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Edition 3

SOUTH AFRICAN NATIONAL STANDARD

The application of the National Building Regulations

Part P: Drainage

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Table of changes		
Change No.	Date	Scope

Acknowledgement

The SABS Standards Division wishes to acknowledge the work of the National Home Builders Registration Council's Technical Advisory Committee and the South African Institution of Civil Engineering in interpreting functional regulations relating to drainage.

Foreword

This South African standard was approved by National Committee SABS SC 138F, *Water and sanitation – Equipment and systems – Drainage*, in accordance with procedures of the SABS Standards Division, in compliance with annex 3 of the WTO/TBT agreement.

This document was published in October 2010.

This document supersedes the corresponding parts of SABS 0400:1990 (first revision).

Compliance with the requirements of this document will be deemed to be compliance with the requirements of part P of the National Building Regulations, issued in terms of the National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977).

SANS 10400 consists of the following parts, under the general title *The application of the National Building Regulations*:

Part A: General principles and requirements.

Part B: Structural design.

Part C: Dimensions.

Part D: Public safety.

Part F: Site operations.

Part G: Excavations.

Part H: Foundations.

Part J: Floors.

Part K: Walls.

Part L: Roofs.

Part M: Stairways.

Part N: Glazing.

Part O: Lighting and ventilation.

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Foreword *(concluded)*

Part P: Drainage.

Part Q: Non-water-borne means of sanitary disposal.

Part R: Stormwater disposal.

Part S: Facilities for persons with disabilities.

Part T: Fire protection.

Part V: Space heating.

Part W: Fire installation.

This document should be read in conjunction with SANS 10400-A.

Annexes A and C form an integral part of this document. Annex B is for information only.

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The application of the National Building Regulations

Part P: Drainage

1 Scope

This part of SANS 10400 provides deemed-to-satisfy requirements for compliance with part P (Drainage) of the National Building Regulations.

NOTE Part P of the National Building Regulations, issued in terms of the National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977), is reproduced in annex A.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

ISO 9896:1996, *Plastics traps for discharge pipework systems inside buildings*.

SANS 497, *Glazed ceramic sanitaryware*.

SANS 1024, *Welded steel fabric for reinforcement of concrete*.

SANS 1200 DB (SABS 1200 DB), *Standardized specification for civil engineering construction – Section DB: Earthworks (pipe trenches)*.

SANS 1200 LB (SABS 1200 LB), *Standardized specification for civil engineering construction – Section LB: Bedding (pipes)*.

SANS 1200 LD (SABS 1200 LD), *Standardized specification for civil engineering construction – Section LD: Sewers*.

SANS 1321-1, *Non-metallic waste traps – Part 1: Plastics waste traps*.

SANS 1321-2, *Non-metallic waste traps – Part 2: Rubber waste traps*.

SANS 2001-CC1, *Construction works – Part CC1: Concrete works (structural)*.

SANS 2001-CC2, *Construction works – Part CC2: Concrete works (minor works)*.

SANS 2001-CM1, *Construction works – Part CM1: Masonry walling*.

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SANS 2001-EM1, *Construction works – Part EM1: Cement plaster.*

SANS 4633/ISO 4633, *Rubber seals – Joint rings for water supply, drainage and sewerage pipelines – Specification for materials*

SANS 10252-2 (SABS 0252-2), *Water supply and drainage for buildings – Part 2: Drainage installations for buildings.*

SANS 10400-A (SABS 0400-A), *The application of the National Building Regulations – Part A: General principles and requirements.*

SANS 50858-1/EN 858-1, *Separator systems for light liquids (e.g. oil and petrol) – Part 1: Principles of product design, performance and testing, marking and quality control.*

SANS 52566-1/EN 12566-1, *Small wastewater treatment systems for up to 50 PT – Part 1: Prefabricated septic tanks.*

SANS 60335-2-16/IEC 60335-2-16, *Household and similar electrical appliances – Safety – Part 2-16: Particular requirements for food waste disposers.*

3 Definitions

For the purposes of this document, the definitions given in SANS 10400-A (some of which are repeated for convenience) and the following apply.

3.1

absorption field

on-site effluent system, such as a french drain or evapo-transpirative bed

3.2

acceptable

acceptable

a) in the opinion of any local authority, or

b) in relation to any document issued by the council, in the opinion of the council

3.3

adequate

adequate

a) in the opinion of any local authority, or

b) in relation to any document issued by the council, in the opinion of the council

3.4

Agrément certificate

certificate that confirms fitness-for-purpose of a non-standardized product, material or component or the acceptability of the related non-standardized design and the conditions pertaining thereto (or both) issued by the Board of Agrément South Africa

3.5

approval

approval

a) by any local authority, including approval contemplated in section 7(7)(b) of the Act, or

b) by the Review Board on appeal to the Review Board in terms of the Act

4

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3.6

approved

approved

a) by any local authority, or

b) by the Review Board on appeal to the Review Board in terms of the Act

3.7

Board of Agrément South Africa

body that operates under the delegation of authority of the Minister of Public Works

3.8

branch discharge pipe

horizontal discharge pipe that conveys the discharge from one or more sanitary fixtures to a discharge stack

3.9

branch drain

drain which discharges into a main drain

3.10

branch vent

horizontal ventilating pipe connecting two or more trap vents to a vent stack or to a stack vent

3.11

capacity

volume of a storage tank between the operating level of the water contained in such tank and the invert of the outlet from the tank

3.12

cleaning eye

access opening to the interior of a discharge pipe or trap provided for the purpose of internal cleaning, and which remains permanently accessible after completion of the drainage installation

3.13

common drain

that portion of a drain which conveys sewage other than or in addition to that sewage which emanates from the site through which such drain runs

3.14

competent person

person who is qualified by virtue of his education, training, experience and contextual knowledge to make a determination regarding the performance of a building or part thereof in relation to a functional regulation or to undertake such duties as may be assigned to him in terms of the National Building Regulations

NOTE This is a generic definition, to be used where no other definition is given, or no references are made to other standards. Other parts of SANS 10400 contain definitions of a more specific nature relevant to their disciplines.

3.15

competent person (sanitation)

person who

a) is registered in terms of the Engineering Profession Act, 2000 (Act No. 46 of 2000), as either a Professional Engineer or a Professional Engineering Technologist, and

b) has a tertiary qualification (degree or diploma) in either civil or mechanical engineering, and

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c) is generally recognized as, or can furnish acceptable proof of, having the necessary experience and training to undertake rational assessments or rational designs in the field of sanitation

3.16

connecting sewer

pipe that is vested in the local authority and which connects a drain to a sewer

3.17

conservancy tank

covered tank used for the reception and temporary retention of sewage, and which requires emptying at intervals

3.18

deemed-to-satisfy requirement

non-mandatory requirement, the compliance with which ensures compliance with a functional regulation

3.19

depth of water seal

quantity of water that would have to be removed from a fully charged trap before gases and odours at atmospheric pressure could pass through such trap

3.20

developed length

length of a pipe between two specified points on such pipe measured along the centre line of such pipe, including any bend, junction or similar fitting

3.21

discharge pipe

pipe which conveys the discharge from a sanitary fixture to a drain, and includes a soil pipe, a waste pipe, a discharge stack, a branch discharge pipe or a fixture discharge pipe

3.22

discharge stack

vertical discharge pipe which conveys the discharge from two or more sanitary fixtures and which is connected directly to a drain

3.23

drain

that part of any drainage installation outside a building and which is below ground level, but does not include the following:

- a) any discharge pipe;
- b) that portion of a discharge stack which is below ground level;
- c) the bend at the foot of the discharge stack

3.24

drainage installation

installation vested in the owner of a site and which is situated on such site and is intended for the reception, conveyance, storage or treatment of sewage, and may include sanitary fixtures, traps, discharge pipes, drains, ventilating pipes, septic tanks, conservancy tanks, sewage treatment works, or mechanical appliances associated therewith

3.25

dwelling house

single dwelling unit and any garage and other domestic outbuildings thereto, situated on its own site

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3.26

dwelling unit

unit that contains one or more habitable rooms and that is provided with adequate sanitary and cooking facilities

3.27

electrical sanitary fixture

device which is connected to an electricity supply and to a water supply to perform a function such as the washing of clothes or dishes, or rendering waste matter suitable for disposal into a discharge pipe, including a food-waste disposal unit

3.28

evapo-transpirative bed

effluent disposal system that comprises a shallow cohesionless sand-filled excavation covered with topsoil and planted over with suitable vegetation

3.29

fixture branch

horizontal fixture discharge pipe

3.30

fixture discharge pipe

discharge pipe which conveys the discharge from a single sanitary fixture

3.31

fixture unit

arbitrary unit of measure for expressing the hydraulic loading on a drainage installation

3.32

fixture unit rating

value in fixture units assigned to a sanitary fixture from a consideration of the duration of its discharge, the interval between discharges, and its mean discharge rate

3.33

floor drain

pipe fitting into which waste water from the floor is discharged and that is normally connected to a branch discharge pipe, which conveys such discharge to a gully, a discharge stack or an open channel

3.34

french drain

trench filled with suitable material which is used for the disposal of liquid effluent from a septic tank or waste water

3.35

functional regulation

regulation that sets out in qualitative terms what is required of a building or building element or building component in respect of a particular characteristic, without specifying the method of construction, dimensions or materials to be used

3.36

gauge pressure

amount by which the pressure exceeds the atmospheric pressure

3.37

gully

pipe fitting incorporating a trap into which waste water is discharged

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3.38

habitable room

room used or designed, erected, adapted or intended to be used by persons for sleeping in, living in, the preparation or consumption of food or drink, the transaction of business, the rendering of professional services, the manufacture, processing or sale of goods, the performance of work, the gathering together of persons or for recreational purposes

3.39

horizontal

in relation to a discharge pipe or ventilating pipe, means inclined at less than 45° to a level plane

3.40

industrial effluent

liquid which might or might not contain matter in solution or suspension which is given off in the course of or as a result of any industrial, trade, manufacturing, mining or chemical process or any laboratory, research or agricultural activity, and includes any liquid other than soil water, waste water or stormwater

3.41

inspection chamber

chamber not deeper than 1 200 mm and of such dimensions that access can be obtained to a drain without requiring a person to enter into such a chamber

3.42

inspection eye

access opening to the interior of any pipe or pipe fitting in a drainage installation provided solely for the purposes of inspection and testing, and to which permanent access after completion of the drainage installation need not be provided

3.43

interceptor

device that

- a) is designed to cool down incoming hot waste water to below 30 °C to enable grease and fat to separate from the water and to solidify or be collected on the surface level of the waste water, and that prevents grease and fat from entering a sewer; or
- b) separates and stores light liquid hydrocarbons from effluent water and stormwater, to prevent the light liquids from entering a sewer

3.44

light liquid

liquid of a lower density than water, that is insoluble or only slightly soluble or only very slightly soluble in water, is non-saponifiable and non-polar (for example, naphthous oils, lubricating oils, diesel and fuel oils (but excluding emulsions and vegetable and animal fats and oils))

3.45

load

value of a force corresponding to an action

3.46

main drain

longest run of drain from a building to a common drain, to a means of sewage disposal situated on the site concerned, or to a connecting sewer

3.47

manhole

chamber of a depth greater than 750 mm and of such dimensions that it allows entry of a person into such chamber for the purpose of providing access to a drain

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3.48

occupancy

particular use or the type of use to which a building or portion thereof is normally put or intended to be put

NOTE Regulation **A20** (see SANS 10400-A) classifies and designates occupancies.

3.49

offset

deviation of the flow in the vertical plane of the discharge stack

NOTE An offset in a discharge stack is normally accomplished with the use of two bends, the first to direct the flow from a vertical direction to a horizontal direction, and the second to direct the flow back to the vertical position (in the same flow direction).

3.50

one-pipe system

system of piping between sanitary fixtures and a drain in which both waste and soil water discharge down a common discharge stack and in which any trap venting, or other venting that is required, may be via a common vent stack

3.51

percolation rate

rate at which clean water, under a constant or nearly constant hydraulic head, percolates into the surrounding soil in both vertical and horizontal directions

3.52

permanent access

entrance to the interior of a drainage installation that remains accessible after completion of the installation

3.53

population

population determined in accordance with Regulation **A21**

3.54

prefabricated septic tank

single-piece factory-made unit, including inlet and outlet openings, which leaves the factory completed, controlled and ready for installation

3.55

range

number of like sanitary fixtures closely spaced and discharging to a common branch discharge pipe which does not receive the discharge from any other sanitary fixture not in the range

3.56

rational assessment

assessment by a competent person of the adequacy of the performance of a solution in relation to requirements including as necessary, a process of reasoning, calculation and consideration of accepted analytical principles, based on a combination of deductions from available information, research and data, appropriate testing and service experience

3.57

rational design

design by a competent person involving a process of reasoning and calculation and which may include a design based on the use of a standard or other suitable document

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3.58

resealing trap

trap so designed that some of the water forming its seal is retained during siphonic action to reseal after siphonage has been broken

3.59

rodding eye

access opening in a drainage installation provided for the purposes of gaining full-bore access to the interior of a drain for internal cleaning, and which remains permanently accessible after completion of the installation, but does not include an inspection chamber or manhole

3.60

sanitary fixture

receptacle to which water is permanently supplied, and from which waste water or soil water is discharged

3.61

sanitary group

combination of sanitary fixtures comprising not more than one each of a toilet pan, bath, shower and sink and either two washbasins or one washbasin and one bidet

3.62

self-cleaning trap

trap that, when tested with glass balls in accordance with the test method given in annex F of ISO 9896:1996, will allow at least 70 % of the balls to pass

3.63

septic tank

tank designed to receive sewage and to retain it for such a time and in such a manner as to secure adequate decomposition

3.64

sewage

waste water, soil water, industrial effluent and other liquid waste, either separately or in combination, but does not include stormwater

3.65

sewer

pipe or conduit which is the property of, or is vested in, the local authority and which is used or intended to be used for the conveyance of sewage

3.66

single-stack system

particular one-pipe system in which trap vents are not required in terms of specific criteria

3.67

site

erf, lot, plot, stand or other piece of land on which a building has been, is being or is to be erected

3.68

soil branch

branch discharge pipe which conveys soil water

3.69

soil fixture

sanitary fixture which receives and discharges soil water

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3.70

soil pipe

discharge pipe which conveys soil water

3.71

soil water

liquid containing excreta

3.72

stack vent

ventilating pipe that connects to a discharge stack above the highest connected discharge pipe

3.73

storage tank

tank, other than any tank used for storage of hot water or any cistern serving a toilet pan or a urinal, which forms part of a water installation and is used for the storage of water

3.74

stormwater

water resulting from natural precipitation or accumulation and includes rainwater, surface water, subsoil water or spring water

3.75

stormwater drain

pipe, conduit or surface channel situated on a site, and which is used to convey stormwater to a suitable point of discharge

3.76

stormwater sewer

pipe, conduit or channel, owned by or vested in the local authority, which is used for the conveyance of stormwater

3.77

stub stack

straight 100 mm diameter discharge stack not more than one storey high with a rodding eye at the top

3.78

suitable

capable of fulfilling or having fulfilled the intended function, or fit for its intended purpose

3.79

the Act

National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977)

3.80

trap

pipe fitting or a part of a sanitary fixture which is designed to retain a water seal

3.81

trap vent

ventilating pipe connecting an individual trap to the open air or to another ventilating pipe

3.82

two-pipe system

system of piping between sanitary fixtures and a drain in which waste water and soil water discharge through separate discharge pipes and in which any trap venting, or other venting that is required, is via separate ventilating pipes for the waste and soil water systems

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3.83

vent stack

main vertical ventilating pipe of any part of a drainage installation

3.84

ventilating pipe

vent

pipe which leads to the open air at its highest point and which provides ventilation throughout a drainage installation for the purpose of preventing the destruction of water seals, but does not include a discharge pipe

3.85

vertical

in relation to a discharge pipe or ventilating pipe, means inclined at 45° or more to the horizontal, and in relation to a glass pane means installed at an angle between 60° and 90° to the horizontal, both figures being inclusive

3.86

waste branch

branch discharge pipe which conveys waste water only

3.87

waste fixture

sanitary fixture from which waste water is discharged

3.88

waste pipe

discharge pipe which conveys waste water only

3.89

waste water

used water which is not contaminated by soil water or industrial effluent and which does not include stormwater

3.90

water seal

water in a trap which acts as a barrier against the flow of any foul air or gas

4 Requirements

4.1 General

The functional regulation **P2** contained in part P of the National Building Regulations (see annex A) shall be deemed to be satisfied where the drainage installation

- a) complies with the requirements of 4.2 to 4.27,
- b) is the subject of a rational design or rational assessment performed by a competent person (sanitation), and using the principles for the design, installation and testing of sanitary drainage contained in this part of SANS 10400; or
- c) is the subject of an Agrément certificate and the system, element or component is used within the scope, conditions and limitations prescribed in the certificate and the element or component is compatible with other elements or components of the drainage system.

