additional consideration must be given to the design of *exits* .

The *pitch* of any stairway or slope of a ramp must not be unsafe or uncomfortable.

The size of openings in any bounding wall, balustrade or the like must be such as to prevent very young mobile children from going through them and injuring themselves. These must also be designed to discourage young children under 5 years of age from gaining any foothold and climbing over them.

NDP3.1 People with disabilities must have the facility to gain reasonable access to buildings so that they are not at any material disadvantage when compared with others.

DEEMED-TO-SATISFY PROVISIONS

PROVISION FOR ESCAPE

ND1.1 Application

This Part applies to all buildings except the internal parts of a *sole-occupancy unit* in a Class 2 building.

ND1.2 Number of exits required

(a) **All buildings** - Every building must have at least one *required exit* .

(b) **Health-care buildings** - In addition to any *horizontal exit*, and subject to (c) not less than 2 *exits* must be provided from any *storeys* which includes a *ward area*.

(c) **Exits from divided wards**: In a *health-care building*, at least one *exit* must be provided from every portion of a *storey* which has been divided in accordance with NC2.3.

ND1.3 Exit travel distances

(a) **Class 2 buildings:**

(i) The entrance doorway of any *sole-occupancy unit* must be not more than 6 m from an *exit* or from a point at which travel in different directions to 2 *exits* is available; and

(ii) no point on the floor of a room which is not in a *sole-occupancy unit* must be more than 20 m from an *exit* or from a point at which travel in different directions to 2 *exits* is available, in which case the maximum distance to one of those *exits* must not exceed 40 m from the starting point.

(b) **Class 3 buildings:**

Subject to (c):

(i) No point on a floor must be more than 20 m from an *exit*, or a point from which travel in different directions to 2 *exits* is available, in which case the maximum distance to one of those *exits* must not exceed 40 m from the starting point.

(c) **Health-care buildings**: In a *ward area* in a *health-care building* -

(i) No point on the floor must be more than 12 m from a point from which travel in different directions to 2 of the *required exits* is available; and

(ii) the maximum distance to one of those *exits* must not be more than 30 m from the starting point.

ND1.4 Distance between alternative exits

Exits that are *required* as alternative means of egress must be -

(a) distributed as uniformly as practicable within or around the *storey* served:

(b) not less than 9 m apart; and

(c) not more than 45 m apart in a Class 2 building or a *storey* containing a *ward area* in a *health-care building*.

ND1.5 Dimensions of exits

In a *required exit* or path of travel to an *exit* -

(a) the unobstructed height throughout must be not less than 2 m;

(b) if the *storey* pertains to a Class 2 buildings or accommodates not more than 100 persons, the unobstructed width except for doorways must be -

(i) not less than 1 m; or

(ii) 2 m in a passageway from a *ward area* ;

(c) if the *storey* accommodates more than 100 persons the aggregate width, except for doorways, must be not less than -

(i) 1 m plus 250 mm for each 50 persons (or part) in excess of 100; or

(ii) 2 m in a passageway from a *ward area* in class 9a buildings;

(d) the clear openings of a doorway must be not less than-

(i) in *ward areas* - 1.6 m wide or 1.25 m if it is a *horizontal exit*;

(ii) in areas used by students in a *school* - 870 mm wide;

(iii) the width of *exit required* by (b) or (c), minus 250 mm; or

(iv) in any other case except where it opens to a *sanitary compartment* or bathroom - 760 mm wide; and

(e) the *required* width of *exit* must not diminish in the direction of travel to a road or *open space*.

ND1.6 External stairways

An external stairway may serve as a *required exit* if the stairway (including any connecting bridges) is of *non-combustible* construction throughout. If any part of such a stairway connecting more than 2 *storeys* is exposed to, and less than 4 m from a *window*, doorway or the like in an *external wall*, the stairway must be fully shielded in the affected area from such *window* or doorway by *non-combustible* construction with a FRL of not less than 60/60/60.

ND1.7 Travel by stairways or ramps

(a) A stairway serving as a *required exit* must provide a continuous means of travel by its own flights of stairs and landings from every *storey* served to the level at which egress to a road or *open space* is provided.

(b) In a Class 2 building, the distance between the doorway of a room or *sole-occupancy unit* and the point of egress to a road or *open space* by way of any *required* stairway or ramp must not exceed 30 m.

(c) In a Class 3 building, the distance from any point on a floor and a point of egress to a road or *open space* by way of a *required* stairway or ramp must not exceed 80 m.

(d) In a Class 2 or 3 building, a *required* stairway or ramp must discharge at a point not more than -

(i) 15 m from a doorway providing egress to a road or *open space* or from a passageway leading to a road or *open space*; or

(ii) 30 m from one of 2 such doorways or passageways if travel to each of them from the stairway or ramp is in opposite or approximately opposite directions.

(e) If 2 or more *exits* are *required* and are provided by means of internal stairways or *ramps*, each *exit* must provide separate egress to a road or *open space*.

ND1.8 Discharge from exits

(a) An *exit* must not be blocked at the point of discharge and where necessary, suitable barriers must be provided to prevent vehicles from blocking the *exit*, or access to it.

(b) If a *required exit* leads to an *open space*, the path of travel to the road must have an unobstructed width throughout of not less than-

(i) the minimum width of the *required exit*; or

(ii) 1 m;

whichever is the greater.

ND1.9 Horizontal exits

Horizontal exits must -

(a) not be counted as a *required exit*, when between *sole-occupancy units*; or

(b) not comprise more than 50% of the number of *required exits* from any part of a *storey* which has been divided by a *fire wall*; and

(c) have a clear area on each side of the *fire wall* to accommodate the total number of persons (calculated under ND1.10) from both parts of the storey, of not less than -

(i) 2.5 m^2 per patient in a *health-care building*; and

(ii) 0.5m^2 per person in any other case.

ND1.10 Number of persons accommodated

The number of persons accommodated in a *storey*, or room must be determined with consideration to the purpose for which it is used and the layout of the *floor area* by -

(a) calculating the sum of the numbers obtained by dividing the *floor area* of each part of the *storey* by the number of square metres per person listed in Table ND1.10 according to the use of the part excluding spaces set aside for -

(i) stairs, ramps, corridors, hallways, lobbies and the like;

(ii) service ducts and the like, *sanitary compartments* or other ancillary uses;

(b) reference to the seating capacity in an *assembly building* or room; or

(c) any other suitable means of assessing its capacity

TABLE ND1.10
AREA PER PERSON ACCORDING TO USE

TYPE OF USE	m^2 per person
Art gallery, exhibition area, museum	4
Bar, cafe, church, dining room	1
Board room	2
Boarding house	15
Computer room for main frame and mini computers	25
Court room - judicial area	10
- public seating	1
Dance floor	0.5
Dormitory	8
Early childhood centre	4
Factory - (a) machine shop, fitting shop, or like place for cutting, grading, finishing or fitting of metals or glass, except in the fabrication of structural steelwork or manufacture of vehicles or bulky products	5
(b) areas used for fabrication and processing other than those in (a)	50
(c) a space in which the layout and natural use of fixed plant or equipment determine the number of persons which will occupy the space during working hours	Area per person determined by the use of the plant or equipment.
Garage - public	30
Gymnasium	3
Hospital *ward area*	10
Hostel, hotel, motel, guest house	15
Indoor sports stadium - arena	10
Kiosk	1
Kitchen, laundry (other than domestic) and laboratory	10
Library - reading space	2
- storage space	30
Office, including one for typewriting or document copying or with desk-top computers	10
Plant Room for - ventilation, electrical or other service units	30
- boilers or power plant	50
Reading Room	2
Restaurant	1
School - common staff room	2
- individual staff room	10
- general classroom	2
- only as for others	
- multi-purpose hall	1
- trade and practical area : primary	4
secondary	As for Workshop
Shop - space for sale of goods -	
(a) at a level entered direct from the open air or any lower level	3
(b) all other levels	5

TABLE ND1.10 Continued
AREA PER PERSON ACCORDING TO USE

Showroom - display	5
Skating rink, based on rink area	1.5
Spectator stand, audience viewing area :	
- bench seating	450 mm/person
- fixed seating	number of seats
- seating not fixed	1
- standing viewing area	0.3
Storage space	30
Swimming pool, based on pool area	1.5
Switch room, transformer room	30
Telephone exchange - private	30
Theatre dressing room	4
Transport terminal	2
Workshop - for maintenance staff	30 (in the whole area)
- for manufacturing processes	As for factory

ND1.11 Measurement of distances

The nearest part of an *exit* means in the case of -

(a) A stairway, passageway, ramp, the nearest part of the doorway providing access to them.

