WATER RETICULATION AND DRAINAGE IN BUILDINGS

SANS10252-1
SANS10400-W
SANS10252-2
SANS10400-P

WATER RETICULATION IN BUILDINGS

LEGISLATIVE BACKGROUND

water affairs

Department:
Water Affairs
REPUBLIC OF SOUTH AFRICA

Government Notice R509 of 08 June 2001

Water Services Act (Act 108 of 1998)

13(2) If constructed or installed after promulgation of these Regulations, a suitable water volume measuring device or volume controlling device must be fitted to separately measure or control the water supply to every –

(a) individual dwelling within a new sectional title development, group housing development or apartment building;

(b) individual building, having a maximum designed flow rate exceeding 60 litres per minute within any commercial or institutional complex;

14. Every consumer installation <u>must</u> comply with SANS 10252: Water Supply (Part 1) and Drainage for Buildings (Part 2) and SANS 10254: The Installation of Fixed Electric Storage Water Heating Systems, or any similar substituting re-enactment or amendment thereof if the consumer installation is of a type regulated by either standard.

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Department:
Trade and Industry
REPUBLIC OF SOUTH AFRICA

National Building Regulations

National Building Regulations and Standards Act (Act 103 of 1977)

A2 Plans and Particulars to be Furnished

(1) Any person intending to erect any building, shall submit to the local authority the following plans and particulars, together with the application:

(v) particulars required in terms of any applicable legislation, by-laws, or part of SANS 10400;

A7 LAYOUT DRAWING

Any layout drawing contemplated in regulation A2(1)(b) shall indicate the occupancy classification, and shall consist of as many plans, sections, elevations and such other details as may be necessary to show.

(m) where provided, the location, type and capacity of water heating installations;

A8 PLUMBING INSTALLATION DRAWINGS AND PARTICULARS

(1)(a) The provisions of regulation A2(1)(c) *[a fire installation drawing]* and A2(1)(d) *[drainage installation drawing]* shall not be construed as preventing the details contemplated in sub-regulations (2), (3), (4) and (5) being clearly indicated on any layout drawing required in terms of regulation A2(1)(b).

(2) Any drawing of a fire installation as contemplated in regulation A2(1)(c) shall contain as many plans, sections and elevations as may be necessary to show, where relevant, the following:

(a) The location and size of any existing or proposed communication pipe serving or intended to serve any building or site;
(b) the location of any pipe, the size of such pipe and the material of which it is manufactured;
(c) the location and capacity of any storage tank;
(d) the location of any overflow;
(e) the location of any pump; and
(f) the pressure for which the installation has been designed.

XA ENERGY USAGE IN BUILDINGS

XA2 At least 50% (volume fraction) of the annual average hot water heating requirement shall be provided by means other than electrical resistance heating including but not limited to solar heating, heat pumps, heat recovery from other systems or processes and renewable combustible fuel.

WATER RETICULATION IN BUILDINGS

HOW TO COMPLY (RESIDENTIAL UNITS)

WHAT IS IMPORTANT?

1. Water supply
2. Water pressure
3. Water quality

NOTE:

None of the above can be guaranteed by a water service authority due to several reasons, therefore we may require

- Emergency storage
- Boosting of pressure

WATER QUALITY

7.1.2 Water supply quality — Human consumption

Conditions unfavourable for the development of the bacterium *Legionaella pneumophila* shall be maintained as far as possible in installations where cold water is stored for drinking purposes, or where hot water could be used for drinking purposes. For this reason,

a) the presence of organic matter in the water as well as the final products of metal corrosion, mainly iron, shall be kept to a minimum,
b) compositions of rubber used shall not form a source of nutrient for the bacterium,

c) storage tanks shall be regularly cleaned and kept free of contamination,
d) stored cold water shall be maintained at a temperature not exceeding 20 °C,
e) in a hot water installation, there shall be no zones where water is stored at temperatures of between 25 °C and 45 °C,
f) the stored hot water shall be maintained at a temperature of at least 55 °C, and
g) the quality of the water shall be such as to comply with SANS 241-1 and SANS 241-2.