NOTE For more information on performance requirements for sanitation systems, see annex B.

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4.2 Materials, pipes, fittings and joints

In any drainage installation, any type of joint between pipes or between such pipes and fittings shall

- a) be appropriate to and compatible with the materials of which such pipes and fittings are made,
- b) remain watertight in accordance with the requirements of 4.24 under normal working conditions, or where there might be any differential movement between such pipes and any building or ground or other construction forming part of the drainage installation, and
- c) be able to withstand an internal water pressure of 50 kPa and an external water pressure of 30 kPa without leaking.

4.3 Sanitary fixtures

4.3.1 General

4.3.1.1 Any sanitary fixture shall be made of impermeable, non-corrosive material, shall have a smooth and readily cleanable surface and shall be so constructed and fitted as to discharge through a trap into a soil pipe or waste pipe, as the case might be.

4.3.1.2 The water supply outlet to any waste fixture shall be situated not less than 20 mm above the flood-level rim of such fixture.

4.3.2 Electrical sanitary fixtures

4.3.2.1 Any clothes-washing machine or dish-washing machine which is permanently connected to a drainage installation shall discharge through a trap into a waste pipe.

4.3.2.2 The drainage installation shall not incorporate an electro-mechanical food-waste disposal unit or other disposal unit which has a power capacity in excess of 15 A and 550 W, unless

- a) the owner of the building has registered such unit with the local authority or it is shown on an approved plan and such local authority is satisfied that the working of any sewerage or sewage treatment system shall not thereby be impaired, and
- b) such unit has been installed in compliance with the relevant requirements of SANS 60335-2-16 contained in the *Compulsory specification for electrical and electronic apparatus* published in Government Notice No. R. 89 (Government Gazette 31844) of 6 February 2009 and is of a type which will not cause such impairment.

4.3.2.3 Any food-waste disposal unit shall discharge through either a P-trap which has a water seal of not less than 75 mm in depth or shall be the resealing trap of the P-type.

NOTE 1 Where any food-waste disposal unit is

- a) installed in contravention of the requirements of this part of SANS 10400; or
- b) not functioning efficiently or is impairing the work of any part of the sewerage system,

the local authority may serve a notice on the owner of such unit, or the owner or the occupier of the building in which such unit is installed, requiring him to remove or alter such unit, or to alter the manner of its installation, by a date and on such conditions that it may determine.

NOTE 2 The owner should notify the local authority within 14 d of the removal of any registered unit.

4.3.2.4 Any waste disposal system, other than domestic, shall connect to a suitably sized grease trap before it connects to the drain.

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4.4 Toilet pans

4.4.1 A toilet pan shall

- a) be so designed and manufactured as to comply with the relevant performance requirements of SANS 497, or
- b) have a horizontal outlet spigot connected to a soil pipe by means of an adaptor which slopes downwards towards the soil pipe at a gradient of not less than 1:40.

4.4.2 Any toilet pan of the pedestal type shall be manufactured as a single unit. Where such pan is installed in such a position that the joint between its outlet spigot and the soil pipe into which it discharges is connected, such pan shall be installed in such a manner that there is access to such joint.

4.4.3 Any toilet pan of the wall-mounted type shall be manufactured as a single unit and shall be so constructed that such pan can

- a) be firmly attached to a wall, or
- b) be rigidly supported by a bracket.

4.4.4 Any toilet pan of the squat type shall be manufactured in two parts where the joint between the upper and lower parts is situated above the normal level of the water seal in the trap of such pan.

4.4.5 Any toilet pan shall be served by its own separate flushing device.

4.4.6 Any seat associated with any toilet pan shall have a smooth non-absorbent surface and shall be held in place by fasteners made of corrosive-resistant material.

4.5 Urinals

4.5.1 Any urinal shall be

- a) of either one or more slabs, or
- b) a stall, trough, bowl or other suitable receptacle which shall have a smooth and readily cleanable non-absorbent surface.

Where a slab or trough-type urinal is provided, a 600 mm length of such slab or trough shall be deemed to be equivalent to one urinal stall or bowl.

4.5.2 Any urinal or group of urinals shall, for the purposes of 4.5.3, be provided with a user-activated flushing device; provided that this requirement shall not apply with regard to any urinal that is specifically designed and constructed as a flushing urinal.

4.5.3 Any urinal shall be so designed and installed that all of the surfaces within its perimeter, from a distance of not more than 100 mm below the outlet of its flushing device, are cleaned by the water discharged from the device.

4.5.4 When any urinal is made of stainless steel, it shall be made as a single unit and be so constructed that

- a) any weld shall have a degree of corrosion resistance not less than that of the parent metal,
- b) any crevice on the exposed side of joints shall be filled with weld metal, and
- c) any removable corner shall be attached by means of a corrosion-resistant fastener.

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4.5.5 The channel fitted to any slab or stall-type urinal shall be graded with a fall of not less than 1 in 100 and the outlet to this channel shall

- a) serve not more than 4,8 m of slab urinal, or eight stall units, and
- b) be provided with a trap, which shall be provided with a corrosion-resistant grating designed to retain solid matter without obstructing the flow of liquids; provided that any such grating shall not be installed in the case of any trap which serves any siphonic urinal.

4.5.6 All joints between any parts of a urinal shall be urine resistant and watertight.

4.5.7 Any urinal of the wall-mounted type shall be so constructed that it shall

- a) discharge by gravity,
- b) have the following minimum dimensions:
 - 1) a vertical distance of 300 mm from the outlet of the bowl to the lowest point of discharge of flushing water into the urinal;
 - 2) an external width of 300 mm at the widest point; and
 - 3) a horizontal distance of 230 mm from the front of the lip to the wetted face immediately opposite the centre point of such lip,
- c) be manufactured as a single unit, and
- d) where it is a urinal flushed by wash-down action, be provided with a separate trap, or where it is flushed by siphonic or jet action, an integral trap.

4.5.8 A urinal may have dimensions less than those contained in 4.5.7(b) if a trapped floor drain is installed in the same room.

4.5.9 Any flushless urinal shall

- a) be constructed of inert material with a smooth finish and a high resistance to water absorption,
- b) be so constructed that the inner surface of any bowl and outlet is smoothly curved to ensure that the flow of urine into the trap is unimpeded and cannot pond in the urinal, and
- c) have waste fittings and discharge piping made of plastics material or other inert material resistant to corrosion.

4.6 Connectors for toilet pans

4.6.1 The connector which is used to connect the outlet spigot of a toilet pan to a soil pipe shall either

- a) comply with the requirements of SANS 4633, or
- b) not permit any leakage of soil water at the joint,

have a maximum water absorption of 2 %, and be sufficiently flexible to accommodate any surface irregularities or dimensional variations between such spigot and pipe.

4.6.2 The inner surface of the connector shall be smooth, and it shall not be of the concertina type or such as will allow the collection of soil within the connector.

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4.7 Sewage lifts

Where a building is at such a level in relation to the nearest connecting sewer that a drainage installation serving such building cannot discharge into such connecting sewer by gravitation, a suitable appliance, so designed and located as not to be offensive or to be injurious or dangerous to health, shall be installed. Where required by the local authority, standby facilities, for the purpose of raising sewage to a level that will enable it to gravitate to such connecting sewer, shall also be provided.

NOTE The owner of the building is responsible for ensuring that the drainage discharges into the connecting sewer. The owner is also responsible for the operation and maintenance of such arrangements.

4.8 Conservancy tanks, septic tanks and french drains

4.8.1 Conservancy tanks shall, subject to the clearing services provided by the local authority in question,

- a) have a capacity as prescribed by such local authority,
- b) be constructed with a means of access for cleaning, and
- c) be provided with a means for clearing as prescribed by such local authority.

4.8.2 A conservancy tank or septic tank to be used on a site for the reception of sewage shall

- a) be so designed and constructed that it will be impervious to liquid,
- b) be so sited
 - 1) that there will be a ready means of access for the clearing of such tank,
 - 2) that it is not less than 2,0 m from the property boundary, or another structure,
- c) be so designed and sited that it is not likely to become a source of nuisance or a danger to health or the structural integrity of adjacent buildings,
- d) satisfy one of the following criteria:
 - 1) it shall be the subject of an Agrément certificate and be used within the scope, conditions and limitations prescribed in the certificate;
 - 2) it shall be rationally designed by a competent person (sanitation);
 - 3) it shall be designed and constructed in accordance with standard drawings issued by a local authority; or
 - 4) it shall be in accordance with the requirements of 4.8.3, 4.8.5, or 4.8.6, as relevant, and
- e) be vented at the building.

NOTE 1 The siting of conservancy tanks should be approved by the local authority. Generally tanks should be located near driveways to facilitate cleaning by a vacuum tanker.

NOTE 2 The function of the septic tank is to condition raw sewage, which has a clogging effect on soil, thereby reducing the effective absorption capacity of the subsoil. When the raw sewage enters the tank some of the suspended solids settle to the bottom of the tank and some collect at the surface, with the result that three distinct layers are formed in the tank: a layer of sludge at the bottom, a floating layer of scum on the top

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and a relatively clear liquid layer in between. The organic solids and dissolved material in the sewage are attacked by bacteria so that the volume of scum and sludge is reduced by liquification and gasification. The only function of the final disposal system is to get rid of the effluent from the septic tank in a safe and inoffensive way.

NOTE 3 Septic tanks and conservancy tanks should be constructed to prevent contamination of water supplies by leakage or spillage. Accordingly, such tanks should be impermeable to their contents and to sub-soil water.

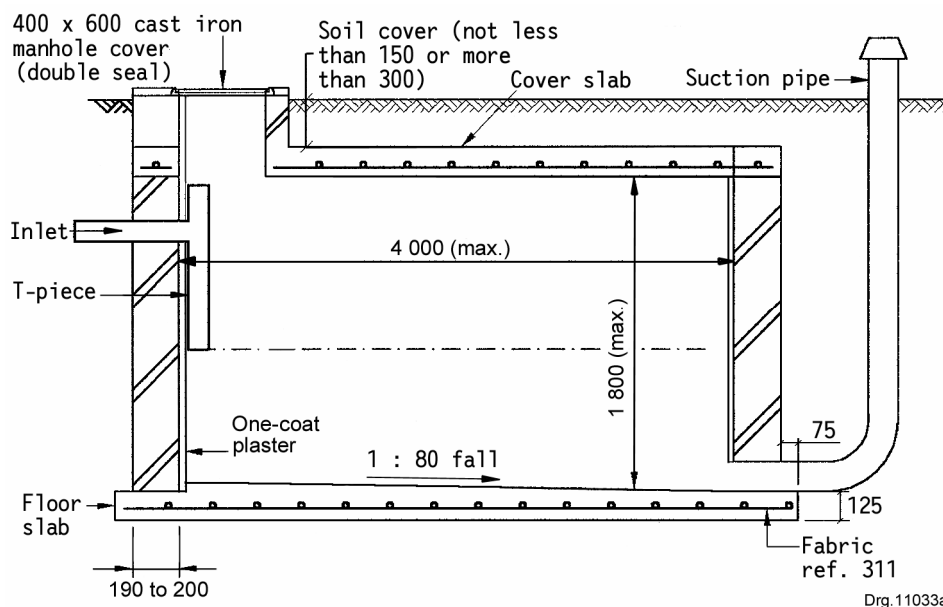
NOTE 4 The vents should extend above the eaves level of the building.

4.8.3 Masonry conservancy tanks shall be constructed in accordance with the details shown in figures 1 and 2 provided that they are constructed above the water table in accordance with the requirements of SANS 2001-CC1 or SANS 2001-CC2, SANS 2001-CM1 and SANS 2001-EM1, and shall comply with the following:

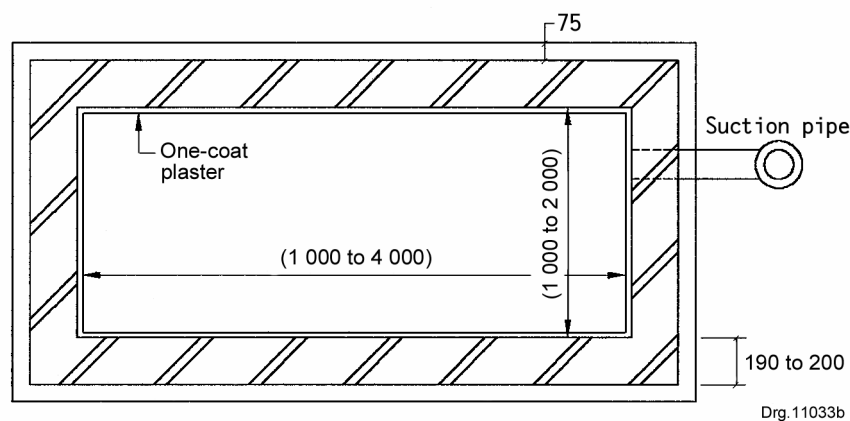
- a) solid and hollow concrete and calcium silicate masonry units shall have a nominal compressive strength of not less than 10,5 MPa and 7,0 MPa, respectively;
- b) burnt clay masonry units shall have a nominal compressive strength of not less than 14,0 MPa and a water absorption of not more than 12 %;
- c) the accuracy of the setting out shall be achieved by positive control measures;
- d) excavations shall be deepened locally, where necessary, to remove soft spots;
- e) hard spots, wherever practicable, shall be removed;
- f) excessive excavations shall be avoided;
- g) excavations shall be kept free of surface water;
- h) where the bottom of the excavation has dried out excessively due to exposure or it has softened due to rain or ground water, the excavation shall be rebottomed before concreting;
- i) backfill, that complies with the requirements of SANS 1200 DB, shall be maintained before compaction, so that a small quantity squeezed in the hand is firm, but does not show signs of moisture;
- j) fill shall be placed in uncompacted layers that do not exceed 100 mm in respect of hand compaction, and 150 mm in respect of compaction by mechanical means; and
- k) each uncompacted layer shall be well compacted before additional fill material is added.

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Dimensions in millimetres



a) Section through conservancy tank



b) Plan of conservancy tank

The suction pipe and coupling details shall be in accordance with local authority requirements.