(b) A doorway opening to a road or *open space*, the nearest part of that doorway.

(c) A *horizontal exit*, the nearest part of the doorway.

ND1.12 Method of measurement

The following rules apply:

(a) In the case of a room that is not a *sole-occupancy unit* in a class 2 building, the distance includes the straight-line measurement from any point on the floor of the room to the nearest part of a doorway leading from it, together with the distance from that part of the doorway to the single *required exit* or point from which travel in different directions to 2 *required exits* is available.

(b) Subject to (d) and (f), the distance from the doorway of a room or *sole-occupancy unit* in a Class 2 building is measured in a straight line to the nearest part of the *required* single *exit* or point from which travel in different direction to 2 *required exits* is available.

(c) Subject to (d) and (f), the distance between *exits* is measured in a straight line between the nearest parts of those *exits.*

(d) Only the shortest distance is taken along a corridor, hallway, external balcony or other path of travel that curves or changes direction.

(e) If more than one corridor, hallway, or other similarly defined internal path of travel connects *required exits*, the measurement is along the path of travel through the point at which travel in different directions to those *exits* is available.

(f) If a wall (including a demountable *internal wall*) that does not bound-

(i) a room; or

(ii) a corridor, hallway or the like,

causes a change of direction in proceeding to a *required exit*, the distance is measured along the path of travel past that wall.

(g) If permanent fixed seating is provided, the distance is measured along the path of travel between the rows of seats.

CONSTRUCTION OF EXITS

ND2.1 Application of Part

Except for ND2.6 and ND2.9, this Part does not apply to the internal parts of a *sole-occupancy unit* in a Class 2 building.

ND2.2 Stairways and ramps

Required stairs and ramps (including landings and any supporting *structural members*) must be constructed only of -

(a) reinforced or prestressed concrete;

(b) steel in no part less than 6 mm thick; or

(c) timber that -

(i) has a finished thickness of not less than 40 mm;

(ii) has an average density of not less than 800 kg/m^3 at a moisture content of 12%; and

(iii) has not been joined by means of glue unless it has been laminated and glued with resorcinol formaldehyde or resorcinol phenol formaldehyde glue.

ND2.3 Installations in exits and paths of travel

(a) Gas or other fuel services must not be installed in a *required exit*.

(b) Services or equipment must not be installed in a *required exit* or in any corridor, hallway, lobby or the like leading to a *required exit* if it comprises -

(i) electricity meters, distribution boards or ducts;

(ii) central telecommunications distribution boards or equipment; or

(iii) electrical motors or other motors serving equipment in the building;

unless it is enclosed by *non-combustible* construction or a *fire-protective covering*.

ND2.4 Width of stairways

(a) The *required* width of a stairway must -

(i) be measured clear of all obstructions such as handrails, projecting parts of balustrades, columns, beams, and the like; and

(ii) extend without interruption, except for ceiling cornices, to a height not less than 2 m vertically above a line along the nosings of the treads or the floor of the landing.

(b) A *required* stairway that exceeds 2 m in width is counted as having a width of only 2 m unless it is divided by a balustrade or handrail continuous between landings and each division is less than 2 m wide.

ND2.5 Ramps

ND2.5.1 Pedestrian ramps

(a) A ramp may be substituted for a stairway if the construction enclosing the ramp and the width and ceiling height comply with the requirements for a stairway.

(b) A ramp serving as a *required exit* must have a gradient of not more than -

(i) 1:12 in are as used by patients in a *health-care building*; or

(ii) 1:14 if *required* by Part ND3;

(iii) 1:10 if subject to wetting; or

(iv) 1:8 in any other case.

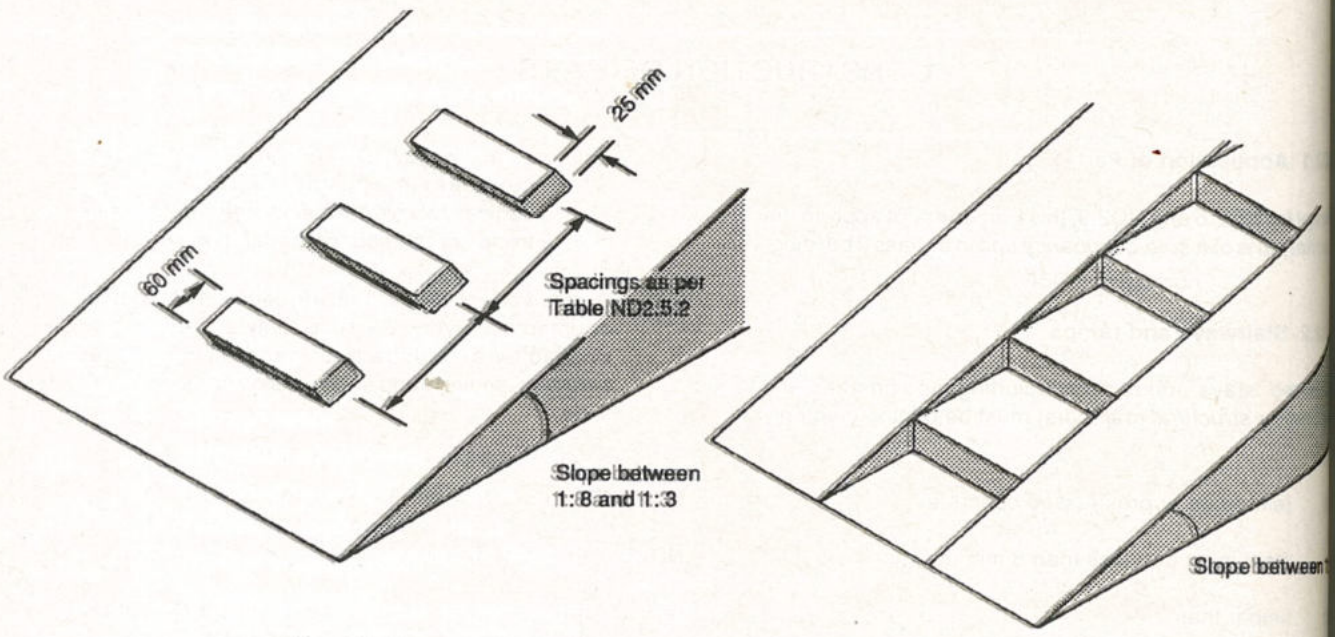
(c) The floor surface of a ramp must have a non-slip finish.

ND2.5.2 Service ramps

Service ramps must not be steeper than 1:3. Where they are steeper than 1:8 cleats must be provided at the spacing shown in Table ND2.5.2. Two examples are shown in figure ND2.5.2.

TABLE ND2.5.2
SPACING OF CLEATS FOR SERVICE RAMPS

Ramp slope not more than	CLEAT SPACING (mm)	
	Goods carried	No goods carried
1:6	360	460
1:5	330	430
1:4	300	400
1:3	280	380



(a) Cleats (b) Steps

FIGURE ND2.5.2 EXAMPLES OF SERVICE RAMPS WITH CLEATS

ND2.6 Treads and risers

ND2.6.1 Straight flights

(a) A stairway must be suitable to provide safe passage in relation to the nature, volume and frequency of likely usage.