WATER DEMAND

Demand, or volume of water needed per period, is related to the number of people in the building who will be using the water.

- NBR A21: Design population
- SANS10252-1: Table 1
Table 2
Table 3

NBR A21

(1) The population of any room or storey or portion thereof shall be taken as the actual population of such room, storey or portion thereof where such population is known or, where such population is not known, the population shall be calculated from the criteria given in table 2.

1	2
Class of occupancy of room or storey or portion thereof	**Population**
A1, A2, A4, A5	Number of fixed seats or 1 person per m^2 if there are no fixed seats
E1, E3, H1, H3, H4	2 persons per bedroom
E4	16 persons provided that the total number of persons per room is not more than 4
H5	16 persons per dwelling unit provided that the total number of persons per room is not more than 4
G1	1 person per 15 m^2
J1, J2, J3, J4	1 person per 50 m^2
C1, E2, F1, F2	1 person per 10 m^2
B1, B2, B3, D1, D2, D3	1 person per 15 m^2
C2, F3	1 person per 20 m^2
A3, H2	1 person per 5 m^2

SANS10252-1

4.2.1.2 An estimate shall be made

a) of the total daily water demand, using table 1 and table 2, or using any other approved data,
b) of the probable (or design) flow demand, in accordance with 4.2.2, and
c) of the total hot water demand, in accordance with 4.2.3, and of the time of peak hot water demand in terms of 4.2.3.2.

Table 1 — Daily water demand for different premises (excluding garden use)

1	2
Premises	**Water demand (including hot water)**
Boarding schools[a], children's homes and residential nurseries	135 L to 200 L per capita
Educational institutions	40 L to 50 L per capita
Kitchens (full meal preparation)	8 L to 12 L per meal prepared
Multiple dwelling units, such as flats	300 L to 400 L per dwelling
Hotels, boarding houses, motels and nurses' homes:	
with resident staff	200 L to 300 L per bed
without resident staff	200 L to 250 L per bed
Commercial premises:	
shops (staff only)	14 L to 18 L per 10 m^2 gross floor area
superstores, such as hypermarkets and warehouses	125 L per WC pan, or per 600 mm width of slab urinal
offices with canteens	10 L to 15 L per 10 m^2 gross floor area
offices without canteens	7 L to 10 L per 10 m^2 gross floor area
Clinics, hospitals, nursing homes and old-age homes	450 L to 550 L per bed
Factory ablutions	100 L to 200 L per capita
[a] Excluding kitchen but including laundry.	

Table 2 — Average water consumption (hot and cold) of appliances

1	2
Domestic and commercial appliances	L/operation
Bath	80 – 90
Bidet	6 – 8
Clothes washing machine	60 – 180
Dishwashing machine	3 – 70
Domestic waste disposal unit	10 – 15[a]
Shower	3 – 6[a]
Wash-hand basin	4 – 8
WC flushing valve (normal flush)	8 – 10
Domestic appliances	L/day/person served
Car washing and garden use	3 – 6
Drinking, food preparation and cooking	18 – 22
Laundry	10 – 15
Personal washing and bathing	20 – 30
Washing dishes	8 – 12
WC flushing	32 – 40
Office installation appliances	L/day/person served
Hand washing: normal taps	8 – 15
Hand washing: spray taps	3 – 7
Urinal flushing: 24 h day	10 – 18
Urinal flushing: 8 h day	4 – 6
WC flushing: no urinals provided	12 – 18
WC flushing: urinals provided	4 – 6

[a] Per minute.

4.2.3 Hot water demand

4.2.3.1 For the assessment of the hot water demand, the following factors shall be considered:

a) the influence that the type of activity performed in the building might have on the demand pattern;

And

b) the influence that external environmental factors (for example, climate) might have on the demand pattern.

Differentiation between the peak and the design hot water demand is advised so that the implications of an installation not meeting the peak demand can be recognized.