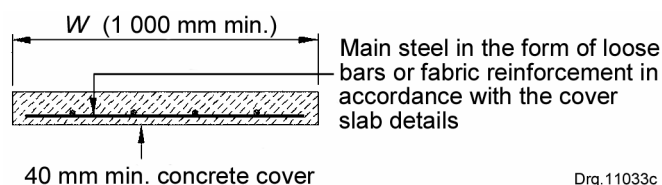
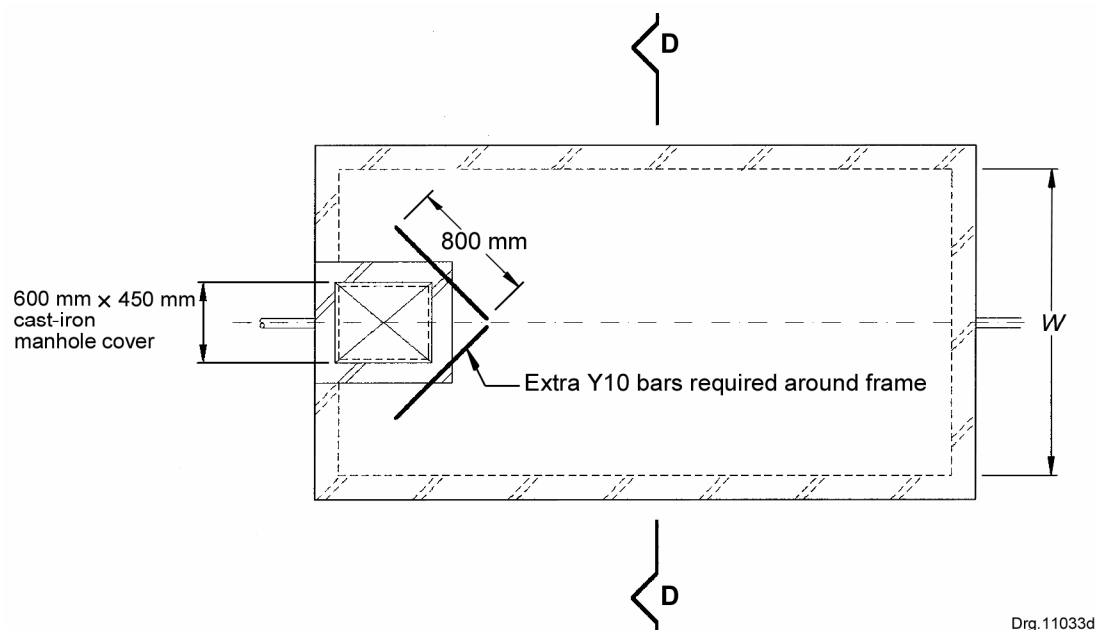
Hollow units shall be filled with grade 10 infill concrete.

A competent person shall provide construction details for tanks founded below perched or permanent water tables.

NOTE See figure 2 for cover slab details.

Figure 1 — Masonry construction details for conservancy tanks

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Section D – D
(Through cover slab of septic tank)

Cover slab details

W m	Slab thickness mm	Reinforcement		Fabric reinforcement (see SANS 1024)
		Short span (main)	Long span (distribution)	
$\geq 1,0$ but $\leq 1,7$	125	Y10 bars at 250 mm centres	Y10 bars at 300 mm centres	Ref. 359
$> 1,7$ but $\leq 2,0$	125	Y12 bars at 250 mm centres	Y12 bars at 300 mm centres	Ref. 617
W = internal width of conservancy tank				
NOTE The slab design is for a maximum of 300 mm soil cover.				

Figure 2 — Reinforced concrete cover slab details for conservancy tanks

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4.8.4 Septic tanks shall

- a) discharge into french drains;
- b) have a minimum capacity of not less than
 - 1) 1,5 m³ where a tank serves a single dwelling house or dwelling unit, and
 - 2) 5,1 m³ where a tank serves a building other than a single dwelling house or dwelling unit;
- c) have a capacity, calculated in terms of annex C, to receive the following number of days' sewage flow immediately before the tank requires desludging:
 - 1) 1 d where the tank serves a single dwelling house or dwelling unit; and
 - 2) 3 d where the tank serves a building other than a single dwelling house or dwelling unit;
- d) be covered with a layer of soil at least 150 mm thick; and
- e) be provided with a means of access for the purpose of emptying and cleaning.

NOTE 1 Septic tanks should be of sufficient size to store sludge and scum in addition to being able to retain liquid. Annex C provides the methods by which the size of septic tanks can be calculated.

NOTE 2 No chemical additives are needed to assist the digestion process in a septic tank and normal amounts of domestic bleach, caustic materials, soaps, detergents and drain cleaners do not impede the process. Materials such as sanitary towels, facial tissue, coffee grounds, cooking oil and cigarette butts should not be flushed into the tank because they do not degrade and might clog the system.

NOTE 3 The tank needs very little routine maintenance and should last for many years. The main cause of problems is failure to periodically desludge the tank because, as the volume of sludge and scum increases, the efficiency of treatment decreases and the result is failure of the absorption field. Tanks should be inspected once every year to establish whether desludging is necessary. Sludge and scum measurements should be carried out in the first (sewage receiving) compartment of multiple-compartment septic tanks. When being desludged, septic tanks should not be washed, scrubbed or disinfected. It is not necessary to leave any solid matter inside to restart the digestive process.

4.8.5 Masonry septic tanks, which are located above any perched or permanent water table, shall be constructed in accordance with the details shown in figures 3 and 4 and in accordance with the requirements of SANS 2001-CC2, SANS 2001-CM1, SANS 2001-EM1, and 4.8.3(a) to (k), and shall have

- a) a depth of soil above the slab of not more than 300 mm;
- b) a minimum width (W) (see figure 3) calculated from the formula

$$W_{\min.} = \sqrt{C/3D}$$

where

C is the required capacity, in cubic metres;

D is the selected depth, in metres, between 1,25 m and 1,80 m;

- c) inlet pipes with a nominal diameter of 100 mm and a gradient over the last 1,0 m not steeper than 1:60;

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- d) outlet pipes with a nominal diameter of not less than 50 mm; and
- e) an incoming drain to the septic tank, ventilated at the building unit and fitted with a T-piece in accordance with the details shown in figure 3.

NOTE 1 If, for example, a tank has a required capacity of $5,1 \text{ m}^3$ and the desired depth (D) is 1,8 m, the minimum width required is equal to $\sqrt{5,1/3 \times 1,8} = 0,97 \text{ m}$ (i.e. 1,0 m).

NOTE 2 The geometry of a tank has an influence on the velocity at which sewage flows through it, on the sludge accumulation, and on the presence of stagnant pockets of liquid inside the tank. When the tank is too deep in relation to its surface area, the plan dimensions will be too small and a direct flow of sewage can take place between the inlet and outlet, resulting in a reduced retention time for the liquid. Where the tank has too large a liquid surface area in relation to its volume, the clear space between sludge and scum will become small, resulting in too high a liquid flow rate for sedimentation and flotation.

NOTE 3 A newly built septic tank should be tested for watertightness. It should be filled with water before use and tested over a period of 24 h for watertightness. If watertight, the tank should be left full. No special chemicals are needed to start the digestion process and it will only take a few weeks for the normal operational conditions to be established. Operational conditions can, however, be accelerated if a few buckets of digested material from another septic tank are introduced into the new tank.

4.8.6 Prefabricated septic tanks shall be in accordance with the requirements of SANS 52566-1.

4.8.7 No industrial effluent shall be allowed to flow into a septic tank.

4.8.8 A french drain which is to receive effluent shall

- a) be so constructed and located as not to cause the pollution of any spring, stream, well or other source of water which is used or is likely to be used, for drinking, domestic use or kitchen purposes,
- b) be so positioned that the foundations of adjacent buildings are not adversely affected by its discharge, and
- c) be not less than 3 m from any building or boundary of the site on which it is situated.

NOTE 1 As a rule, the susceptibility of a water source to pollution decreases sharply as its distance from a french drain increases, except in areas with fissured rock, limestone or very coarse sand. French drains should, where possible, be located downhill of a water source such as a borehole or spring. Where location downhill of such water source is not possible, french drains should be located at least 50 m from the water source. The Department of Water Affairs and Forestry has produced a protocol to manage the potential of ground water contamination from on-site sanitation. Further particulars in this regard can be found in this protocol.

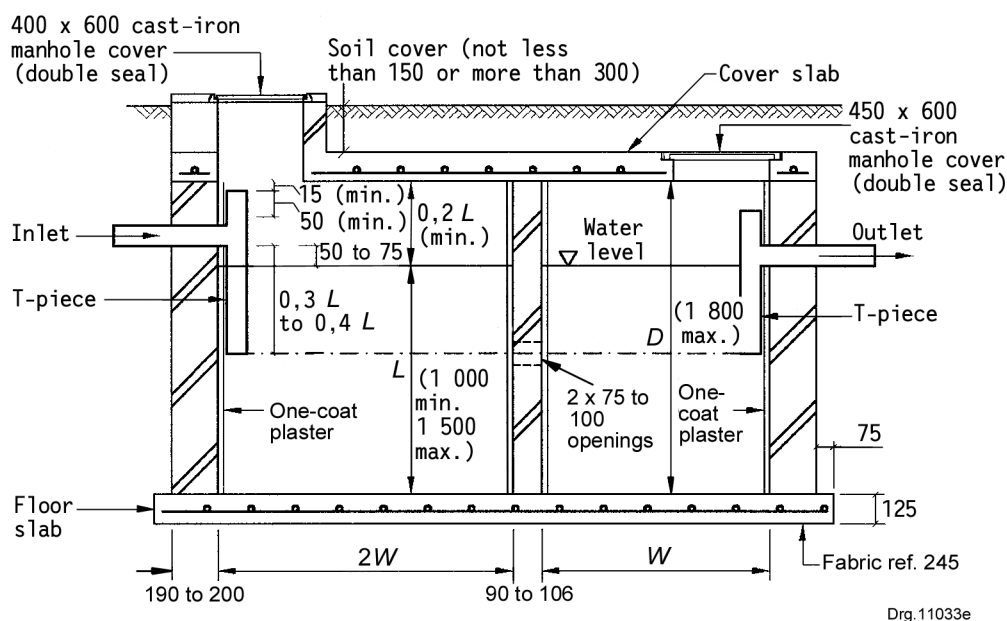
NOTE 2 French drains should preferably be constructed along the contour of the soil surface.

4.8.9 The in-situ percolation test described in 4.25 shall be conducted on all sites which are to receive french drains. No french drain shall be constructed

- a) in ground that has a percolation rate that exceeds 30 min;
- b) where effluent might flow out due to the contours of, or the strata forming, the ground;
- c) where the site to be affected by such effluent is of insufficient size to accommodate the soaking-away of the effluent; or
- d) where the level of the water table is, or might be, such as to prevent adequate percolation.

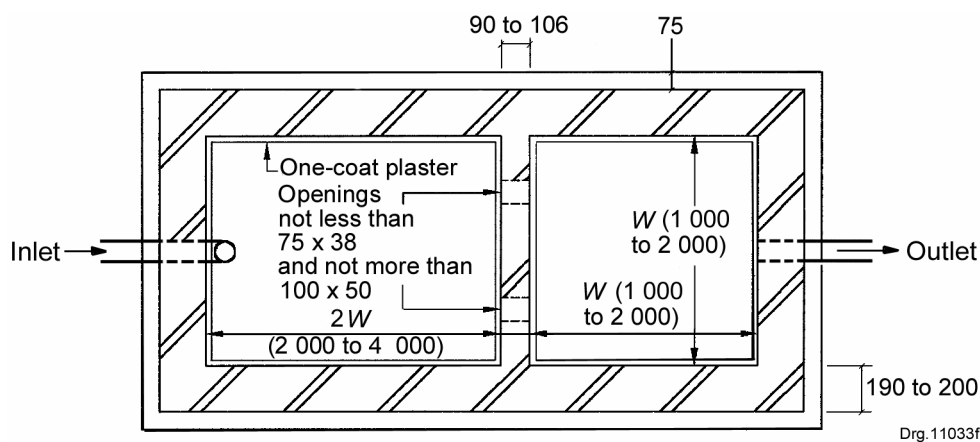
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Dimensions in millimetres



L = depth of water in tank

a) Section through septic tank



b) Plan of septic tank

The diameter of the inlet shall not be less than 100 mm.

The diameter of the outlet shall not be less than 50 mm.

The inlet pipe shall be vented at the housing unit.

Hollow units shall be filled with grade 10 infill concrete.

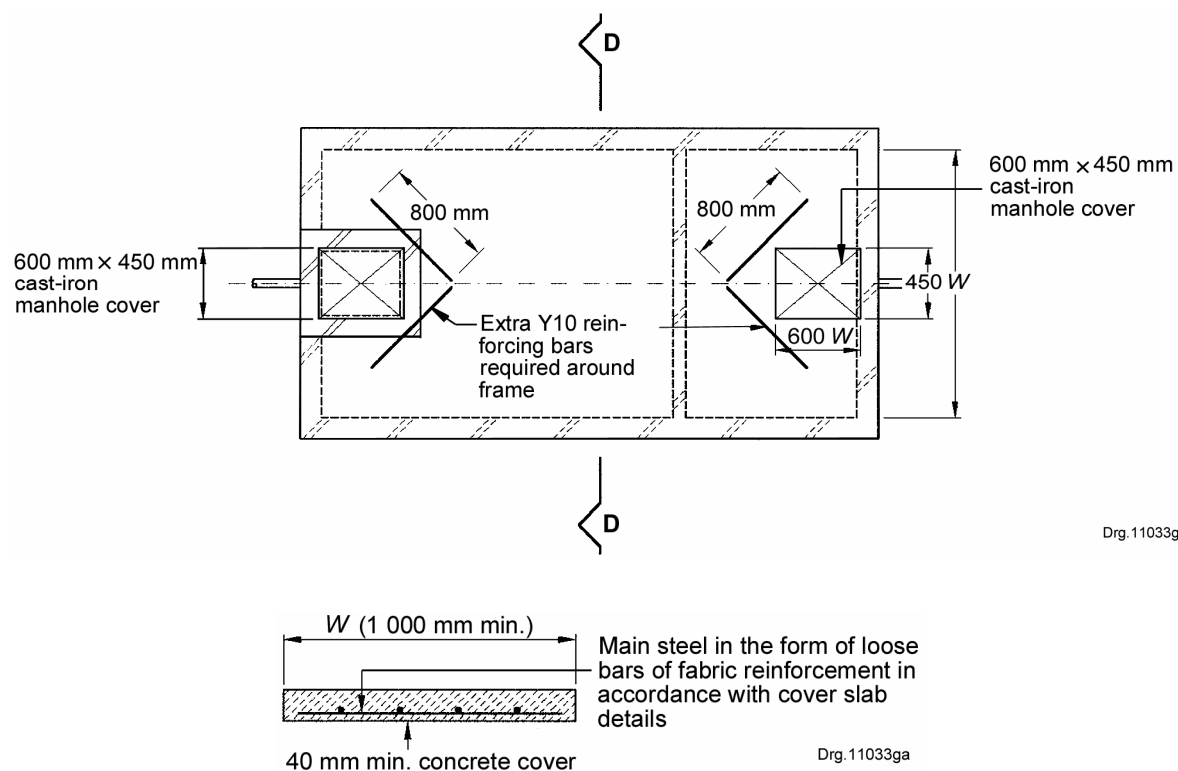
A competent person shall provide construction details for tanks where bases are below perched or permanent water tables.

NOTE See figure 4 for cover slab details.