(b) A stairway in any building (including a *sole-occupancy unit* in a Class 2 building) satisfies (a) if it has –

(i) subject to (v), not more than 18 nor less than 2 risers in each flight;

(ii) going and riser dimensions in accordance with Figure ND2.6.1 and Table ND2.6.1 that are constant throughout each flight;

(iii) risers which do not have any openings that would allow a 100 mm sphere to pass through between the treads;

(iv) treads which have a non-slip finish or a suitable non-skid strip near the edge of the nosings;

(v) in a *health-care building* where the difference in level is not more than 600 mm a ramp must be provided instead of steps;

(vi) a cross fall of between 1:100 and 1:50 where the stairway is subject to wetting; and

(vii) treads not exceed the goings by more than 30 mm.

ND2.6.2 Curved stairs

Curved stairs must comply with the relevant requirem of ND2.6.1 as well as the following:

(a) For the pursoses of satisfying Table ND2.6.1 going must be measured:

(i) along half way across the width of the s where the clear width is less than 900 m and

(ii) 300 mm from each side of the stair where clear width is 900 mm or more.

(b) All steps must have the same uniform taper.

(c) The going at the narrow end of the steps must be less than 75 mm.

(d) Winders are not permitted.

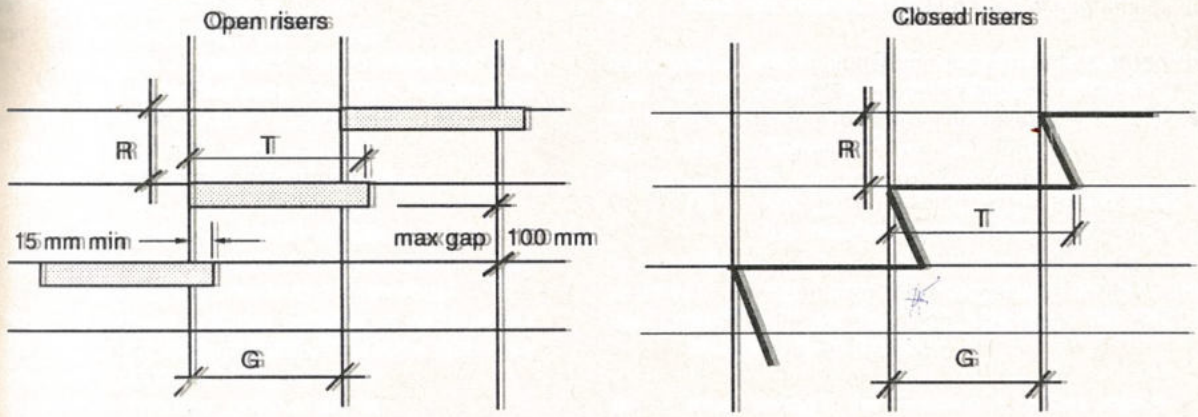
ND2.7 Landings

In a stairway –

a) landings having a maximum slope of 1:50 may used in any building to limit the number of rises each flight and each landing must –

(i) be not less than 750 mm long measured mm from the inside edge of the landing; a

(ii) have a non-slip finish throughout or a suita non-skid strip near the edge of the landi where it leads to a flight of stairs below; a



Note: R = Riser
G = Going
T = Tread

FIGURE ND2.6.1 MEASUREMENT OF RISER GOING AND TREAD

TABLE ND2.6.1
RISER DIMENSIONS (mm) TO MATCH GOING

Pitch	GOING (mm)								
	250	260	270	280	290	300	310	320	330
37°	188								
36°	182	188							
35°	175	182	189						
34°	168	175	182	188					
33°	162	169	175	181	188				
32°	156	162	168	174	181	187			
31°	150	156	162	167	174	180	186		
30°		150	156	161	167	173	179	185	
29°			150	155	161	167	173	179	183
28°				150	155	160	165	170	175
27°					148	153	158	163	168
26°						146	151	156	161
25°								149	154
24°									147

Notes:

1 Actual riser dimension may be selected to suit the inter landing height. However the value of the riser dimension must not be outside the maximum or minimum dimensions shown for each value of going.

2 The dimensions shown within the outlined box are preferred because they are less strenuous for individuals on crutches or with minor disabilities.

(b) in a *health-care building* -

(i) the area of any landing must be sufficient to move a stretcher, 2 m long and 600 mm wide, at an incline not more than the slope of the stairs, with at least one end of the stretcher on the landing while changing direction between flights; or

(ii) the stair must have a change of direction of 180°, and the landing a clear width of not less than 1.6 m and a clear length of not less than 2.7 m.

ND2.8 Thresholds

The threshold of a doorway must not incorporate a step or ramp at any point closer to the doorway than the width of the door leaf unless-

(a) in patient-care areas in a *health-care building*, the door sill is not more than 25 mm above the finished surface of the ground, balcony or the like to which the doorway opens;

(b) in other cases -

(i) the doorway opens to a road, *open space* or external balcony; and

(ii) the door sill is not more than 190 mm above the finished surface of the ground, balcony, or the like, to which the doorway opens.

ND2.9 Balustrades

(a) In a Class 2 or 3 building a continuous balustrade must be provided along the side of any stairway or ramp, or any corridor, hallway, balcony, bridge or the like, if -

(i) it is not bounded by a wall; and

(ii) the change in level is more than 1 m,

(b) A balustrade *required* by (a) must prevent, as far as practicable-

(i) children climbing over or through it;

(ii) persons accidentally falling from the floor; and

(ii) objects which might strike a person at a lower level accidentally falling from the floor surface.

(c) At balconies a balustrade satisfies (b) if -

(i) it has a height of not less than 930 mm above the balcony floor;

(ii) the space between balusters or the width of any opening in the balustrade is not more than 100 mm except where the space betwee rails or the height of the opening is not mo than 100 mm;

(iii) all parts of the balustrade more than 150 m and less than 760 mm from the floor nosings are vertical or otherwise do n provide a toe-hold; and

(d) In stairways and ramps (including access bridges an landings) a balustrade satisfies (b) if -

(i) it has a height of not less than 865 mm abov the nosings of the stair treads and the flo of the landing, balcony, corridor, hallwa access bridge or the like;

(ii) the space between balusters or the width o any opening in the balustrade (including an openable window or panel) is not more tha 100 mm except where the space betwee rails or the height of the opening is not mo than 100 mm; and

(iii) all parts of the balustrade more than 150 mm and less than 760 mm from the floor or nosings are vertical or otherwise do not provide a toe-hold.

ND2.10 Handrails

(a) Suitable handrails must be provided where necessary to assist and provide stability to persons using a ramp or stairway.

(b) Handrails satisfy (a) if they are -

(i) located along at least one side of the ramp o flight of stairs;

(ii) not more than 2 m apart in the case o intermediate handrails;

(iii) fixed at a height of not less than 700 mm above the nosings of stair treads in a buildin that is used as a primary *school*;

(iv) in any other case fixed at a height of not less than 865 mm above the nosings of stair treads and the floor surface of the ramp, landing, o the like; and

(v) continuous between stair flight landings and have no obstruction on or above them that wil tend to break a hand-hold.

ND2.11 Fixed platforms, walkways and ladders

Fixed platforms, walkways, non-*required* stairways, handrails, balustrades and ladders must comply with AS 1657 in a workshop factory or warehouse.