Table 5 — Hot water demand, storage and heater power requirements

1	2	3	4
Premises	**Total hot water demand**	**Storage volume at 60 °C**	**Heater power**[a]
Clinics	(120 to 150) L/bed/d	(30 to 35) L/bed/d	1,5 kW/[illegible]
Colleges and schools:			
Day school	(10 to 12) L/capita/d	(3 to 5) L/capita	0,1 kW/[illegible]pita
Boarding school[b]	(50 to 115) L/capita/d	(25 to 30) L/capita	(0,5 to 0,[illegible]) kW/capita
Dwelling houses:[c]			
Low rental	(80 to 115) L/capita/d	(100 to 150) L/unit	(2 [illegible]) kW/unit
Medium to high rental	(115 to 140) L/capita/d	(40 to 50) L/capita	(2 [illegible]) kW/unit
Factories:			
Staff	(10 to 20) L/capita/d	(5 to 7) L/capita/d	[illegible] kW/capita
Ablutions	(30 to 60) L/capita/d	(30 to 60) L/capita/d	([illegible] to 2) kW/capita
Flats (blocks):			
Low rental	(65 to 75) L/capita/d	(20 to 25) L/capita	(2 to 3) kW/unit
Medium to high rental	(115 to 140) L/capita/d	(25 to 35) L/capita	(2 to 5) kW/unit
Hospitals:			
General	(130 to 140) L/bed/d	(25 to 30) L/bed/d	(1 to 1,5) kW/bed
Infectious	(220 to 230) L/bed/d	(40 to 50) L/bed/d	(1,5 to 2) kW/capita
Infirmaries	(65 to 75) L/capita/d	(20 to 25) L/capita/d	(0,9 to 1,2) kW/capita/d
Infirmaries with laundry	(85 to 95) L/capita/d	(25 to 30) L/capita/d	(1 to 1,4) kW/capita/d
Maternity	(220 to 230) L/bed/d	(30 to 35) L/bed/d	(1,5 to 2) kW/bed
Mental	(85 to 95) L/capita/d	(20 to 25) L/ca[illegible]	(1 to 1,4) kW/capita/d
Nurses' homes	(120 to 130) L/capita/d	(40 to 50) L/ca[illegible]	(1 to 1,5) kW/bed
Hostels	(60 to 120) L/capita/d	(30 to 35) L/c[illegible]/d	(0,6 to 1,1) kW/capita/d
Hotels:			
with resident staff	(120 to 140) L/bed/d	(50 to 70) [illegible]bed/d	(0,9 to 1,2) kW/bed
without resident staff	(100 to 120) L/bed/d	(40 to 60) [illegible]bed/d	(0,8 to 1,1) kW/bed
Kitchens:			
Full meal preparation	(5 to 7) L/meal	(5 to [illegible]) L/meal	0,1 kW/meal
Offices:			
with canteens	(25 to 28) L/capita/d	(20 [illegible]) L/capita/d	0,5 kW/capita
without canteens	(10 to 12) L/capita/d	(5 [illegible]) L/capita/d	0,1 kW/capita
Shops (staff only)	(10 to 12) L/capita/d	([illegible] 5) L/capita	0,1 kW/capita
Sports pavilions (participants only)	(30 to 40) L/capita/d	(30 to 40) L/capita/d	(1,5 to 2) kW/capita

[a] Refers to direct electrical heating elements only.
[b] Excluding the kitchen but including the laundry.
[c] Storage normally a minimum of 115 L, with a 4 h heat-up period.

DIRECT ELECTRICAL HEATING ELEMENTS ONLY

EXAMPLE

Domestic residence (H4), 3 bedrooms

Hot water demand:

NBR A21: 2 persons per bedroom

$3 \times 2 = 6$ persons

SANS10252-1 Table 5:

$6 \times 140\ell$/person $= 840\ell$

This will be the demand over a 24h period.

Storage required depends on heating cycle of the heater.