Figure 3 — Masonry construction details for septic tanks

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Section D – D
(Through cover slab of septic tank)

Cover slab details

W m	Slab thickness mm	Reinforcement		Fabric reinforcement (see SANS 1024)
		Short span (main)	Long span (distribution)	
$\geq 1,0$ but $\leq 1,7$	125	Y10 bars at 250 mm centres	Y10 bars at 300 mm centres	Ref. 359
$> 1,7$ but $\leq 2,0$	125	Y12 bars at 250 mm centres	Y12 bars at 300 mm centres	Ref. 617
W = internal width of conservancy tank				
NOTE The slab design is for a maximum of 300 mm soil cover.				

Figure 4 — Reinforced concrete cover slab details for septic tanks

4.8.10 French drains shall be sized so that the length of the drain is not less than that calculated in accordance with the following formula:

$$L = ((SF/A_{\text{rate}}) - (W \times 2 \times H))/H$$

where

L is the length of the trench, in metres;

SF is the sewage flow, in litres per day, as obtained from table 1 or calculated from table 2, based on the number of people contributing to the flow;

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A_{rate} is the rate of application of effluent to subsoil in filtration areas, in litres per square metre, interpolated from table 3 using the results of the in-situ percolation test;

W is the width of the trench, in metres;

H is the height of the trench, in metres.

EXAMPLE If the rate of sewage flow from a three-bedroom house to a septic tank is 900 L/d (see table 1), and the percolation time is 9 min, the rate of application of effluent to subsoil infiltration areas is 85 L/m² of surface area. Then the required surface area is (900/85) 10,6 m². A 1,0 m deep; 0,6 m wide trench will need to have a length of:

(Surface area – area of trench ends) / (height of trench × 2)
i.e. (10,6 – 0,6 × 1,0 × 2)/(1,0 × 2)
= 4,7 m.

NOTE The bases of trenches are excluded from the calculation of the percolation area as the bases inevitably become clogged with sludge.

4.8.11 Parallel french drains shall not be closer than twice their depth from each other.

NOTE Drains should ideally be constructed in series to ensure that each trench is either fully used or not used at all so as to prevent the development of a surface crust.

4.8.12 Pipes discharging into french drains shall be open-jointed or perforated.

4.8.13 French drains shall not be deeper than 1,8 m. The top and infiltrative surfaces shall be protected by means of either a polyester filter fabric or a 30 mm to 100 mm thick layer of fine gravel or coarse sand. A topsoil layer of between 100 mm and 150 mm shall be placed on top of the drain over an impermeable covering (see figure 5).

NOTE The impermeable covering is required to prevent ingress of rain or surface water.

4.8.14 An inspection pipe shall be installed in all french drains (see figure 5).

NOTE 1 If failure has resulted from the development of a biological clogging layer at the infiltrative surface under anaerobic conditions, the absorptivity of a malfunctioning french drain can often be restored by not using the drain for 10 to 12 months (while another french drain is being used).

NOTE 2 Alternatively to note 1, the system can be rejuvenated by treating it with hydrogen peroxide (H₂O₂), which is a strong oxidizing agent that requires extreme safety precautions to be taken when it is used. Sandy soils require lower concentrations of H₂O₂ than silty soils and can be successfully rejuvenated with a solution of 7,5 % or 15 % at application rates of 0,5 L/m² or 1,25 L/m², respectively. However, for silty soils, an application of at least 2,44 L/m² is needed. Unfortunately, H₂O₂ treatment can be expensive and the decision as to whether to construct a new absorption field or to use H₂O₂ is purely a balance between economics and convenience.

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Table 1 — Flow from dwellings with full internal water reticulation

1	2
Description	Sewage flow L/d
Low-income group:	
Per person per dwelling unit, or	70
Per dwelling unit	500
Middle to upper-income groups:	
Per person per dwelling unit, or	160
Dwelling unit with 2 bedrooms	750
Dwelling unit with 3 bedrooms	900
Dwelling unit with 4 bedrooms	1 100
Dwelling unit with 5 bedrooms	1 400
Dwelling unit with 6 bedrooms	1 600
NOTE An allowance of 15 % for stormwater infiltration and other contingencies should be added to these design figures.	

Table 2 — Sewage flow from dwelling units that do not have internal water reticulation

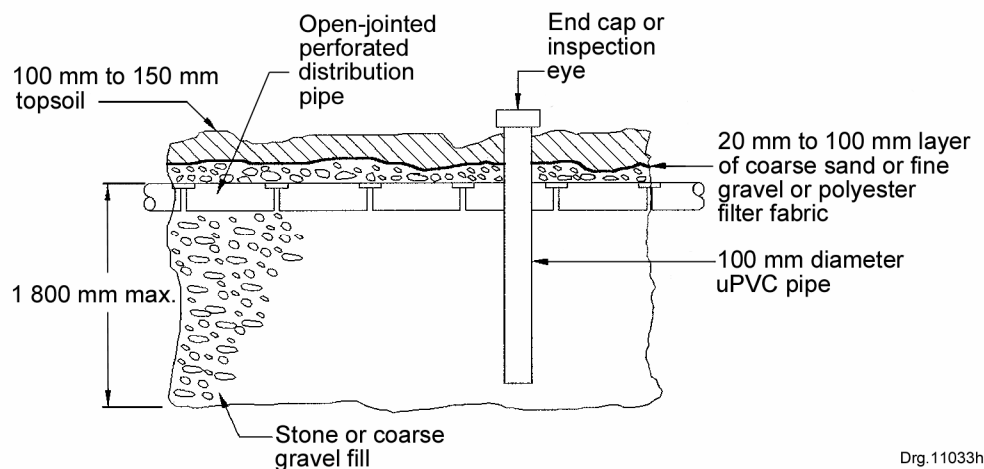
1	2
Level of water supply	Sewage flow L/person/d
Public street standpipes	12 to 15
Single on-site standpipe with dry sanitation system	20 to 25
Single on-site standpipe with a toilet pan connected to the water supply	45 to 55
Single in-house tap with a toilet pan connected to the water supply	50 to 70

Table 3 — Rates of application

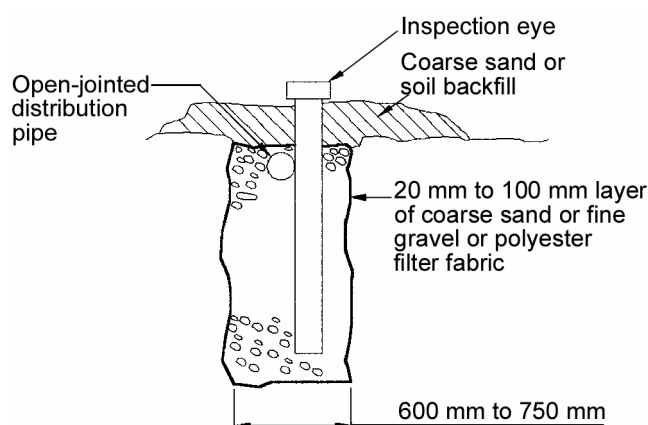
1	2
Percolation time determined in accordance with percolation test min	Rate of application of effluent to subsoil infiltration areas (L/m ² of french drain sides)
0 to 3	108 max.
3 to 5	108 to 100
6 to 10	99 to 80
11 to 15	79 to 65
16 to 20	64 to 53
21 to 26	52 to 40
27 to 30	39 to 33
Over 30	Not permitted
NOTE Intermediate values may be obtained by interpolation.	

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a) Longitudinal section



b) Cross section

Figure 5 — Detail of french drain construction

4.9 Discharges from washing areas

4.9.1 General

Any building used as a stable, garage, cowshed, dairy, kennel, butchery, abattoir or any vehicle-washing area or other similar area that requires regular cleansing and which produces waste water or soil water, shall be connected to a drain which serves such building or area. The drain shall

- be paved with a suitable impervious material, and be graded to a gully which shall be fitted with a removable grating and be connected to a suitable grease, petrol or oil interceptor (or a combination of two or more of these) in accordance with the requirements of SANS 50858-1 or SANS 10252-2,
- be roofed over, and
- be surrounded by a kerb not less than 100 mm high, or be elevated above the immediately surrounding ground level by not less than 100 mm.

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4.9.2 Grease interceptors

4.9.2.1 When a grease interceptor is required for a building, it shall serve only that building.

NOTE Two types of grease interceptors exist, namely those designed for installation inside a building or room and those designed for installation outside a building. Typically, small restaurants or similar establishments that generate small amounts of grease would most likely use a grease interceptor that is installed inside the building.

4.9.2.2 A grease interceptor shall be so located that it is easily accessible for inspection and cleaning purposes and that intercepted fat, grease and oil can be removed hygienically. The location shall be such that

- a) there will be no need to use ladders or to move bulky objects to check or service the interceptor, and
- b) it is possible to completely empty and clean the interceptor.

4.9.2.3 Small factory-constructed grease interceptors shall be designed to

- a) produce a separation performance of at least 92 % when waste water mixed with linseed oil is discharged through the interceptor, and
- b) store at least 40 L of light substances such as grease, fat and oil through flow in litres per second.

4.9.2.4 The flow of water through a small factory-designed grease interceptor shall at no time exceed its rated capacity.

4.9.2.5 No grease interceptor situated below ground outside a building shall be located within 1,0 m of any building foundation or property boundary.

4.9.3 Light liquid interceptors

4.9.3.1 When a light liquid interceptor (for example oil and petrol) is required for a building, it shall serve only that building.

4.9.3.2 A light liquid interceptor shall be so located that it is easily accessible for inspection purposes and for the safe and hygienic removal of intercepted light liquids. The location shall be such that

- a) there will be no need to use ladders or to move bulky objects to check or service the interceptor,
- b) it is possible to completely empty and clean the interceptor, and
- c) it is located within 1 m of any building foundation or property boundary.

4.9.3.3 Light liquid interceptors shall comply with the requirements of SANS 50858-1 and be fitted with an automatic closure device.

4.9.3.4 When tested in accordance with SANS 50858-1, the interceptors shall not have residual oil values of higher than 10 mg/L (10 parts per million) for class 1 interceptors and 120 mg/L (120 parts per million) for class 2 interceptors.

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4.10 Discharges from swimming baths, swimming pools, fountains or reservoirs

4.10.1 Where the owner of a swimming bath, swimming pool, fountain or reservoir requires an overflow to lead away excess rainwater, such overflow shall be designed and constructed to discharge

- a) onto the site upon which such bath, pool, fountain or reservoir is situated, or
- b) into a suitable surface channel, stormwater drain or natural watercourse.

4.10.2 A swimming bath, swimming pool, fountain or reservoir shall be so designed and constructed that the water from the backwashing of any filter is discharged onto the site upon which such bath, pool, fountain or reservoir is situated or, with approval, into a drain.

4.11 Provision of sanitary fixtures

4.11.1 The number of sanitary fixtures to be provided in a building shall be based on the population for which such building is designed, and such population shall be calculated in terms of Regulation **A21** (see SANS 10400-A), provided that

- a) where, in any particular occupancy, separate sanitary facilities are provided for each sex, the number of sanitary fixtures installed for them shall be based on the population of that particular sex for which such facilities are intended and, if the number of persons of each sex cannot be determined, it shall be assumed that they are in equal proportions;
- b) where fixtures are to be situated in separate groups, the number of fixtures in any group shall be based on the calculation of that portion of the total population for which the group is intended; and
- c) a building for which the population cannot be determined shall, where such building contains one or more habitable rooms, be provided with at least one toilet pan and one washbasin.

4.11.2 Subject to the requirements of 4.11.1, the minimum number of sanitary fittings to be provided in any building shall be as given in tables 4 to 9, and such fixtures shall

- a) be situated in places which are easily accessible, and
- b) where necessary, be designated for the use of males or females (or both), provided that any room containing fixtures designated for the use of both sexes shall be capable of being locked from the inside.

NOTE 1 The population calculated in terms of Regulation **A21** (see SANS 10400-A) is the total population for a building of a particular class of occupancy and includes the personnel, the public and visitors.

NOTE 2 Table 8 may be used where guidance on any provision above the minimum is required.

NOTE 3 In using tables 5 to 9, the population referred to in column 1 of all the tables is the population of the particular sex for which the minimum provision is to be determined. Unless the population of each sex is otherwise known, this will be one-half of the total number of persons or total population, in accordance with the requirements of 4.11.1(a).

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Table 4 — Provision of sanitary fixtures

1	2	3
Type of occupancy and population	Fixtures	Exceptions
A1: Personnel Public and visitors	See table 6 Males: 1 toilet pan 1 washbasin Females: 1 toilet pan 1 washbasin	- In any building where facilities in accordance with table 6 are available to both personnel and the public or visitors, no separate facilities shall be required for the public or visitors. - No separate facilities for the public or visitors shall be required within a shop that has a floor area of less than 50 m². - In any group of shops under one ownership or in a shopping complex on a single site - facilities for personnel may be situated at convenient locations and not necessarily in any particular shop or shops; - facilities for the public and visitors may be situated at convenient locations, and not necessarily in any particular shop or shops; - facilities for personnel may be grouped or combined with those provided for the use of the public or visitors. - In any occupancy where personnel are exposed to high-risk substances, dirt, filth, dust, soot, oil, grease or any similar substance, exposure to which is such that showers are necessary, at least 1 shower per 15 persons shall be provided separately for each sex and such showers shall be located in, or have direct access to, a change room.
A2: Personnel Public and visitors: Peak demand No peak demand Participants in sports	See table 6 See table 7 See table 8 See table 9	
A3: —	See table 6	
A4: Personnel Public and visitors	See table 6 Males: 1 toilet pan 1 washbasin Females: 1 toilet pan 1 washbasin	
A5: Public and visitors: Peak demand No peak demand Participants in sports	See table 7 See table 8 See table 9	
B1, B2 and B3: Personnel Public and visitors	See table 6 1 toilet pan 1 washbasin	
C1 and C2: Personnel Public and visitors	See table 6 Males: 1 toilet pan 1 washbasin Females: 1 toilet pan 1 washbasin	
D1, D2 and D3: Personnel Public and visitors	See table 6 No separate provision required	
D4: —	No provision required	
F1: Personnel Public and visitors	See table 6 Males: 1 toilet pan 1 washbasin Females: 1 toilet pan 1 washbasin	
F2 and F3: Personnel Public and visitors	See table 6 1 toilet pan 1 washbasin	

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Table 4 (concluded)

1	2	3
Type of occupancy and population	Fixtures	Exceptions
G1: Personnel Public and visitors	See table 6 Males: 1 toilet pan 1 washbasin Females: 1 toilet pan 1 washbasin	(see above)
H1: Personnel Public and visitors	See table 6 Males: 1 toilet pan 1 washbasin Females: 1 toilet pan 1 washbasin	Any single hotel room or suite or any servant's room with its own facilities need not be provided with separate facilities for males and females. Showers may be substituted for baths in the following maximum ratios:
Residents	See table 5	Males: two-thirds of total Females: one-third of total
H2: –	See table 5	
H3, H4 and H5: Within each dwelling unit	1 toilet pan 1 washbasin 1 bath or shower	–
J1, J2, J3 and J4: –	See table 6	–
Educational institutions: Classrooms and lecture rooms (A3 occupancy): Personnel Students and pupils: Peak demand No peak demand Dormitories or other residential accommodation (H2 occupancy): Personnel Students and pupils	See table 6 See table 7 See table 8 See table 5 See table 5	In primary schools the indicated number of sanitary facilities shall in each case be increased by one. Separate facilities for personnel and students or pupils shall not be required where all facilities are available to both groups Separate facilities for residential accommodation and classrooms or lecture rooms shall not be required where facilities in one are easily available to the other.
E1, E2, E3 and E4	Number to be provided (depends on type and design of institution). Table 5 may be used as a guide.	–
NOTE This table refers to table 6 in most occupancy classifications for the minimum provision to be made for personnel as distinct from that for the public and visitors.		
NOTE The minimum provision of facilities for public and visitors is given in column 2 of this table. In some circumstances this minimum may be considered less than adequate. The view has been taken that rather than be prescriptive, it should be left to the owner to decide what provisions he wishes to make above the minimum to satisfy the public and to safeguard his business interests.		