ND2.12 Doorways and doors

A doorway serving as a *required exit*, forming part of a *required exit*, or in a patient-care area of *a health-care building* -

(a) must not be fitted with a revolving door;

(b) must not be fitted with a roller shutter or tilt-up door unless -

(i) it serves a shop, factory or warehouse building or part with a *floor area* not more than 200 m²;

(ii) the doorway is the only *required exit* from the building or part; and

(iii) it is held in the open position while the building or part is lawfully occupied;

ND2.13 Swinging doors

A swinging door in a *required exit* or forming part of a *required exit* -

(a) must not encroach-

(i) at any part of its swing by more than 500 mm on the *required* width of a *required* stairway, passageway or ramp, including the landings; and

(ii) when fully open, by more than 100 mm on the *required* width of the *required exit*, and

the measurement of encroachment in each case is to include door handles or other furniture or attachments to the door;

(b) must swing in the direction of egress unless -

(i) it serves a building or part with a *floor area* not more than 200m², it is the only *required exit* from the building or part and it is fitted with a device for holding it in the open position; or

(ii) it serves a *sanitary compartment* or airlock (in which case it may swing in either direction); and

(c) must not otherwise impede the path or direction of egress.

ACCESS FOR PEOPLE WITH DISABILITIES

ND3.1 Application of Part

This Part applies to all Class 2 and 3 buildings.

ND3.2 Access to buildings

Access for people with disabilities must be provided to buildings as set out in Table ND3.2 by means of a continuous path of travel in accordance with AS 1428.1.

(a) from the boundary of the allotment;

(b) from any carpark space on the allotment (whether within or outside the building) -

(i) that is set aside for people with disabilities using the building; or

(ii) if there are no carpark spaces set aside for them, from any carpark area that serves the building; and

(c) from any other building on the allotment to which access for people with disabilities is *required*.

TABLE ND3.2
REQUIREMENTS FOR ACCESS FOR PEOPLE WITH DISABILITIES

CLASS OF BUILDING	ACCESS REQUIREMENTS
Class 2	To and within -
(a) If the building contains -	
more than 10 units up to 49 units	one *sole-occupancy unit*.
more than 49 units	2 *sole-occupancy units*.
(b) If accommodation is provided for more than 10 persons other than in *sole-occupancy units* -	
up to 49 beds	2 beds.
more than 49 units	4 beds.
(c) Common areas of buildings that are *required* to be accessible	the entrance floor and to all public areas on that floor.
Class 3	To and within the entrance floor if its *floor area* is more than 500 m². To and within any floor if irrespective of *floor area*, the floor is not more than 190 mm at the point of entrance above or below the adjacent finished ground level; and within any other floor to which vertical access by way of a ramp, step or kerb ramp is provided.
Health-care building..	To and within all areas normally accessible to the public, patients or staff.

Note: The calculation of *floor area* and the number of persons accommodated are in accordance with ND1.10.

For the purposes of this Table, a double bed counts as 1 bed.

ND3.3 Parts of buildings to be accessible

(a) Access for people with disabilities must be provided-

(i) from the doorway at the entrance floor providing access to any *sanitary compartment required* for the use of people with disabilities; and

(ii) to areas normally used by the occupants, excluding any plantroom, commercial kitchen, cleaners' store room, maintenance accessway, rigging loft, or the like.

(b) A path of travel providing *required* access must not include a stairway, turnstile, revolving door, escalator or other impediment which would prevent a person in a wheelchair using it.

(c) Access, finishes and fittings, including passageways, ramps, step or kerb ramps, passenger lifts, signs, doorways and other parts of the building required by this Part must comply at least with the provisions of AS 1428.1.

ND3.4 Concessions

It is not necessary to provide access for people with disabilities -

(a) to more than 30% of the public space in a restaurant, cafe, bar, function room, or the like, in a Class 3 building; and

(b) to any area if access would be inappropriate because of the particular purpose for which the area is used.

NATIONAL BUILDING CODE 1990

PUBLIC BUILDINGS AND GROUP DWELLINGS (CLASS 2 TO 9)

SECTION **NE**

SERVICES AND EQUIPMENT

Performance Requirements Deemed-to-Satisfy Provisions

CONTENTS

PERFORMANCE REQUIREMENTS

OBJECTIVES

A building must be so designed and constructed that the following objectives are fulfilled:

Part NEP1 Fire Fighting Equipment

Having regard to the size and use of the building, adequate in-built and external fire protection services must be provided to-

(a) restrict fire growth to the compartment of origin;

(b) prevent fire spread to adjoining building or allotments; and

(c) facilitate the fighting of fire to minimise damage to the building and its contents.

Part NEP2 Smoke Control

Ventilation and air-conditioning systems installed in a building must-

(a) provide suitable air for the health and safety of the occupants; and

(b) incorporate reasonable measures to minimise the spread of smoke in the event of fire to escape paths from the building, to other compartments and to enable access for fighting the fire.

REQUIRED PERFORMANCE

NEP1.1 Active fire fighting

In determining the type and extent of active fire fighting systems that must be provided for a building the following must be taken into account -

(a) the class of occupancy;

(b) proximity to *fire-source features* ;

(c) size of fire compartments

(d) *effective height* ;

(e) the technical resources available locally to satisfactorily instal and regularly test and maintain the active fire fighting system.

Fire and smoke alarms

Reliable detection and warning systems must be installed for *automatic* operation in the event of a fire or generation of unacceptable levels of smoke.

NEP2.1 Smoke control

Buildings must have a sufficient number of *windows* or other openings or ventilating arrangements to quickly disperse any smoke generated in a fire. In the case of buildings used as theatres, public halls or the like, the audience seating area and egress routes must be protected against fire and smoke spreading from any fire occurring on the stage, in back stage areas or in a rigging loft.

DEEMED-TO-SATISFY PROVISIONS

FIRE-FIGHTING EQUIPMENT

NE1.1 Application of Part

This Part applies to Class 2 and 3 buildings.

NE1.2 Portable fire extinguishers

Portable fire extinguishers containing an extinguishing agent suitable for the risk beong protected must be installed in accordance with NZS 4503.

NE1.3 Provision for special hazards

Suitable additional provision must be made if special problems of fighting fire could arise because of-

(a) the nature or quantity of materials stored, displayed or used in a building or on the allotment; or

(b) the location of the building in relation to a water supply for fire fighting purposes.

TABLE NE1.2 PORTABLE FIRE EXTINGUISHER SELECTION CHART

TYPE OF EXTINGUISHER		WATER	FOAM	DRY CHEMICAL	CARBON DIOXIDE
Class and Type of Fire		CONTENTS OF EXTINGUISHER Electrically Conductive		Electrically Non-Conductive	
A	Ordinary combustibles (wood, paper, etc)	✓ YES MOST SUITABLE	✓ YES	✓ YES	✓ YES
B	Flammable liquids	X NO	✓ YES SPECIAL FOAM REQUIRED FOR ALCHOL-TYPE FIRE	✓ YES	✓ YES
C	Flammable gases	X NO	X NO	✓ YES	✓ YES
D	Combustible metals	X NO	X NO	X NO	X NO
		← USE SPECIAL PURPOSE EXTINGUISHERS ONLY →			
	(E.) Fire involving live electrical equipment	X NO	X NO	✓ YES	✓ YES

SMOKE CONTROL

NE2.1 Natural smoke venting

Windows, doors, panels, or the like, provided to control the movement of smoke must be as evenly distributed as practicable and be readily openable.

NE2.2 Smoke venting in theatres and stages

The design of smoke control systems for theatres, stages and public halls must fulfil up-to-date and relevant fire engineering principles and practices.

ELECTRICAL WORK

NE3.1 Safety

NE3.1.1 General Requirements

All electrical wiring and installations in or on any Class 2 and 3 building must ensure safety from electric shock and fire. This requirement is satisfied if all electrical work associated with the building is done to comply with AS 3000 - Electrical installations - buildings, structures and premises (known as the SAA Wiring Rules). The capacity of the system must allow for the long term anticipated requirements of the occupants.

NE3.1.2 Plug and power sockets

Plug and power sockets must:

(a) have their individual switch;

(b) be located so that

(i) cords and cables need not be taken across doorways;

(ii) trailing cords and cables do not have to cross circulation routes;

(c) not be located behind door-swings; and

(d) in the kitchen in Class 2 buildings be located 250 mm above worktops at the back of benches or on a return wall where it exists.