DIFFERENT TYPE OF WATER HEATERS & ASSOCIATED STORAGE

1. Conventional electrical element
   - Approx. 50ℓ/capita (4h/140ℓ)

2. Solar without backup electrical element
   - 120% of daily demand under winter conditions

3. Solar with backup electrical element
   - 100% of daily demand under summer conditions

4. Solar with backup electrical element
   - total hot water demand

5. Instantaneous
   - No storage

EXERCISE

Calculate the storage capacity required to achieve maximum efficiency for a 2 bedroom dwelling for

1. Conventional electric element geyser
2. Solar geyser without backup element
3. Solar geyser with backup element

EXERCISE

Calculate the storage capacity required to achieve maximum efficiency for a 2 bedroom dwelling for

1. Conventional electric element geyser

$2 \times 2 = 4$ persons

$4 \times 50\ell = 200\ell$

EXERCISE

Calculate the storage capacity required to achieve maximum efficiency for a 2 bedroom dwelling for

2. Solar geyser without backup element

2 × 2 = 4 people

4 × 140ℓ = 560ℓ

560ℓ × 120% = 672ℓ

EXERCISE

Calculate the storage capacity required to achieve maximum efficiency for a 2 bedroom dwelling for

3. Solar geyser with backup element

$2 \times 2 = 4$ people

$4 \times 140\ell = 560\ell$

NATIONAL BUILDING REGULATIONS

XA2 At least 50% (volume fraction) of the annual average hot water heating requirement shall be provided by means other than electrical resistance heating including but not limited to solar heating, heat pumps, heat recovery from other systems or processes and renewable combustible fuel.

- Conventional electrical geyser not compliant
- Solar geysers and heat pumps with backup elements will only be compliant if correctly installed with correct minimum storage capacity

$$Q = \frac{hot\ water\ per\ person \times 365\ days}{50\%}$$

A20 Classification:	H4
A21 Occupancy:	2 persons/bedroom
Type of hot water generation:	Solar with back-up element
Hot water demand (SANS10252-1):	140ℓ per day per person
Number of Bedrooms:	3
Total demand:	3 × 2 × 140 = 840ℓ
Hot water storage capacity required:	840 × 50% = 420ℓ (50% XA2)
Capacity provided:	300ℓ + 150ℓ

A20 Classification:	H1
A21 Occupancy:	2 persons/bedroom
Type of hot water generation:	Solar with back-up element
Hot water demand (SANS10252-1):	140ℓ per day per bed
Number of Bedrooms:	10
Total demand:	10 × 2 × 140 = 2800ℓ
Hot water storage capacity required:	2800 × 50% = 1400ℓ (50% XA2)
Capacity provided:	5 × 300ℓ

GUIDELINE: STORAGE CAPACITY OF DOMESTIC SOLAR GEYSERS WITH BACKUP ELEMENT

	EFFICIENT	XA2
1 Bedroom	230ℓ - 280ℓ	115ℓ - 140ℓ
2 Bedroom	460ℓ - 560ℓ	230ℓ - 280ℓ
3 Bedroom	690ℓ - 840ℓ	345ℓ - 420ℓ
4 Bedroom	920ℓ - 1 040ℓ	460ℓ - 560ℓ

SANS1307 - Domestic storage solar water heating systems

4.5.5 Frame and stand

4.5.5.1 Any stand or frame that carries a storage tank on top of a roof shall comply with the following:

a) The stand shall include a structurally sound load spreading support that evenly distributes the loads, on the rear legs and that protrudes at least 300 mm past each leg.

b) The stand shall include cross braces that stabilize the frame.