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Table 5 — Provision of sanitary fixtures in residential accommodation

1	2	3	4	5	6	7	8
Population number of people	Number of sanitary fixtures to be installed						
	Males				Females		
	Toilet pans	Urinals	Wash- hand basins	Baths	Toilet pans	Wash- hand basins	Baths
≤ 8	1	1	1	1	2	1	1
≤ 20	1	2	2	2	3	2	2
≤ 40	2	3	3	3	4	3	3
≤ 60	3	4	4	4	6	4	4
≤ 80	4	6	5	5	9	5	5
≤ 100	4	8	6	6	12	6	6
≤ 120	5	9	6	6	14	7	7
≤ 140	5	10	7	7	15	8	8
≤ 180	5	11	8	8	16	8	8
> 180	Add 1 sanitary fixture to the above for every 50 persons						

Table 6 — Provision of sanitary fixtures for personnel

1	2	3	4	5	6
Population ^a number of people	Number of sanitary fixtures to be installed				
	Males			Females	
	Toilet pans	Urinals	Wash-hand basins	Toilet pans	Wash-hand basins
≤ 15	1	1	1	2	1
≤ 30	1	2	2	3	2
≤ 60	2	3	3	5	3
≤ 90	3	5	4	7	4
≤ 120	3	6	5	9	5
> 120	Add 1 sanitary fixture to the above for every 100 persons			Add 1 sanitary fixture to the above for every 50 persons	Add 1 sanitary fixture to the above for every 100 persons

NOTE If the facilities provided in a shopping complex can be conveniently situated so that they are available to the personnel and the public and visitors, it might not be necessary to provide separate facilities for the personnel in individual shops. The minimum number of facilities provided should then be the total required in accordance with this table for the total number of personnel in the shops within the complex who make use of these facilities.

^a Population is the number of personnel only of a particular sex in an occupancy. The total number of personnel will, in some cases, be the total population obtained from Regulation A21, the public and visitors being very few in number. In other cases the proportion of personnel to the public and visitors will have to be established. The total number of personnel in a shopping complex, or in any particular shop, may be taken as 10 % of the total population for such complex or shop calculated in terms of Regulation A21.

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Table 7 — Provision of sanitary fixtures for public, visitors, students and pupils subject to peak demand

1	2	3	4	5	6
Population number of people	Number of sanitary fixtures to be installed				
	Males			Females	
	Toilet pans	Urinals	Wash-hand basins	Toilet pans	Wash-hand basins
≤ 50	1	1	1	2	1
≤ 100	1	2	1	3	2
≤ 150	1	3	1	5	3
≤ 250	2	4	2	7	4
≤ 500	3	7	3	12	6
≤ 1 000	3	12	4	16	7
≤ 1 500	4	15	5	20	8
> 1 500	Add 1 sanitary fixture to the above for every 500 persons	Add 1 sanitary fixture to the above for every 300 persons	Add 1 sanitary fixture to the above for every 500 persons	Add 1 sanitary fixture to the above for every 150 persons	Add 1 sanitary fixture to the above for every 500 persons

Table 8 — Provision of sanitary fixtures for public, visitors, students and pupils not subject to peak demand

1	2	3	4	5	6
Population number of people	Number of sanitary fixtures to be installed				
	Males			Females	
	Toilet pans	Urinals	Wash-hand basins	Toilet pans	Wash-hand basins
≤ 50	1	–	1	1	1
≤ 100	1	1	1	2	1
≤ 150	1	2	1	3	2
≤ 250	2	3	2	5	3
≤ 500	2	4	3	6	4
≤ 1 000	2	6	5	8	6
≤ 1 500	3	7	6	10	7
> 1 500	Add 1 sanitary fixture to the above for every 1 000 persons	Add 1 sanitary fixture to the above for every 500 persons	Add 1 sanitary fixture to the above for every 700 persons	Add 1 sanitary fixture to the above for every 300 persons	Add 1 sanitary fixture to the above for every 700 persons

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Table 9 — Provision of sanitary fixtures for participants in sport

1	2	3	4	5	6	7	8
Population number of people	Number of sanitary fixtures to be installed						
	Males				Females		
	Toilet pans	Urinals	Wash- hand basins	Showers	Toilet pans	Wash- hand basins	Showers
≤ 10	1	1	1	2	2	1	2
≤ 20	1	2	2	2	3	2	2
≤ 30	2	2	3	3	5	3	3
≤ 40	3	3	3	3	6	3	4
≤ 60	3	4	4	5	7	4	5
≤ 80	4	5	5	5	9	5	5
≤ 100	4	6	5	6	10	5	6
> 100	Add 1 sanitary fixture to the above for every 100 persons			Add 1 sanitary fixture to the above for every 40 persons	Add 1 sanitary fixture to the above for every 80 persons		Add 1 sanitary fixture to the above for every 40 persons

4.12 Hydraulic loading of drainage installations

4.12.1 The hydraulic load discharged into, or carried by, a discharge pipe or a drain shall be calculated in units, referred to as fixture units.

4.12.2 The hydraulic load at any point in a discharge pipe or a drain shall be the sum of the fixture unit ratings of all sanitary fixtures, the discharges from which enter the discharge pipe or drain upstream of such point.

4.12.3 The hydraulic load discharged from any sanitary fixture specified in column 1 of table 10 shall be as given in column 3, and in the case of a sanitary fixture not listed in column 1, the diameter of the trap outlet of such a fixture, when identified in column 2, shall indicate the hydraulic load, given in column 3, which shall be prescribed for such a fixture.

Table 10 — Fixture unit ratings of sanitary fixtures

1	2	3
Examples of sanitary fixtures	Nominal diameter of trap mm	Hydraulic load fixture units
Wash-hand basin, bidet, wall-mounted urinal (separate trap)	32	1
Bath, sink, shower, wash trough	40	2
Wall-mounted urinal with integral trap, commercial electrical sanitary fixtures	50	3
	75 or 80	5
Toilet pan	100	8
Sanitary group ^a	—	12
NOTE 1 The fixture unit rating given above for each type of fixture is a measure of the hydraulic load and takes into account the duration of discharge, the interval between discharges, and the mean discharge rate of a particular fixture.		
^a The hydraulic load for a sanitary group is not the same as the sum of the hydraulic loads for the individual fixtures comprising such group because the assumption made regarding the interval between discharges is different in each case.		

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4.13 Drainage systems

4.13.1 The following requirements shall apply with regard to the single-stack system:

- a) It shall only be installed where the building in question is of the office class, which has sanitary fixtures installed in ranges, or of the residential class, which has sanitary fixtures installed in groups.
- b) It shall not be installed in any residential building that exceeds 30 storeys in height or in any office building that exceeds 24 storeys in height above the lowest ground level abutting such building.
- c) No trap vents for the protection of any water seals shall be required in terms of these requirements or in terms of 4.13.2 or 4.13.3.
- d) The supplementary vent stack specified in 4.13.2 or 4.13.3 shall be cross-connected at each storey with the discharge stack above the level of the highest branch discharge pipe connected to the discharge stack.
- e) The discharge stack shall be continued upwards to form a stack vent.
- f) The radius of the centre line of the bend at the foot of the discharge stack shall not be less than 300 mm.
- g) No offset shall be made in the discharge stack unless a ventilating pipe is provided to reduce the pressure which might be caused by any offset, and the nominal diameter of such ventilating pipe shall be not less than half the diameter of the discharge stack.
- h) The waste fixture trap shall be either a P-trap that has a water seal of not less than 75 mm in depth, or shall be a resealing trap of the P-type.
- i) The vertical distance between the invert of the lowest branch discharge pipe connected to the discharge stack, and the invert of the bend at the foot of the stack, shall be not less than
 - 1) 450 mm for stub stacks, stacks in single dwellings of up to three storeys in height, and stacks of up to two storeys in height serving a maximum of two groups of sanitary fixtures;
 - 2) 750 mm for stacks up to five storeys in height in buildings other than those specified in (i), and
 - 3) one storey in height for stacks higher than five storeys.
- j) Where a waste branch and an opposed soil branch from a toilet pan are connected to a discharge stack, the centre line of such waste branch shall not intersect the centre line of the stack within 200 mm below the intersection of the centre line of the soil branch with the centre line of the stack.
- k) The inlet of a branch discharge pipe or a fixture discharge pipe joining a discharge stack of equal diameter, shall be swept in the direction of flow with a radius of not less than 50 mm, or shall be at an angle of 45°.

4.13.2 The following supplementary requirements shall apply with regard to a single-stack installation in a building where the occupancy is of the residential class:

- a) The fixture branch of a sanitary fixture in a sanitary group shall be separately connected to the discharge stack.
- b) Where the trap fitted to a washbasin has a nominal diameter of 32 mm, the internal diameter of the fixed branch serving the washbasin shall be not less than 40 mm.

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- c) Not more than two sanitary groups installed in any one storey shall be connected to the same discharge stack.
- d) A discharge stack of not more than two storeys in height, serving a maximum of two groups of sanitary fixtures, may discharge into a stub stack.
- e) The minimum discharge stack size and, where required, supplementary vent stack size and cross-ventilation requirements shall be as prescribed in table 11.

Table 11 — Minimum discharge stack and supplementary vent stack sizes and requirements for single-stack systems for residential occupancy

1	2	3
Number of storeys served by discharge stack	Nominal diameter of discharge stack mm	Minimum nominal diameter of a supplementary vent stack serving not more than two sanitary groups in each storey, with a cross-vent at each floor mm
≤ 10	100	None
11 to 15	100 150	50 None
16 to 30	150	None

4.13.3 The following supplementary requirements shall apply with regard to a single-stack installation in a building where the occupancy is of the office class:

- a) where sanitary fixtures are installed in ranges as contemplated in column 2 of table 12, the minimum nominal diameter of the discharge stack and of the supplementary vent stack, where required, shall be as given in columns 3 and 4, respectively, for the number of storeys served by such discharge stack as given in column 1;
- b) a soil or waste branch discharge pipe to which a sanitary fixture (see (a)) is connected, shall be separately connected to the discharge stack;
- c) for the purposes of table 12, four urinals or less may be regarded as equal to one toilet pan; and
- d) where a closed system is used and a discharge pipe is connected to a stub stack, it shall not receive the discharge from more than four sanitary fixtures in a range.

NOTE Figure 6 shows a single-stack system. Figure 7 shows a stub stack in a closed system.

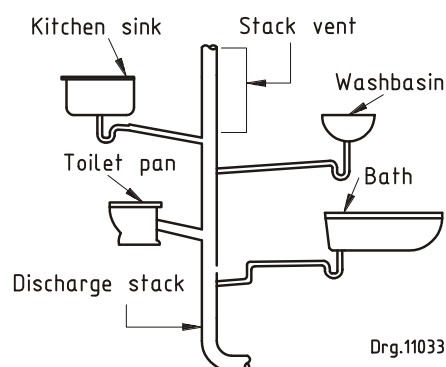


Figure 6 — Single-stack system

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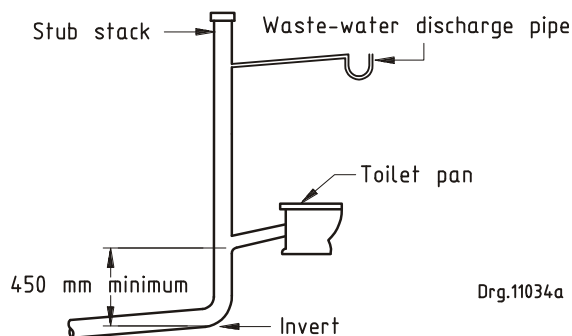


Figure 7 — Stub stack in closed system

Table 12 — Minimum discharge stack and supplementary vent stack size requirements for single-stack systems for office occupancy

1	2	3	4
Number of storeys served by discharge stack	Maximum number of sanitary fixtures in a range in each storey	Minimum nominal diameter of discharge stack mm	Minimum nominal diameter of supplementary vent stack mm
1 to 4	≤ 5 toilet pans and 5 wash-hand basins	100	Vent stack not required
5 to 8	≤ 2 toilet pans and 2 wash-hand basins		
	3 toilet pans and 3 wash-hand basins		32
	> 3 toilet pans and 3 wash-hand basins but ≤ 5 toilet pans and 5 wash-hand basins		40
9 to 12	≤ 2 toilet pans and 2 wash-hand basins		32
	> 2 toilet pans and 2 wash-hand basins but ≤ 4 toilet pans and 4 wash-hand basins		40
1 to 8	≤ 5 toilet pans and 5 wash-hand basins	150	Vent stack not required
9 to 24	> 3 toilet pans and 3 wash-hand basins but ≤ 5 toilet pans and 5 wash-hand basins		75
NOTE Where there are fewer wash-hand basins than toilet pans in a storey, the number of toilet pans shall determine the supplementary vent stack requirements.			

4.13.4 The following requirements shall apply with regard to the one-pipe system (including the single system):

- a) a soil pipe shall be connected to another soil pipe, a stack or direct to a drain;
- b) a waste pipe shall be connected to another waste pipe, a soil pipe, a stack, direct to a drain or to a gully, which shall be connected to a drain; and
- c) a waste or any soil fixture trap may have a common ventilating pipe.

NOTE Figure 8 shows a one-pipe system.

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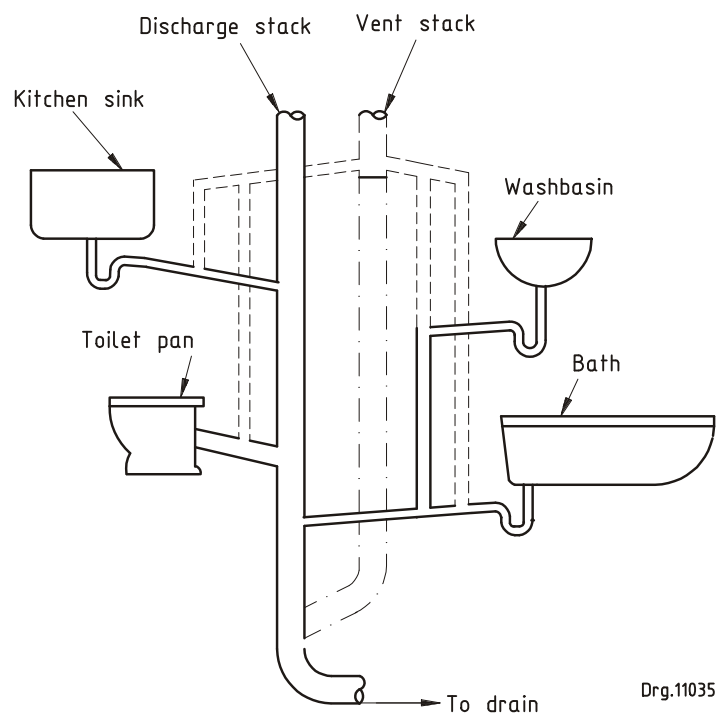


Figure 8 — One-pipe system

4.13.5 The following requirements shall apply with regard to the two-pipe system:

- a) a soil pipe shall be connected to another soil pipe, a stack or direct to a drain;
- b) a waste pipe shall discharge into another waste pipe, a stack or to a gully, which shall be connected to a drain; and
- c) waste and soil fixture traps shall be separately ventilated.