NE3.1.3 Meter and distribution board

The meter must be located in a position from which it can easily be read. If the main switches and circuit breakers/ fuses are not located with the meter they must be located at a height of not less than 1.8 m from the floor where they can be found easily in the dark.

NE3.2 Amenity

NE3.2.1 Light switch layout

(a) The layout of light switches in Class 2 buildings must follow the main night time circulation routes such as from the entrance hall to the living area to the bed-rooms to the bathroom and toilet. Crossing any major space in the dark must be avoided. The switches must be located close to door openings.

(b) All stairs must have two-way switching at the top and the bottom.

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SECTION **NF**

HEALTH AND AMENITY

Performance Requirements Deemed-to-Satisfy Provisions

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PERFORMANCE REQUIREMENTS

OBJECTIVES

A building must be designed and constructed to meet the following objectives -

NFP1 Damp and Weatherproofing

Suitable drainage, damp and weatherproofing must be provided where necessary to prevent-

(a) moisture or damp affecting the stability of the building;

(b) the creation of any unhealthy or dangerous condition; or

(c) causing damage to adjoining property.

NFP2 Cooking and Sanitary Facilities

Adequate toilet and washing facilities must be provided for the occupants of a building, having regard to its use and size. In residential buildings other than those meant for transient occupants suitable facilities must also be available for the preparation and cooking of food, the cleaning of utensils and the laundering of clothes.

NFP3 Room Sizes

The *floor area* , plan dimensions and ceiling heights of rooms and other spaces within a building must be adequate for their use or purpose.

NFP4 Light and Ventilation

The standard of light and ventilation within a building must be adequate for the occupants, having regard to the use or purpose of the building.

NFP5 Water Supply Plumbing

An appropriate safe and hygienic system of plumbing for the supply of water for domestic needs must be provided.

NFP6 Sanitary Plumbing

An appropriate system of drainage for the hygienic waterborne conveyance of *waste water* must be provided.

NFP7 Roof Drainage

Where a roof drainage system is provided, it must give reasonable protection against the overflow of rainwater into the building.

REQUIRED PERFORMANCE

NFP1.1 Damp and weatherproofing

Water and damp conditions must not be allowed to -

(a) affect the stability of buildings;

(b) create ill health or discomfort for the occupants;

(c) damage or deface buildings as a result of moisture present at the completion of construction;

(d) cause damage to adjacent property; or

(e) pond surface water against buildings or beneath the floor.

NFP2.1 Cooking and sanitary facilities

Any cooking facility provided must not spread smoke which may affect health or create a nuisance to the occupants or neighbours. Washing and clothes laundering facilities provided in residential buildings must be consistent with the size and occupancy of the building. The standard of toilet and washing facilities provided must in any building not create a nuisance or lead to ill health to the occupants or neighbours. These facilities must be located conveniently and the number of units provided must be consistent with the size and class of occupancy. Smoke extraction units from kitchens and other process operations in class 3 buildings must ensure that the progresive build- up of soot grease and the like does not lead to a fire or unhealthy conditions.

NFP3.1 Room sizes

The size and disposition of rooms in a building must be consistent with the requirements of health and hygiene.

NFP4.1 Light and ventilation

Where airhandling systems are provided in a building there must be adequate provision for natural ventilation to cater for any prolonged failure of the system.

NFP5.1 Water supply plumbing

Plumbing for potable watersupply must use materials which do not react with the water and thereby make it unsuitable. Suitable precautions must be taken to ensure that unsafe or unhygienic materials have no chance of entering the supply system. The installation of hot water systems must not impair the safety of the users. All concealed and difficult-to-access plumbing work must be suitably protected so that there is no likelihood of damage and leakage. The

plumbing must take into account the current and anticipated needs of the user and allow for the simultaneous use of the connected system by others.

NFP6.1 Sanitary plumbing and drainage

Sanitary plumbing must be laid to self-cleansing grades consistent with their discharge loading, unless other suitable arrangements are made to ensure that the system is kept free of the accretion of sewage and other waste matter. The size of drains and the layout of their connections must reasonably ensure the current and anticipated needs of the users. The connections to sanitary installations must ensure that foul gases are not allowed to produce unhygienic conditions nor create any nuisance to anyone and are suitably vented.

NFP7.1 Roof drainage

Any roof drainage system provided must be capable of handling the reasonably expected peak intensities of rainfall.

DEEMED-TO-SATISFY PROVISIONS

DAMP AND WEATHERPROOFING

NF1.1 Site drainage

The construction of a site drainage system and the position and manner of discharge of a stormwater drain must not-

(a) result in the entry of water into any building;

(b) affect the stability of any building; or

(c) create any unhealthy or dangerous condition within or around any building.

NF1.2 Building on land subject to dampness or flooding

One or all of the following measures must be carried out if it is warranted by the dampness of the building *site* or proneness to flooding:

(a) The subsoil must be adequately drained.

(b) The ground under the building must be regraded or filled and provided with outlets to prevent accumulation of water.

(c) The surface of the ground under the building must be covered with a suitable damp-resisting material.

(d) The top of the floor must be kept at not less than 300 mm above the known flood level at the *site*.

NF1.3 Drainage of land external to building

A suitable system of drainage must be provided if paving, excavation or any other work on an allotment will cause undue interference with the existing drainage of rainwater falling on the allotment whether the existing drainage is natural or otherwise.

NF1.4 Weatherproofing of roofs and walls

Roofs and *external walls* must be constructed to prevent rain or dampness penetrating to the inner parts of a building, unless it is a workshop or open shed and in the particular case there is no necessity for compliance.

NF1.5 Pliable roof sarking

Pliable roof *sarking-type material* used under roof or wall coverings must comply and be fixed in accordance with-

(a) AS 1736; or

(b) AS 1903 and AS 1904

NF1.6 Water proofing of wet areas in buildings

The following parts of a building must be impervious to water:

(a) In any building - the floor surface or substrate in a shower enclosure, or within 1.5 m measured horizontally from a point vertically below the shower fitting, if there is no enclosure;

(b) In a Class 2 or 3 building - the floor surface or substrate in a bathroom or shower room, slop sink compartment, laundry or *sanitary compartment* which is used in common by the occupants.

(c) The wall surface or substrate-

(i) of a shower enclosure, or if the shower is not enclosed, within 1.5 m and exposed to a shower fitting, to a height of 1.8 m above the floor;

(ii) immediately adjacent or behind a bath, trough, basin, sink, or similar fixture, to a height of 300 mm above the fixture if it is within 75 mm of the wall.

(d) The junction between the floor and wall if the wall and floor are *required* to be impervious to water.

(e) The junction between the wall and fixture if the wall is *required* to be impervious to water.

NF1.7 Damp-proof courses

Except in a building that is exempt from weatherproofing under NF1.4, moisture from the ground must be prevented from reaching-

(a) the lowest floor timbers and the walls above the lowest floor joists;

(b) the walls above the damp-proof course; and

(c) the underside of a suspended floor constructed of a material other than timber, and the supporting beams or girders.

NF1.8 Acceptable damp-proof courses

A damp-proof course must consist of-

(a) a material that complies with AS 2904;

(b) suitable termite shields placed on piers; or

(c) other suitable material.

NF1.9 Damp-proofing of floors on the ground

If a floor of a room is laid on the ground or on filling-

(a) moisture from the ground must be prevented from reaching the upper surface of the floor and adjacent walls by-

(i) the insertion of a vapour barrier in accordance with AS 2870.1; or

(ii) other suitable means; and

(b) damp-proofing need not be provided if the building is exempt from weatherproofing under NF1.4.

SANITARY AND OTHER FACILITES

NF2.1 Facilities for Class 2 buildings

Sanitary and other facilities for Class 2 buildings, must be provided in accordance with Table NF2.1.