NOTE Figure 9 shows a two-pipe system.

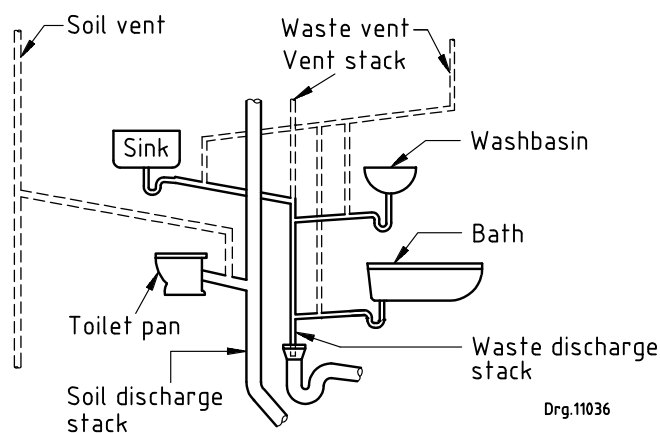


Figure 9 — Two-pipe system

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4.14 Sizing of discharge pipes

4.14.1 The following requirements shall apply with regard to the sizing of a discharge pipe:

- a) the internal diameter of a discharge pipe shall not be less than the internal diameter of any pipe or outlet of the sanitary fixture which discharges into it, provided that where the internal diameter of any horizontal pipe in an offset is more than that of the discharge stack which discharges into it, the internal diameter of the stack downstream of the offset may be less than that of the horizontal pipe;
- b) the internal diameter of a soil pipe, other than a soil pipe from a urinal, shall be not less than 100 mm;
- c) the internal diameter of any waste pipe shall be not less than 32 mm if it serves a washbasin, bidet or drinking fountain, and not less than 40 mm if such pipe serves any other waste fixture;
- d) in the single-stack system, the internal diameter of a waste pipe shall be not less than 40 mm; and
- e) the hydraulic load carried by any discharge pipe which has a nominal diameter given in column 1 of table 13 shall not exceed the number of fixture units given in columns 2, 3 or 4, as the case might be, provided that where a horizontal pipe to which a discharge stack is connected is larger than such stack, any bend connecting the horizontal pipe to the stack shall have a nominal diameter equal to that of the horizontal pipe.

4.14.2 For the purposes of tables 13 and 14, a waste pipe which has a diameter of 100 mm or greater and a soil pipe shall, subject to the requirements contained in 4.16.3, be deemed to be a drain from that point downstream of which the gradient of such pipe or of any drain to which it is connected does not again exceed 45° below the horizontal, except where the pipe drain is connected to a connecting sewer.

4.14.3 Where the diameter of a horizontal pipe at the base of a discharge stack is more than that of the drain to which it discharges, the horizontal pipe shall have a length of not less than 2,5 m, measured from the centre line of the discharge stack, before it is reduced in diameter and connected to the drain.

NOTE Figure 10 shows the parts of a drainage system.

Table 13 — Maximum permissible hydraulic discharge pipe loadings

1	2	3	4
Nominal pipe diameter mm	Maximum hydraulic loading fixture units		
	Discharge stacks	Discharge pipes other than those referred to in column 4	Branch discharge pipes
32	2	1	1
40	6	2	3
50	18	5	8
65	84	18	35
75	140	29	60
100	680	120	280
125	2 400	350	870
150	6 000	760	2 100

NOTE Currently, no pipes with a 125 mm nominal diameter are used.

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4.15 Sizing of drains

The following requirements shall apply with regard to the sizing of a drain:

- the nominal diameter of a drain shall not in any case be less than 100 mm;
- the hydraulic load carried by a drain shall not exceed the number of fixture units given in table 14 for a given diameter and gradient of drain; and
- where, due to the slope of the ground, a drain is required to be laid at a gradient steeper than 1 in 5, the hydraulic load carried by the drain shall not exceed that given in table 14 for a gradient of 1 in 5.

Table 14 — Maximum permissible hydraulic drain loads

1	2	3	4	5	6	7	8
Gradient of drain	Maximum load fixture units						
	Nominal pipe diameter mm						
	100 (110 OD) ^a	150 (160 OD) ^a	200	225	250	300	375
1 in 5	12 000	40 000	75 000	105 000	—	—	—
1 in 10	9 000	27 000	56 000	76 000	100 000	165 000	295 000
1 in 20	6 400	19 000	40 000	54 000	72 000	117 000	210 000
1 in 40	4 500	13 500	28 500	38 000	51 000	82 000	148 000
1 in 60	3 650	11 000	23 000	31 000	41 000	67 000	125 000
1 in 80	3 150 ^b	9 500	20 000	27 000	36 000	58 000	104 000
1 in 100	2 800 ^b	8 400	18 000	24 000	32 000	52 000	93 000
1 in 120	2 550 ^b	7 700	16 500	22 000	29 000	47 500	85 000
1 in 150	^c	6 900	15 000	19 500	26 000	42 500	76 000
1 in 200	^c	6 000	13 000	17 000	22 500	37 000	66 000
1 in 300	^c	^c	10 600	14 000	18 500	30 000	54 000
1 in 400	^c	^c	^c	^c	16 000	26 000	47 000
1 in 500	^c	^c	^c	^c	^c	23 500	42 000
OD = outside diameter							
^a Nominal outside diameter for non-metallic pipes.							
^b Special permission is required from the local authority in this case. A detailed cost benefit study shall be done, taking into account the cost of a regular systematic maintenance and silt/sand removal programme that would be required when pipes are laid to such flat grades (resulting in lower flow velocities), against the higher initial capital cost required to maintain steeper grades.							
^c Not permitted.							

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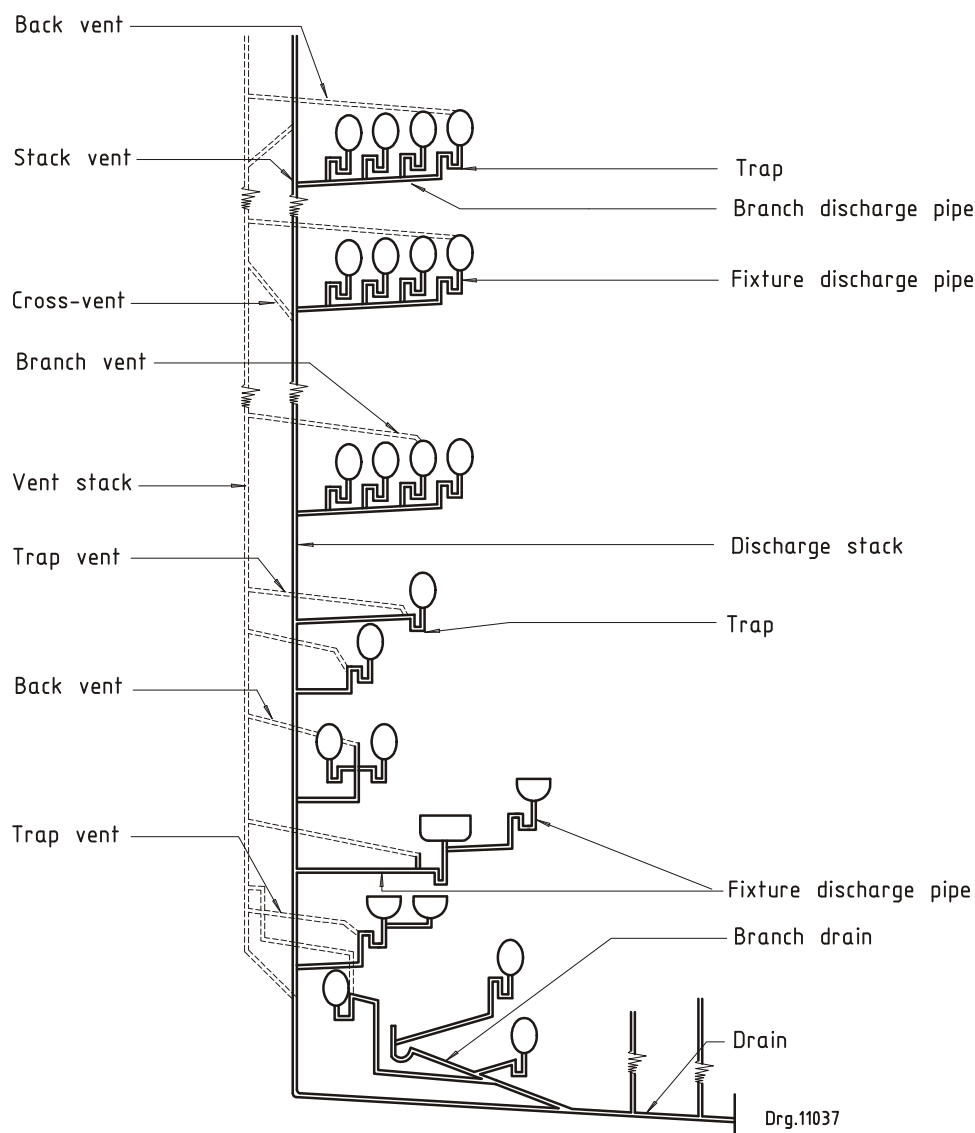


Figure 10 — Discharge pipes and ventilating pipes

4.16 Protection of water seals

4.16.1 The water seal contained in the trap of a soil fixture shall, subject to the requirements contained in 4.13.1, be protected by a trap vent where the discharge from the soil fixture is conveyed by

- an unventilated branch drain or soil pipe which has a fall that exceeds 1,2 m within 300 mm of the outlet of the fixture trap,
- an unventilated soil pipe which receives the discharge from any other soil fixture,
- a discharge stack which receives the discharge from any soil fixture at a higher level, or
- a soil branch which receives the discharge from any other soil fixture, provided that such trap vent may be omitted in the case where a soil fixture discharges to a soil branch where
 - the hydraulic load carried by the soil branch does not exceed 50 fixture units,

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2) the soil branch is served by a 100 mm diameter back vent, and

3) not more than 16 soil branches discharge into the same discharge stack.

4.16.2 Notwithstanding the requirements contained in 4.16.1,

a) in the case of any installation of the two-pipe system, the water seal in the trap of any waste fixture shall be protected by a trap vent unless a resealing trap is fitted to such fixture, provided that this requirement shall not apply to a single bath, shower or sink which is situated within 2 m vertically above and 3 m horizontally of the gully, and

b) in the case of any installation of the one-pipe system, the water seal in the trap of a waste fixture shall, except in the case of the single-stack system, be protected by a trap vent.

4.16.3 The water seal in the trap of any waste fixture, which is required to be protected in terms of 4.16.2, may, as an alternative, be protected by an air-admittance valve.

4.16.4 A ventilating pipe shall be provided for a

a) main drain or branch drain at a point not more than 6 m from the head of the main drain or branch drain, as the case may be, where the head is deemed to be the centre line of the discharge stack or vertical discharge pipe to which the main drain or branch drain is connected, provided that such ventilating pipe shall not be required

1) for any branch drain where the length, measured along the branch drain from its head to the point of connection to any ventilated main drain, is not more than 6 m, or

2) where the main drain or branch drain is connected to a discharge stack that has a stack vent;

b) soil branch which receives the discharge from only one sanitary fixture, and which exceeds 6 m in length, measured along the branch from the outlet of the trap of the fixture to the point of connection to the ventilated soil pipe;

c) waste pipe longer than 6 m in length, measured along the pipe from the outlet of the trap of the waste fixture discharging to it, to the point of discharge of the pipe into a gully or, in the case of the one-pipe system, to the point of connection of the waste pipe with the ventilated soil pipe or the ventilated drain, provided that such waste pipe may be omitted where the diameter of the waste pipe, as referred to in column 1 of table 13, is increased by one nominal pipe size and the length of the waste pipe is not more than 10 m;

d) waste branch longer than 6 m, measured along the branch from the outlet of the trap of the waste fixture discharging to it, to the point of connection to the ventilated waste pipe; and

e) stub stack where

1) the crown of the toilet trap connected to such stack is more than 1,5 m above the invert of the bend at the base of the stack,

2) the topmost connection of a waste pipe to the stack is more than 2 m above the invert of the bend at the base of the stack,

3) the stack serves more than one group of sanitary fixtures, or

4) the stack serves branch discharge pipes to which ranges of sanitary fixtures are connected.

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4.17 Sizing of ventilating pipes

4.17.1 The following requirements shall apply with regard to the sizing of ventilating pipes:

- a) A drain or branch drain or any part thereof carrying a hydraulic load of not more than 50 fixture units, shall have a ventilating pipe with a nominal diameter of not less than 40 mm.
- b) The diameter of the ventilating pipe shall be not less than that given in table 15 for the relevant developed length of the pipe and the sum of the fixture units derived from the sanitary fixtures the traps of which are ventilated, either directly or indirectly, by the ventilating pipe.
- c) A stack vent shall have a nominal diameter which is not less than that of the discharge stack to which it is connected, provided that the stack vent connected to the following types of discharge stack may have a nominal diameter less than that of any such discharge stack, but shall not have a nominal diameter of less than 40 mm:
 - 1) a stub stack, where a stack vent is required; and
 - 2) a two-storey-high discharge stack that serves a maximum of two groups of sanitary fixtures.
- d) Where a stack vent is connected to the top of any discharge stack, such connection shall be at a point not less than 150 mm above the flood level of the highest positioned sanitary fixture in the drainage installation which discharges to the discharge stack, provided that the nominal diameter of the stack vent connected to the discharge stack shall be not less than the nominal diameter of the discharge stack, or not less than that required in terms of 4.17.1(c), whichever is the greater.

Table 15 — Size of ventilating pipes

1	2	3	4	5	6	7	8	9	10	11	12	13
Maximum number of fixture units served	Minimum nominal diameter of ventilating pipe											
	mm											
	32	40 (OD)	40	50 (OD)	50	65	75 (OD)	75	110 (OD)	125	160 (OD)	200
Maximum developed length of ventilating pipe												
m												
2	^a											
6		^a										
16		9	30	51								
48			9	30	51							
84			5	9	21	51	75					
128				7	15	36	60	90				
190				5	7	27	51	75				
1 000						7	18	24	96			
2 200						5	9	15	57	177		
3 800							5	7	27	75	195	
7 200									7	21	57	222
OD = outside diameter												
^a Minimum vent size, unlimited length.												

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4.17.2 The developed length of

- a) a branch vent shall be measured from the point of its connection to a vent stack or stack vent to the furthest trap vent connected to the branch vent,
- b) a back vent shall be measured from the point of its connection to a vent stack or stack vent to the furthest point of its connection to the discharge pipe, and
- c) a vent stack shall be measured from the open end of the vent stack or, where the vent stack is connected to a stack vent, from the open end of the stack vent to the furthest trap vent served by it or its furthest point of connection to the discharge pipe, whichever is the greater.

4.18 Installation of discharge pipes and ventilating pipes

4.18.1 A discharge pipe or ventilating pipe shall

- a) not cause electrolytic corrosion due to any association of dissimilar metals,
- b) not be deformed in any way that would restrict flow,
- c) be so installed that no bend forms an acute angle, and has the largest practicable radius of curvature with no change in the cross section of the pipe throughout the bend,
- d) be safely supported at intervals along its length without restraining thermal movement,
- e) be so installed that the gradients, where applicable, are within the limits given in table 16,
- f) be so installed as to be capable of withstanding the test referred to in 4.26, and
- g) have a means of access for internal cleaning.

4.18.2 Where a discharge pipe located within a building is to be enclosed, it shall be enclosed within a duct, provided that any part of such pipe may be built into brickwork or concrete where the interior of such part is rendered readily accessible for cleaning. The duct shall either be of a size and shape that any person can readily enter it and work therein, or shall be provided with covers that can be readily removed to enable access to be gained to all junctions, bends and cleaning eyes.

4.18.3 In any room contemplated in 4.19.1(c), where a duct is installed, a means shall be provided inside the duct which, in the event of any leak from any pipe therein, will direct any released liquid or matter from the area of the room to a point of discharge where it shall be readily detectable.

4.18.4 An enclosed discharge pipe shall be installed in such a way that the removal of any part of a building for the purpose of gaining access to the pipe will not endanger the structural stability of the building.

4.18.5 The discharge pipe or the ventilating pipe shall be adequately protected against damage from vehicular impact.

4.18.6 A ventilating pipe or two-way vent valve shall

- a) be carried upwards without any reduction in diameter and, when relevant, shall be horizontal or so graded as to provide a continuous fall from its open end back to the discharge pipe or drain to which it is connected,

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b) be so installed that its open end is

- 1) not less than 2,5 m above finished ground level,
- 2) not less than 100 mm above the closest part of the roof covering of the building through which it passes, or to which it is attached,
- 3) not less than 2 m above the head of any window, door or other opening in the same building or any other building, whether on the same site or not, within a horizontal distance of 5 m of the said open end, and
- 4) not less than 2,5 m above the surface level of any roof slab covering the building which it serves, where the slab might at any time be occupied by persons.

4.18.7 A trap vent shall be connected to the crown of the fixture discharge pipe on the outlet side of the protected trap at a point not less than 75 mm or not more than 750 mm, from the crown of the trap and the trap vent shall, unless carried up independently, be connected to another ventilating pipe at a point not less than 150 mm above the flood-level of the sanitary fixture which the trap vent serves.

4.18.8 Where a two-pipe system is installed, a ventilating pipe that serves a soil pipe or a soil fixture shall not be connected to a ventilating pipe that serves a waste pipe or waste fixture.

4.18.9 Where a supplementary vent stack is installed in addition to, and adjacent to, a discharge stack, such vent stack shall be connected to the discharge stack at a point below the lowest branch discharge pipe connection to the discharge stack and continued upwards, either independently or interconnected with the discharge stack, as required in 4.17.1(d).

4.18.10 The interconnection between the ventilating pipe and a discharge pipe or drain shall be so located and made that no soil water or waste water can, under any circumstances, be discharged through the ventilating pipe.

4.18.11 Two-way vent valves shall only be used in the open air.

Table 16 — Limiting gradients of discharge pipes

1	2	3	4	5	6	7	8	9	10
Limiting gradients									
Waste branches				Soil branches				Horizontal fixture discharge pipes	
Single-stack system		Ventilated one-pipe or two-pipe system		Toilet pan		Other soil fixtures		All systems	
Min.	Max. ^a	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1,25° (1 in 46)	5° (1 in 11,5)	1,25° (1 in 46)	5° (1 in 11,5)	1,43° (1 in 11,5)	14° (1 in 4)	1,43° (1 in 23)	5° (1 in 11,5)	2,5° (1 in 23)	45° (1 in 1)
^a The maximum gradient of a waste pipe serving only wash-hand basins (one or more) shall be 2,5° (1 in 23).									

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4.19 Access to the drainage installation

4.19.1 The following requirements shall apply with regard to access to a drain:

- a) A drainage installation shall be so designed and constructed as to permit adequate access to the interior of any pipe in such installation for the purposes of inspection, testing and internal cleaning.
- b) Where a discharge pipe enters the ground, adequate means of access to the interior of the pipe shall be provided within 2 m above the point of entry.
- c) Where a drain or discharge pipe passes through a room which is used as a kitchen, pantry, or for the preparation, handling, storage or sale of food, the means of access to the drain or pipe, for cleaning purposes, shall be situated outside such room, provided that this requirement shall not apply in the case of the waste pipe serving a waste fixture contained in such room.
- d) The access opening to a drain or discharge pipe installed within a building shall be covered by an adequately screwed or bolted airtight cover.
- e) A rodding eye or manhole shall be installed
 - 1) where there is a change in direction of the drain that exceeds 45°, provided that where any bend which has a centre-line radius of not less than 600 mm is installed, the rodding eye may be omitted for not more than two such changes of up to 90° each between any two rodding eyes required in terms of (2), (3) and (4),
 - 2) at any point within 1,5 m of the connection of the drain to a connecting sewer, septic tank or conservancy tank, provided that an inspection eye shall be installed immediately downstream of such point,
 - 3) at the highest point of the drain, and
 - 4) at such intervals along the drain that no rodding distance is more than 25 m measured along the line of the drain from a rodding eye, or other permanent means of access to such drain.
- f) The rodding eye shall
 - 1) join the drain in the direction of flow at an angle of not more than 45°, be continued up to the ground level and be adequately supported; and
 - 2) be adequately marked and protected.

4.19.2 The access contemplated in 4.19.1 may, subject to the requirements contained in 4.19.7, be provided by an adequate and appropriately marked removable device.

4.19.3 Any permanent access which is covered by any paved area of ground shall be covered by an adequate and appropriately marked removable device.

4.19.4 Where any part of a drainage installation passes under a building,

- a) access shall be provided to the installation outside of, and as near as possible to, the building at each point of entry to, or exit from under, the building, and
- b) no access shall be provided from within the building.

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4.19.5 The lid covering the opening which gives access into the drainage installation shall be so sealed that the lid will remain effective under all working conditions.

4.19.6 Any means, other than a manhole or inspection chamber, provided for access to a drainage installation shall

- a) have a removable cover and be so designed and constructed that it will sustain any normal load which might be imposed upon it and exclude the ingress or egress of water,
- b) be of such size and shape as to permit ready access to the installation for the purposes of inspecting, testing or cleaning, as the case might be, and
- c) when within a building, be so constructed as to be watertight when subjected to a maximum internal water pressure of 50 kPa.

4.19.7 A manhole or inspection chamber shall have a minimum plan dimension of not less than 450 mm and shall be

- a) located in an open air space,
- b) so constructed and covered as to prevent the ingress of water, and
- c) of sufficient strength to sustain any load which might normally be imposed upon it.

NOTE An open air space should not be taken to preclude location under the roof of a carport, or any similar well-ventilated area outside the building.

4.19.8 Where the connection between two sections of a drain are at different levels which necessitate a steep fall, the change in level shall be effected by one or more 22,5° bends which shall be connected to the shortest possible length of drain pipe connected in turn through one or more 22,5° bends to the lower drain.

4.20 Provision of traps

4.20.1 A sanitary fixture shall be provided integrally or immediately at its outlet with an effective self-cleaning trap, except where such fixture is a bath, washbasin or shower which discharges into

- a) an open channel which shall
 - 1) be made of impervious material,
 - 2) have a semi-circular cross section of diameter not less than 100 mm,
 - 3) be accessible for cleaning throughout its length,
 - 4) be fixed immediately beneath the point of discharge, and
 - 5) discharge into a gully, or
- b) an open channel serving a urinal where such bath, washbasin or shower is installed in the same room as the urinal.

4.20.2 Any trap which is integral with a sanitary fixture shall

- a) have a smooth waterway, and
- b) be so constructed that any change from one cross section to another does not cause an obstruction to the passage of solids.

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4.20.3 Any trap that is not integral with a sanitary fixture shall be made of non-absorbent and corrosion-resistant material and shall be so constructed that

- a) it has a smooth waterway,
- b) there is no constriction,
- c) it has an outlet diameter which is not less than that of its inlet, and
- d) it has at its lowest point a means of access for cleaning, provided that this requirement shall not apply where the trap is made of rubber or other similar material.

4.20.4 The minimum nominal diameter of a trap connected to a sanitary fixture, and the minimum depth of its water seal shall be in accordance with those values given for the relevant fixture and installation in table 17, provided that the maximum depth of the water seal contained in the trap shall be 100 mm.

4.20.5 Where a trap serving a toilet pan is provided with a vent horn, the horn shall have a nominal diameter of not less than 40 mm and shall be located at the side of, and not less than 75 mm from, the crown of the trap on its outlet side.

4.20.6 Traps shall comply with the requirements of SANS 1321-1 and SANS 1321-2.

Table 17 — Minimum diameter and water seal depth of traps

1	2	3	4	5
Type of trap	Type of sanitary fixture ^a	Type of installation	Minimum nominal diameter mm	Minimum depth of water seal mm
Integral	Toilet pan, hospital soil fixture Wall-mounted urinal	All	75 50	50 50
Non-integral	Bidet, drinking fountain, wash-hand basin, wall-mounted urinal	Two-pipe system or one-pipe system	32	40
		Single-stack system	32	75
	Bath, shower, sink (hospital, kitchen or laboratory type), laundry trough, clothes-washing machine, dish-washing machine, food-waste disposal unit (all of the domestic type)	Two-pipe system	40	40
		One-pipe system	65	65
		Single-track system	40	75
	Clothes-washing machine, dish-washing machine, food-waste disposal unit, floor drain (all of the commercial type)	All	50	75
	Urinal of slab or stall type up to 3 units or 1,8 m in length	All	50	50
	Urinal of slab or stall type (all other), gully	All	75	50
^a Commercial electrical sanitary fixtures can have throughlet traps of nominal diameter 40 mm up to 80 mm.				

4.21 Provision of gullies

4.21.1 Subject to the requirements contained in 4.21.4, 4.21.5 and 4.21.6, a drainage installation shall be provided with one gully for each municipal sewer connection, storage or disposal system.

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The head of the gully shall consist of

- a) an overflow fitting covered with a removable cover which fits over the gully head and that permits overflow through a cross-sectional area not less than that of the trap of the gully, but that prevents the ingress of foreign matter direct from above, or
- b) a hopper covered with a removable grating set in the gully head and the spaces between the bars of the grating shall be not less than 10 mm or more than 12 mm wide, and shall provide an effective open area through the bars not less than the minimum cross-sectional area of the trap of the gully, provided that the gully head may be dished, in which case the overflow level of the dish shall be not less than 75 mm above the level of the grating of the gully, provided such ground is not subject to flooding.

NOTE Although this subclause calls for the installation of one gully, this does not preclude more gullies being fitted, should they be required.

4.21.2 The overflow of the gully shall be not less than

- a) 150 mm below the crown of the lowest trap serving a sanitary fixture in the installation, provided that this requirement shall not apply to any sanitary fixture where its discharge is raised;
- b) 150 mm above the surrounding ground, or 50 mm above any permanent surrounding paving, and such paving shall ensure drainage away from such gully.

4.21.3 The following requirements shall apply with regard to the trap of a gully:

- a) the nominal diameter equivalent to its minimum cross-sectional area and the depth of its water seal shall be in accordance with the requirements of 4.20.4;
- b) the surface level of the water in the gully shall be not more than 500 mm below the overflow level of the gully where the gully is a dished gully; and
- c) the water seal in the gully shall be maintained by means of at least one waste pipe which discharges into the gully.

4.21.4 A trapped floor drain may be installed within a building as a waste-water outlet in any floor which shall slope at a gradient of not less than 1 in 200 from all sides towards the floor drain, provided that the floor drain shall

- a) be so located that it is accessible,
- b) be made of non-absorbent and corrosion-resistant material,
- c) have a minimum outlet diameter and a trap seal depth as specified in 4.20.4,
- d) be provided with a removable grating, the open area of which shall be not less than two-thirds of the area of the waste pipe into which the outlet discharges, and
- e) have its water seal maintained by means of
 - 1) a tap situated above it, or
 - 2) a waste fixture located in the same room, the outlet of which will discharge waste water directly into the gully above the level of the water seal in such a manner as not to overflow onto the floor.

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4.21.5 A suitable grease trap shall

- a) be provided to take the discharge of waste water from a sink or other fixture,
 - 1) in any building where waste water is to be discharged to a french drain, and
 - 2) where the discharge of grease, oil or fat might cause an obstruction to the flow in a drain or sewer, or might interfere with the efficient operation of any sewage disposal system; and
- b) be designed and constructed to have a removable lid or manhole cover which shall permit the effective removal of grease, oil, fat or solid matter.

NOTE The accumulation of grease, fat, oil or solid matter in the grease-trap tank or chamber, should be regularly removed to ensure the effective operation of such grease-trap tank or chamber.

4.21.6 A paved area upon which petrol or oil or wash-water contaminated with petrol or oil might fall shall be graded and drained to a gully which shall discharge into a suitable petrol and oil interceptor trap which shall discharge into a drain.

4.21.7 The surface level of the water in any gully trap shall be not more than 500 mm below the top of a dished gully, except that where it is impracticable so to comply, the gully trap shall be located in a manhole which shall have its walls brought up to a height of not less than 150 mm above the surrounding ground and the access to the manhole shall be covered with a metal grating of such strength as to sustain any load which might normally be imposed upon it.

4.21.8 A waste pipe which discharges into a gully shall discharge at a point above the surface of the water seal of the gully trap but not more than 100 mm above the level of the grating.

4.21.9 A gully shall be situated outside the building, or be situated in any place which is permanently open to the external air, and shall in either case be accessible for cleaning and maintenance, provided that a gully may be installed within a building as a waste-water outlet in a floor and be so located that it is easily accessible and such floor shall slope at a gradient of not less than 1 in 200 from all sides towards the gully.

4.21.10 The outlet contemplated in 4.21.9 shall be made of non-absorbent and corrosion-resistant material, and shall have a minimum diameter of 50 mm.

4.22 Installation of drains

4.22.1 Drains shall be installed in accordance with the requirements of SANS 1200 DB, SANS 1200 LB and SANS 1200 LD.

4.22.2 Where any portion of a drain passes under a building, such portion shall

- a) be protected against the transmission of loads to it,
- b) be laid without change of direction or gradient, and
- c) not be provided with any means of access for cleaning from inside the building.

4.22.3 Where a portion of a drain passes through a building, such portion shall be

- a) supported throughout its length, without restricting thermal movement, and such support shall be securely attached to the building, and
- b) so placed that any junction, bend or point of access into it is readily accessible.

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4.22.4 A drain shall

- a) be laid in a straight line between any points where changes of direction or gradient occur,
- b) be laid with suitable flexible joints which will permit joint movement to take place throughout the life of the drainage installation, withstand root penetration and not deteriorate when in contact with sewage or water and will not cause any obstruction in the interior of the drain,
- c) be laid at a gradient, suitable for the hydraulic load to be carried by such drain, as given in table 14, and
- d) where its gradient exceeds 1 in 5, be provided with anchor blocks to securely fix the drain in place.

4.22.5 A drain shall have

- a) a soil cover over the outside of the drain of not less than 300 mm, or
- b) precast or cast-in-situ concrete slabs placed over the drain, isolated from the crown of the pipe by a soil cushion not less than 100 mm thick and the slabs shall be wide enough and strong enough to prevent excessive superimposed loads being transferred directly to the pipes.

4.22.6 Where any drain has a branch drain connected to it, such connection shall

- a) be by means of a junction fitting which shall not be a saddle junction, and
- b) enable the flow from the branch drain to enter the drain obliquely in the direction of flow so that the included angle between the axes of the two drains does not exceed 45°.

4.23 Common drains

Drainage installations on any two or more sites, whether such sites are in the same ownership or not, may be permitted to discharge into a connecting sewer through a common drain.

4.24 Grease interceptors

A grease interceptor shall be provided to take the discharge from any sanitary fixture or appliance where the discharge of such fixture or appliance could contain grease, fat or vegetable oil and

- a) where such discharge will drain directly to a french drain, or
- b) discharge in quantities that could
 - 1) cause an obstruction to the flow in any drain, or
 - 2) interfere with the efficient operation of any sewage treatment or disposal system.