TABLE NF2.1
PROVISION OF SANITARY AND OTHER FACILITIES

CLASS OF BUILDING	MINIMUM FACILITIES REQUIRED
Class 2	Facilities for residents-
	For each 10 residents for whom private facilities are not provided-
	(a) a shower; and
	(b) a closet pan and washbasin
	If situated outside the building, these facilities must be conveniently accessible.

NF2.2 Calculation of number of occupants and fixtures

(a) The number of persons accommodated must be calculated according to Table ND1.10 if it cannot be more accurately determined by other means.

(b) Unless the premises are predominantly used by one sex or numbers of male and female users are known, sanitary facilites must be provided equally for both sexes.

In addition where the nature of employment of an employee is such that a shower is highly desirable at the end of the work (eg. cooks and kitchen hands), showers must be provided for each 10 such male or female employee in any one shift.

NF2.3 Facilities in Class 3 Buildings

Sanitary facilities must be provided in Class 3 buildings in accordance with Table NF2.3.

TABLE NF2.3
SANITARY AND OTHER FACILITIES

Class of Building	User	Max Number Served by-								
		Closet Fixture (s)			Urinals (s)			Washbasin (s)		
		1	2	Each Extra	1	2	Each Extra	1	2	Each Extra
All Class 3	**Employees**									
	Males	20	40	20	25	50	50	60	120	60
	Females	15	30	15	-	-	-	60	120	60
Restaurants cafes, bars, public halls, function rooms and for out patients in *health-care buildings*	**Patrons-**									
	Males	50	200	250	50	200	100	50	200	250
	Females	30	70	80	-	-	-	50	200	250
Health-care buildings (other than for out patients)	**Patients-**									
	Males	-	16	8	-	-	-	16	32	16
	Females	-	16	8	-	-	-	16	32	16
	- Other facilities -	One shower for each 8, or part, patients or inmates.								

TABLE NF2.3 Continued
SANITARY AND OTHER FACILITIES

Class of Building	User	Max Number Ser								
		Closet Fixture (s)			Urinals (s)			Washbasin (s)		
		1	2	Each Extra	1	2	Each Extra	1	2	Each Extra
Schools	**Students and staff**									
	Males	30	70	70	30	70	35	60	140	140
	Females	20	40	30	-	-	-	60	140	1 40
Sporting venues, theatres cinemas,or the like and churches, chapels or the like	**Participants at sporting venues, theatres or the like**									
	Males	20	40	20	10	20	10	20	40	20
	Females	15	30	15	-	-	-	20	40	20
	- Other facilities: One shower for each 10 or part, participants									
	Spectators or patrons									
	Males	250	500	500	100	200	100	250	500	500
	Females	75	250	250	-	-	-	250	500	500

NF2.4 Construction of sanitary compartments

Partitions - Other than in any *early childhood centre*, *sanitary compartments* must have doors and partitions must separate adjacent compartments and extend-

(a) from floor level to the ceiling in the case of a unisex facility; or

(b) to a height of not less than 1500 mm above the floor if primary *school* children are the principal users, or 1800 mm above the floor in all other cases.

NF2.5 Interpretation: Urinals and washbasins

(a) A urinal may be either-

(i) an individual stall or wall hung urinal;

(ii) each 600 mm length of a continuous urinal trough; or

(iii) a closet pan used in place of a urinal.

(b) A washbasin may be either-

(i) an individual basin; or

(ii) a part of a hand wash trough served by a single water tap.

NF2.6 Facilities for people with disabilities

Sanitary facilities must be provided in accordance with Table NF2.6 in every Class 2 and 3 building that is *required* by Part ND3 to be accessible to people with disabilities.

TABLE NF2.6
SANITARY FACILITIES FOR PEOPLE WITH DISABILITIES

CLASS OF BUILDING	MINIMUM FACILITY FOR USE BY PEOPLE WITH DISABILITIES
Class 2 - In every *sole-occupancy unit* to which access for people with disabilities is *required* -	
	(a) one closet pan and washbasin; and
	(b) one shower .
Class 3 buildings with *floor area* more than 1000 m² and **Class 2** if accommodation is other than in *sole-occupancy units* , or other parts of the building are *required* to be accessible-	
NUMBER OF PERSONS FOR WHOM TOTAL FACILITIES NORMALLY REQUIRED	MINIMUM NUMBER FOR USE BY PEOPLE WITH DISABILITIES
Closet pans -	
1 - 100	(a) one unisex facility; or
	(b) one closet pan and washbasin for each sex.
More than 100	(a) 2 unisex facilities; or
	(b) one closet pan and washbasin for each sex and one unisex facility.

In all cases, facilities for females must include adequate means for the disposal of sanitary towels.

Baths or showers one shower or shower-bath for each 10 or part thereof normally *required*, but not less than one for use by both sexes.

ROOM SIZES AND HEIGHTS

NF3.1 Height of rooms

Minimum heights below the ceiling and any framing excluding minor projections such as cornices, are:

(a) Class 2 buildings -

(i) *habitable* room - 2.4m;

(ii) laundry or the like - 2.1m.

(iii) corridor or passageway - 2.1m.

(b) Subject to (c) and (d) Class 3 buildings-

(i) office, shop, warehouse or factory space - 2.4 m;

(ii) corridor, passageway, or the like - 2.1 m.

(c) *Health-care building* -

(i) *ward area* - 2.4 m;

(ii) operating theatre or delivery room - 3.0 m;

(iii) treatment room, clinic, waiting room, passageway, corridor, or the like - 2.4 m.

(d) Ancillary and other spaces -

(i) bathroom, shower room, water closet, toilet room, airlock, tea preparation room, pantry, store room, garage, carparking area, or the like, in any building - 2.1 m;

NF3.2 Reduced height permissible

These heights may be reduced if the reduction does not unduly interfere with the proper functioning of the room in-

(a) attic rooms

(b) rooms with a sloping ceiling or projection below ceiling line; or

(c) other rooms or spaces.

NF3.3 Ceiling fans

Ceiling fans and other such appliances must be at a minimum clerance of 2.1 m.

LIGHT AND VENTILATION

NF4.1 Provision of natural light

Natural lighting must be provided in:

(a) Class 2 buildings - to all bedrooms and dormitories.

(b) *Health-care buildings* - to all rooms used for sleeping purposes.

(c) *School* buildings - to all general purpose classrooms in primary or secondary *schools* and all playrooms or the like for the use of children in an *early childhood centre* .

NF4.2 Methods and extent of natural lighting

Direct natural lighting must be provided by *windows* that-

(a) have an aggregate light transmitting area measured excluding framing members, glazing bars or other obstructions of not less than 10% of the *floor area* of the room;

(b) face-

(i) a court or other space open to the sky; or

(ii) an open verandah, open carport, or the like;

(c) are not less than a horizontal distance from any adjoining allotment, or a wall of the same building or another building on the allotment that they face, that is the greater of-

(i) in a Class 2 or *health-care buildings* - 1 m; and

(ii) in a *ward area* or other room used for sleeping purposes in a *health-care building* - 3m.

NF4.3 Natural light borrowed from adjoining room

Natural lighting to a *sole-occupancy unit* of a Class 2 building may come through a glazed panel or opening from an adjoining room (including an enclosed verandah) if-

(a) in the building both rooms are within the same *sole-occupancy unit* or the enclosed verandah is on common property;

(b) the glazed panel or opening has an area of not less than 10% of the *floor area* of the room to which it provides light; and

(c) the adjoining room has *windows* with an aggregate light transmitting area of not less than 10% of the combined *floor areas* of both rooms.

The areas specified in (b) and (c) may be reduced as appropriate if direct natural light is provided from another source.