4.25 In-situ percolation test for soils

4.25.1 The percolation test shall be carried out in a test pit, or a number of test pits, uniformly spaced throughout the area in which a french drain is to be constructed, and which has been excavated to the depth proposed for a french drain.

4.25.2 At the bottom of the test pit, a 300 mm × 300 mm square or 300 mm diameter hole, 350 mm deep shall be excavated (see figure 11).

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4.25.3 The test hole sides shall be roughened to provide a natural infiltration surface. Any loose material from the bottom of the hole shall be removed and replaced with a 50 mm thick layer of gravel to prevent soaking when the hole is filled with water.

4.25.4 The prepared hole shall be filled with water to a height of not less than 300 mm above its bottom and maintained at such level for a period of not less than 4 h. At the end of this period, the level of the water shall be recorded, and the drop in level as the water soaks away over a subsequent period of 30 min shall be measured. Should the water drain away within the 30 min period, the actual time taken for this to occur shall be measured.

4.25.5 The percolation rate shall be reported as the time taken in minutes for the water level to drop 25 mm. Where a number of holes are tested, the average shall be reported.

NOTE The percolation test measures the rate at which clean water, under constant or nearly constant hydraulic head, percolates into the surrounding soil in both the vertical and the horizontal direction. The test is designed to quantify the rate at which water moves into the soil. Percolation will therefore change as moisture conditions change.

Dimensions in millimetres

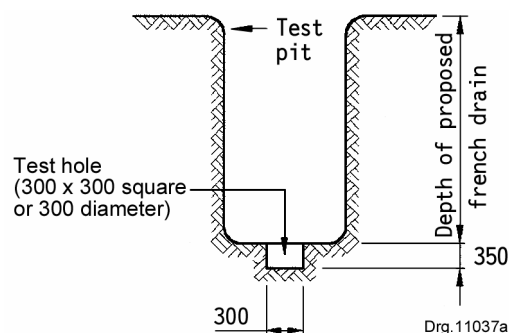


Figure 11 — In-situ percolation test pit and test hole

4.26 Test for drains

After any drainage installation has been completed and backfilled with water, the drains shall be tested as follows:

- An air test conducted by pumping air into the drains under a gauge pressure of not less than 0,35 kPa (35 mm head of water) shall be performed.
- The drains shall be deemed to have passed the test if the pressure after 3 min is not less than 0,25 kPa (25 mm head of water).

4.27 Test for discharge pipes and ventilating pipes

After a drainage installation has been completed, the discharge pipes and ventilating pipes shall be tested as follows:

- all traps shall be filled with water;
- the outlets of all ventilating pipes shall be plugged; and
- the air test described in 4.26 shall be applied and the criterion for passing the test shall apply.

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Annex A

(normative)

National Building Regulations Part P: Drainage

Definitions

public place

square, park, recreation ground or open space which

- a) is vested in the local authority, or
- b) the public has the right to use, or
- c) is shown on a general plan of a township filed in a deeds registry or a Surveyor-General's office and has been provided or reserved for the use of the public or the owners of erven in such township

street

street, road, thoroughfare, lane, footpath, sidewalk, subway or bridge which

- a) is vested in the local authority, or
- b) the public has the right to use, or
- c) is shown on a general plan of a township filed in a deeds registry or a Surveyor-General's office and has been provided, or reserved the use of the public or the owners of erven in such township

Regulations

P1 Compulsory Drainage of Buildings

- (1) (a) Where in respect of any building a suitable means of disposal of waterborne sewage is available the owner of such building shall provide a drainage installation.
- (b) Where there is no such means of disposal, sewage shall be disposed of in accordance with part Q of these regulations.
- (2) (a) Where a sewer is or becomes available for the drainage of such building the owner of such building shall, at his own cost, lay, alter or extend any drain serving such building to terminate at a location and level as prescribed by the local authority for the connection to such sewer.
- (b) In the case of any existing building the local authority shall serve a notice, in writing, upon the owner stating the period within which the connection contemplated in paragraph (a) shall be made.
- (3) Where a connecting sewer has been provided to any site the owner of such site shall cause all sewage discharged from any building on such site to be conveyed by a drain to such connecting sewer.
- (4) Where the owner of such building fails to lay, alter or extend any drain in terms of subregulation (2) the local authority may lay, alter or extend such drain and recover the costs

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thereof from the owner: Provided that the local authority shall, before carrying out such work give not less than 14 days notice to such owner of its intention to carry out such work.

- (5) Any owner who fails to comply with any requirement of subregulation (1) or (2), shall be guilty of an offence.

P2 Design of Drainage Installations

- (1) Any drainage installation in any building shall be so designed and constructed that –
- (a) an adequate number of sanitary fixtures is provided in relation to the population and class of occupancy of such building;
 - (b) such installation is capable of carrying the design hydraulic load;
 - (c) such installation is capable of discharging into any common drain, connecting sewer or sewer provided to accept such discharge;
 - (d) all components and materials used in such installation are watertight;
 - (e) no nuisance or danger to health will be caused as a result of the operation of any such installation;
 - (f) any drain in such system is of such strength, having regard to the manner in which it is bedded or supported, that it is capable of sustaining the actions to which it may normally be subjected and that it is, where necessary, protected against any damage;
 - (g) all sanitary fixtures are so located that they are easily accessible to those persons they are intended to serve;
 - (h) any necessary inspection, cleaning and maintenance required, may be performed through the means of access provided.
- (2) The requirements of subregulation (1) shall be deemed to be satisfied where such installation complies with SANS 10400-P: Provided that where a local authority is of the opinion that the size or complexity of the drainage installation in any building renders it essential for such installation to be the subject of an approved rational design prepared by an approved competent person, such local authority shall, in writing, notify the owner of such building of its reasons for the necessity for such design and may require such owner to submit for approval plans and particulars of a complete drainage installation based on such design.

P3 Control of Objectionable Discharge

- (1) No person shall cause or permit sewage discharged from any sanitary fixture to enter –
- (a) any stormwater drain, stormwater sewer or excavated or constructed watercourse;
 - (b) subject to the National Water Act, 1998 (Act No 36 of 1998), any river, stream or natural watercourse whether ordinarily dry or otherwise; or
 - (c) any street or other site.
- (2) No person shall cause or permit stormwater to enter any drainage installation on any site.

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- (3) The local authority may by notice in writing order the owner of any site to execute, at his own cost, any precautionary measures required by the local authority to prevent such entry contemplated in subregulation (1) or (2), as the case may be.
- (4) No person shall, without the written permission of the local authority, discharge or cause the discharge of any water from a swimming pool, fountain or reservoir, either directly or indirectly, onto any public street or public place, or onto any site other than onto the site upon which such swimming pool, fountain or reservoir is situated.
- (5) Any person who contravenes or permits the contravention of any requirement of this regulation or fails to comply with a notice served on him in terms of subregulation (3), shall be guilty of an offence.

P4 Industrial Effluent

- (1) (a) Where any person has obtained approval to discharge into any drain any liquid or solid matter, other than soil water or waste water, and where any additional drainage and other installations including storage, pre-treatment and metering installations are required by the local authority as a condition of such approval, such person shall submit any plans and other details of such installations required by the local authority.

(b) The installations contemplated in paragraph (a) shall be constructed in accordance with the relevant requirements of these regulations and shall be maintained in good working order.
- (2) Any person who constructs an installation contemplated in subregulation (1) other than in accordance with such approval, shall be guilty of an offence.

P5 Disconnections

- (1) Where any soil fixture is permanently disconnected from any soil pipe, or where any soil pipe is permanently disconnected from any drain, the owner shall seal the opening to such pipe or drain in such a manner that such disconnection will not be a danger to health.
- (2) Where any drain is permanently disconnected any remaining part shall be sealed by the owner of such drain.
- (3) When any drainage installation is disconnected from a connecting sewer the local authority shall be notified, in writing, by the owner thereof within 30 days from the date of such disconnection.
- (4) Any person who contravenes any requirement of this regulation, shall be guilty of an offence.

P6 Unauthorized Drainage Work

- (1) Unless authorized by the local authority –
 - (a) no person shall in any manner interfere with any sewer or connecting sewer;
 - (b) no person shall break into or interfere with any part of a drainage installation other than for the purpose of repair and maintenance.
- (2) Any person who carries out or permits the carrying out of any unauthorized work contemplated in this regulation, shall be guilty of an offence.

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P7 Inspection and Testing of Drainage Installations

- (1)** Any drain, discharge pipe or ventilating pipe shall be so installed as to be capable of withstanding the test pressures contemplated in 4.26 or 4.27, as the case may be, contained in SANS 10400-P and such tests shall be carried out in the presence of the building control officer of, or other officer duly authorized by, the local authority.
- (2)** Any equipment, material or labour required for any inspection or any testing contemplated in Part P of these regulations shall be made available by the person installing such pipe or drain.
- (3)** No person shall put into use any drainage installation before such installation has been inspected, tested and passed by the local authority as complying with these regulations.
- (4)** Any person who contravenes the requirement of subregulation **(3)**, shall be guilty of an offence.

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Annex B

(informative)

Performance requirements for sanitation systems

B.1 General

Sanitation systems should comply with the requirements in B.2 and B.3.

B.2 Goal

Sanitation systems shall

- a) be sustainable,
- b) dispose of pathogens, pollutants and contaminants in a manner that does not compromise the health and safety of the users or others, and
- c) be acceptable to the community.

B.3 Performance description

B.3.1 Sanitation systems shall, with an appropriate degree of reliability over the lifetime of a building,

- a) provide for privacy and protect the user and others from the weather when in use,
- b) prevent soil, garbage and other foreign materials from entering the system by the action of rain, wind or animals,
- c) not present or cause a nuisance or a danger to health as a result of their use and operation,
- d) withstand all the actions to which they are likely to be subjected to,
- e) not leak soil water into the surrounding soil, if buried,
- f) be compatible with the water supply,
- g) be capable, where required, of carrying the design hydraulic load and drain and discharge into a municipal sewer system, a common drain or other sewage disposal system, or dispose of effluent in a safe and inoffensive manner,
- h) not contaminate clean water supplies or ground water to the extent that such contamination poses a health risk,
- i) be easy to use, clean and maintain,
- j) be able to accommodate and dispose of commonly used cleaning materials, and
- k) satisfy nominated parameters, depending upon the nature of the system.

B.3.2 Sanitary fixtures shall comprise impermeable, non-corrosive material, and have a smooth and readily cleanable surface that is free from ledges or protrusions that can be easily soiled.

Annex C (normative)

The sizing of septic tanks

C.1 General

Septic tanks shall be of sufficient size to store sludge and scum in addition to being able to retain liquid for at least 24 h. The desirable septic tank capacity can be calculated by one of three methods, as given in C.2 to C.4.

C.2 Method 1 — Dwelling houses and dwelling units

This method, where the capacity of the septic tank required is related to the number of bedrooms, is applicable mainly to middle-income and higher-income areas because there is often a relationship between the number of occupants in a dwelling house or dwelling unit and the number of bedrooms. Each habitable room in outbuildings should be counted as an additional bedroom.

When this method is used to establish the capacity of a septic tank for dwellings in lower-income areas, each room in the dwelling shall be regarded as a bedroom. The desired capacity of the tank, in litres, for a 24 h liquid retention period can be interpolated from table C.1.

Table C.1 — Required tank capacity to retain liquids for a period of 24 h

1	2	3	4	5	6	7	8	9
Number of bedrooms	Required tank capacity for a period of 24 h							
	L							
	Nominated frequency of cleaning							
	years							
	1	2	3	4	5	6	7	8
2	1 500	1 500	1 500	1 500	1 600	1 700	1 800	1 900
3	1 500	1 500	1 500	1 900	2 000	2 300	2 500	2 800
4	1 900	2 000	2 100	2 300	2 600	2 900	3 200	3 600
5	2 400	2 500	2 600	2 900	3 200	3 600	4 000	4 500
6	2 700	2 800	3 000	3 300	3 700	4 100	4 600	5 300
A minimum tank size of 5,1 m ³ shall be provided where the tank serves more than one dwelling house or unit.								
NOTE 1 000 L = 1 m ³ .								

C.3 Method 2 — Alternative method for dwelling houses and dwelling units

This method, where the capacity of a septic tank is determined from the number of persons served, should be used when materials other than water or paper are used for anal cleaning, or for dwellings without multiple sanitary fixtures, or multiple residential systems. The rate of sludge and scum accumulation will depend on various factors, such as ambient temperature, living standards, diet, the health of the occupants, etc.

The typical rate of sludge and scum accumulation for dwellings without multiple sanitary fixtures is given in table C.2, and the information for dwellings with multiple sanitary fixtures, is given in table C.3.

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The septic tank capacity is calculated by adding the estimated daily sewage flow in litres (see tables C.4 and C.5) to the capacity required, in litres, to store sludge and scum between the septic tank cleanings, namely

$$C = Q + P$$

where

C is the septic tank capacity, in litres;

Q is the estimated daily sewage flow, in litres;

P is the capacity, in litres, needed for sludge and scum between septic tank cleanings.

**Table C.2 — Rate of sludge and scum accumulation
in dwellings without multiple sanitary fixtures**

1	2
Materials used for anal cleaning	Rate of accumulation L/person/year
Sand stone, etc.	
Toilet wastes only	55
Additional household sewage	70
Hard paper, leaves and grass	
Toilet wastes only	40
Additional household sewage	50
Water and soft paper	
Toilet wastes only	25
Additional household sewage	40

**Table C.3 — Rate of sludge and scum accumulation
in dwellings with multiple sanitary fixtures**

1	2		
Years of service	Rate of accumulation L/person/year		
	Sludge	Scum	Total
1	65	20	85
2	105	35	140
3	125	50	175
4	145	65	210
5	170	85	255
6	195	95	290
8	240	120	360
10	295	145	440

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Table C.4 — Flow from housing units with full in-house water reticulation

1	2
Description	Sewage flow L/d
Low-income group:	
Per person per dwelling unit, or	70
Per dwelling unit	500
Middle to upper-income groups:	
Per person per dwelling unit, or	160
Dwelling unit with 2 bedrooms	750
Dwelling unit with 3 bedrooms	900
Dwelling unit with 4 bedrooms	1 100
Dwelling unit with 5 bedrooms	1 400
Dwelling unit with 6 bedrooms	1 600
An allowance of 15 % for stormwater infiltration and other contingencies shall be added to these design figures.	

Table C.5 — Sewage flow from dwelling units that do not have full in-house water reticulation

1	2
Level of water supply	Sewage flow L/person/d
Public street standpipes	12 to 15
Single on-site standpipe with dry sanitation system	20 to 25
Single on-site standpipe with a toilet pan connected to the water supply	45 to 55
Single in-house tap with a toilet pan connected to the water supply	50 to 70

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C.4 Method 3 — Buildings other than dwelling houses and dwelling units

With this method, the size of the tank is equal to the three day per capita sewage flow derived from table C.6, namely

Tank size = 3 × number of people × daily sewage flow from table C.6 for establishment type.

Table C.6 — Sewage flow from buildings other than dwelling houses and dwelling units

1	2
Type of establishment	Sewage flow L/person/d
Boarding houses	110
Additional kitchen wastes for non-resident boarders	23
Hotels without private baths	110
Hotels with private baths	140
Restaurants (toilet and kitchen wastes per patron)	20
Day schools	37
Day workers at offices per shift	90
Hospitals	500
Factories (litres per person per shift, exclusive of industrial wastes)	140
Swimming baths	9
Motels (per bed)	90
Drive-in theatres (per car space)	9
The minimum tank size shall not be less than 5,1 m ³ .	

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