NF4.4 Artificial lighting

Artificial lighting must be provided-

(a) in *required* stairways and ramps by means of separate electrical wiring circuits from the main switchboard for the exclusive use of the stairway or ramp; and

(b) if natural lighting of a standard equivalent to that *required* by NF4.2 is not available and the periods of occupation, or use of the room or space will create undue hazard to occupants seeking egress in an emergency, in -

- Class 2 and 3 buildings - to all rooms that are frequently occupied and all corridors, lobbies, internal stairways, other circulation spaces and paths of egress.

NF4.5 Ventilation of rooms

(a) A *habitable room*, office, shop, factory, workroom, *sanitary compartment* , bathroom, shower room, laundry and any other room occupied by a person for any purpose must have adequate flow-through or cross-ventilation and air quality, including sufficient air-changes and fresh air quantities.

(b) Provision of either-

(i) natural ventilation complying with NF4.6; or

(ii) a mechanical ventilation or air conditioning system with provision for reasonable natural ventilation in case of a lengthy failure of the mechanical system,

satisfies (a).

Where it is not practical to provide any natural ventilation for a *sanitary comparment*, bathroom, shower or laundry (other than commercial), it is permissible to have only a mechanical ventilation system with the same effect as otherwise *required* for natural ventialtion.

NF4.6 Natural ventilation

Required natural ventilation must be provided by permanent *windows* , openings, doors or other devices which can be opened-

(a) with an aggregate opening or openable size not less than 15% of the *floor area* of the room *required* to be ventilated; and

(b) open to-

(i) a court, or space open to the sky; or

(ii) an open verandah, open carport, or the like.

NF4.7 Ventilation borrowed from adjoining room

Natural ventilation to a room may come through a *window*, opening, ventilating door or other device from an adjoining room (including an enclosed verandah) if both rooms are within the same *sole-occupancy unit* or the enclosed verandah is common property, and-

(a) in a *sole-occupancy unit* of a Class 2 building -

(i) the room to be ventilated is not a *sanitary compartment* ;

(ii) the *window* , opening, door or other device has a ventilating area of not less than 15% of the *floor area* of the room to be ventilated; and

(iii) the adjoining room has a *window* , opening, door or other device with a ventilating area of not less than 15% of the combined *floor areas* of both rooms;

(b) in a Class 3 building-

(i) the *window* , opening, door or other device has a ventilating area of not less than 15% of the *floor area* of the room to be ventilated, measured not more than 3.6 m above the floor; and

(ii) the adjoining room has a *window* , opening, door or other device with a ventilating area of not less than 15% of the combined *floor areas* of both rooms; and

(c) the ventilating areas specified in (a) and (b) may be reduced as appropriate if direct natural ventilation is provided from another source.

NF4.8 Restriction on position of WCs and urinals

A room containing a closet pan or urinal must not open directly into-

(a) a kitchen or pantry;

(b) a public dining room or restaurant;

(c) a dormitory in a Class 2 building;

(d) a room used for public assembly; or

(e) a workplace normally occupied by more than one person.

NF4.9 Airlocks

If a room containing a closet pan or urinal is prohibited under NF4.8 from opening directly to another room-

(a) in a *sole-occupancy unit* in a Class 2 building -

(i) access must be by an airlock, hallway or other room; or

(ii) the room containing the closet pan or urinal must be provided with an exhaust fan; and

(b) in a Class 3 building (which is not an *early childhood centre*, or primary *school*) -

(i) access must be by an airlock, hallway or other room with a *floor area* of not less than 1.1 m^2 and fitted with *self-closing* doors at all access doorways; or

(ii) the room containing the closet pan or urinal must be provided with mechanical exhaust ventilation and the doorway to the room adequately screened from view.

NF4.10 Sub-floor ventilation

(a) Suitable provision must be made to prevent undue deterioration of the lowest floor of a building because of dampness, other conditions on the allotment or the design of the building.

(b) The following would satisfy the requirements of (a)-

(i) where timber is used, the floor framing must be suspended with a minimum 400 mm clearance from the ground underneath to the floor and all around. Subfloor ventilation must be provided with ventilation openings totalling not less than 3% of the peripheral vertical area between the ground and the boundary of the floor. These openings are to be spaced as uniformly as practicable.

(ii) where other than timber is used:

. subfloor ventilation should be provided if the floor is suspended;

. an impervious cover provided over the ground surface beneath the building; or

. the floor members suitably treated.

WATERSUPPLY PLUMBING

NF5.1 General requirements

The plumbing work for water supply must ensure -

(a) the appropriateness of the materials and products used;

(b) the correct sizing of water services for the intended use;

(c) the control of cross-connections and prevention of backflow;

(d) adequate care in the installtion of the services;

(e) suitable provision of main and subsidiary storage as *required* ;

(f) adequate connections to sanitary services without endangering health and hygiene; and

(g) the installation of hot water systems to provide safe and adequate service.

NF5.2 Means of compliance

The requirements of NF5.1 are satisfied if all plumbing for watersupply is carried out to the relevant provisions of -

(a) AS 3500 - Part 1 for cold water service; and

(b) AS 3500 - Part 4 for hot water service.

NF5.3 Pipes which are not easy to access

Particular attention is drawn to the provisions in AS 3500 - Parts 1 and 4 which prohibit the installation of pipes and fittings of certain materials in locations which are concealed or difficult to access. These include pipes made of ABS, galvanised steel, polybutylene and UPVC. Pipes and fittings made of copper, copper alloy, stainless steel, ductile iron, cast iron and polyethylene when used in concealed or difficult to access locations must follow the special precautions specified in AS 3500 - Parts 1 and 4.

NF5.4 Access to domestic-type water heaters

(a) A household water heater which is installed in a building must-

(i) be supported on construction sufficient to carry its full capacity weight and any possible wind or earthquake loads;

(ii) be positioned to enable adequate access for operation, maintenance and removal; and

(iii) provide suitably for any overflow, especially if installed in a concealed location.

(b) AS 3500 - Part 4 is the relevant standard for the installation of a household water heater.

NF5.5 Rainwater storage

When rainwater is collected and stored, the storage and distribution must reasonably ensure that the water is not contaminated by unsafe or unsuitable materials. The capacity of the catchment and storage must be adequate to provide a continued supply of water during years of low rainfall. Specification DF5.5 may be used to provide storage.

SANITARY PLUMBING AND DRAINAGE

NF6.1 General requirements

Sanitary plumbing and drainage must ensure -

(a) the appropriateness of the products and materials used;

(b) the correct sizing of drainage services for the intended use;

(c) adequate care in the installation of the services including the provision of appropriate grades; and

(d) that foul gases are not allowed to produce unhygienic conditions or any nuisance to anyone.

NF6.2 Means of compliance

The requirements of NF6.1 are satisfied if all sanitary plumbing and drainage works are carried out to the relevant provisions of AS 3500 - Part 2 - Sanitary plumbing and sanitary drainage.

Where appropriate, these requirements may also be met by complying with the provisions of Part DF6.

NF6.3 Certain floors to be drained

In a Class 2 building the floor of each bathroom and laundry in a *sole-occupancy unit* which is located at other than the lowest level must be graded to permit drainage to a floor waste gully.

NF6.4 Grease trap

Where the nature of the occupancy is such that the waste water contains grease, fats or oils to levels unacceptable to the Authority having jurisdiction, a suitable grease trap must be installed. The accumulated grease and oils must be removed at intervals sufficient to prevent their escape into the disposal system. After removal the grease and oils must be suitably disposed off.

NF6.5 Trade wastes

Any trade waste unacceptable to the Authority having jurisdiction must be pretreated before it enters the disposal system.

NF6.6 Small treatment plants

Where there is no public sewerage and treatment system available one of the following methods may be used for the treatement of sewage:

(a) Packaged treatment plants.

(b) Septic tanks.

(c) Any other suitable method.

The details given in Annexure 2 to Specification DF2.1 may be used for the preliminary design of the main elements of a septic tank system if such a system is considered.

ROOF DRAINAGE

NF7.1 Roof drainage

Roof drainage where provided must comply with the requirements of Part DF7.

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PUBLIC BUILDINGS AND GROUP DWELLINGS (CLASS 2 TO 9)

SECTION **NG**

ANCILLARY PROVISIONS

Performance Requirements
Deemed-to-Satisfy Provisions

PERFORMANCE REQUIREMENTS

OBJECTIVES AND REQUIRED PERFORMANCE

This Section contains more specific requirements for particular parts of buildings or structures.

Parts of buildings and structures must be so designed and constructed that the following objectives, **in addition** to those listed for Sections A, B, NC, ND, NE and NF where relevant, are fulfilled:

NGP1 Minor Structures and Components

NGP1.1 Refrigerated chambers, strong rooms and vaults

Refrigerated, cooling chambers, strong rooms and vaults, or the like, which are capable of entry by a person must have adequate safety measures to facilitate escape and for alerting persons outside the chamber or vault in the event of an emergency.

NGP1.2 Domestic-type water heaters

Household water heaters must be adequately supported and drained, and accessible.

NGP1.3 Safety at elevated places

Elevated places with regular access such as some flat roofs must have adequate protection to prevent anyone from falling.

NGP1.4 Use of airspace over public places

Any use of the airspace over public places such as footpaths and roads must be limited to ensure that normal public use of such places is not obstructed.

NGP2 Fireplaces, Chimneys and Flues

Fireplaces, chimneys and flues must be adequately constructed or separated to prevent-

(a) ignition of nearby parts of the building; or

(b) escape or discharge of smoke to the inside of the building or to adjacent *windows* , ventilation inlets, or the like.

DEEMED-TO-SATISFY PROVISIONS

MINOR STRUCTURES AND COMPONENTS

NG1.1 Refrigerated chambers, strong rooms and vaults

(a) A refrigerated or cooling chamber which is of sufficient size for a person to enter must-

(i) have a door which is in an opening with a clear width of not less than 600 mm and a clear height of not less than 1.5 m; and

(ii) at all times, be able to be opened from inside without a key.

(b) A strong room or a vault in a building must have-

(i) internal lighting controllable only from within the room; and

(ii) a pilot light located outside the room but controllable only by the switch for the internal lighting.

(c) A refrigerated or cooling chamber, strong room or vault must have a suitable alarm device located outside but controllable only from within the chamber, room or vault.

NG1.2 Access to domestic-type water heaters

(a) A household water heater which is installed in a building must-

(i) be supported on construction sufficient to carry its full capacity weight and any possible wind or earthquake loads;

(ii) be positioned to enable adequate access for operation, maintenance and removal; and

(iii) provide suitably for any overflow, especially if installed in a concealed location.

(b) Installation of a household water heater in accordance with AS 1529 satisfies (a).

NG1.3 Parapets on flat roofs

Where a flat roof or other elevated place has regular access a parapet or balustrade of not less than 1 m height above the surface of the roof or elevated place must be provided. The smallest dimension of any opening in the parapet or balustrade must not exceed 100 mm.

NG1.4 Projections over public places

Buildings must not project beyond the allotment boundary. Architectural features such as eaves cornices clocks lamps ventilating equipment trade signs hoardings flag poles bay or oriel windows and such like as well as a platform or balcony to provide additional means of egress from an existing building, may however project over public footpaths or roads with the following minimum clearances-

(a) 3300 mmabove existing or intended finished level of footpaths; and

(b) the outer extremity of the feature must be setback 500 mm from the existing or intended kerb.

Any drainage from such architectural features (including drainage from airconditioning and other ventilating equipment) must be suitably taken down to a *drain* with downpipes which must also satisfy the *required* clearances.

NG1.5 Moveable Awnings or sunshades over public places

Any moveable awnings or sunshades must be firmly fixed so that they do not create any danger obstrúction or inconvenience to pedestrians. They must provide the following minimum clearances if they project over public places:-

(a) 2300 mm above the finished levels of the footpath; and

(b) their outer extremity must be set back 500 mm from the kerb.

NG1.6 Fences

Any fencing or free-standing wall must be suited to the occupancy of the building within. If any barbed wire or other such is used it must be at a height of not less than 2 m above the finished level of any existing or intended adjacent footpath.

FIREPLACES, CHIMNEYS AND FLUES

NG2.1 General requirements

A chimney or flue must be constructed-

(a) to withstand the temperatures likely to be generated by the appliance to which it is connected;

(b) so that the temperature of the exposed faces will not exceed a level that would cause damage to nearby parts of the building;

(c) so that hot products of combustion will not-

(i) escape through the walls of the chimney or flue; or

(ii) discharge in a position that will cause fire to spread to nearby *combustible* materials or allow smoke to penetrate through nearby *windows*, ventilation inlets, or the like;

(d) in such a manner as to prevent rainwater penetrating to any part of the interior of the building;

(e) such that its termination is not less than:

(i) 600 mm above any point of penetration of or contact with the roof; and

(ii) 900 mm above any opening or openable part in any building, within 3 m horizontal distance of the chimney or flue; and

(f) so that it is accessible for cleaning.

NG2.2 Open fireplaces deemed-to-satisfy

An open fireplace, or solid-fuel burning appliance in which the fuel-burning compartment is not enclosed, satisfied NG2.1 if it has-

(a) a hearth constructed of stone, concrete, masonry or similar *non-combustible* material so that-

(i) it extends not less than 300 mm beyond the front of the fireplace opening and not less than 150 mm beyond each side of that opening.

(ii) it extends beyond the limits of the fireplace or appliance not less than 300 mm if the fireplace or appliance is free-standing from any wall of the room;

(iii) its upper surface does not slope away from the grate or appliance; and

(iv) *combustible* material situated below the hearth (but not below that part *required* to extend beyond the fireplace opening or the limits of the fireplace) is not less than 155 mm from the upper surface of the hearth;

(b) walls forming the sides and back of the fireplace up to not less than 300 mm above the underside of the arch or lintel which-

(i) are constructed in 2 separate leaves of solid masonry not less than 180 mm thick, excluding any cavity; and

(ii) do not consist of concrete block masonry in the construction of the inner leaf;

(c) walls of the chimney above the level referred to in (b)-

(i) constructed of masonry units with a net volume, excluding cored and similar holes, not less than 75% of their gross volume, measured on the overall rectangular shape of the units, and with an actual thickness of not less than 90 mm; and

(ii) lined internally to a thickness of not less than 12 mm with rendering consisting of 1 part cement, 3 parts lime, and 10 parts sand by volume, or other suitable material; and

(d) suitable damp-proof courses or flashings to maintain weatherproofing.

NG2.3 Incinerator rooms

(a) If an incinerator is installed in a building any hopper giving access to a charging chute must be-

(i) *non-combustible* ;

(ii) gastight when closed;

(iii) designed to return to the closed position after use;

(iv) not attached to a chute that connects directly to a flue unless the hopper is located in the open air; and

(v) not located in a *required exit*

(b) If an incinerator is in a separate room, that room must be separated from other parts of the building by construction with an FRL of not less than 60/60/60.

DEEMED-TO-SATISFY PROVISIONS

MINOR STRUCTURES AND COMPONENTS

NG1.1 Refrigerated chambers, strong rooms and vaults

(a) A refrigerated or cooling chamber which is of sufficient size for a person to enter must-

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(ii) at all times, be able to be opened from inside without a key.

(b) A strong room or a vault in a building must have-

(i) internal lighting controllable only from within the room; and

(ii) a pilot light located outside the room but controllable only by the switch for the internal lighting.

(c) A refrigerated or cooling chamber, strong room or vault must have a suitable alarm device located outside but controllable only from within the chamber, room or vault.

NG1.2 Access to domestic-type water heaters

(a) A household water heater which is installed in a building must-

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