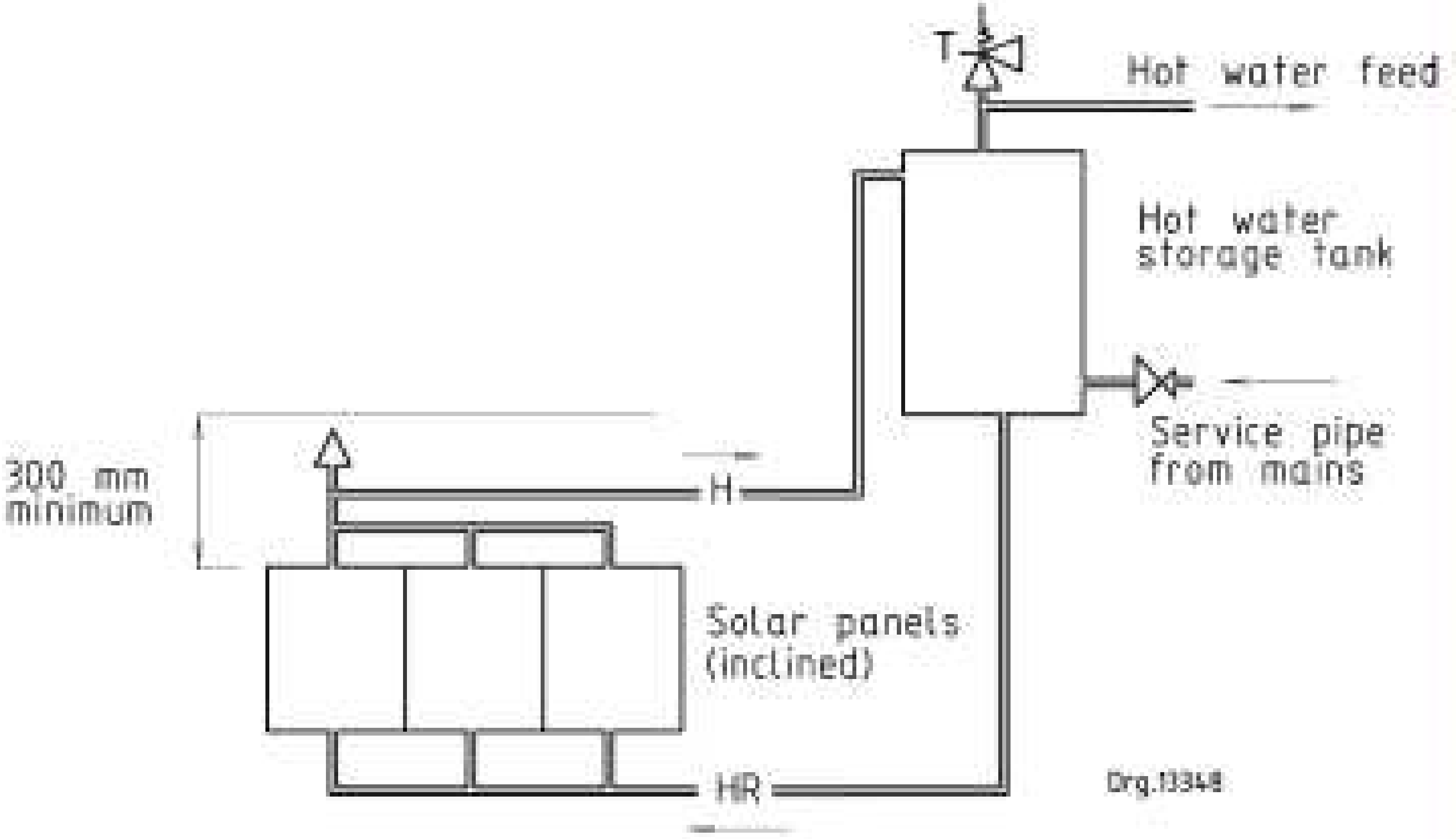
4.5.5.2 Any stand or frame that will determine the angle of the collectors or the storage tank (or both) shall comply with the following:

a) The stand or frame shall allow for the system to be installed at the inclination specified by the manufacturer, on any roof pitch as nominated by the manufacturer.

b) The manufacturer shall provide clear instructions on how to adjust the inclination of the frame.

c) After adjustment the frame shall still comply with all material, corrosion and structural requirements stated in this standard.

SANS10160 - The installation, maintenance, repair and replacement of domestic solar water heating systems



NOTE H is the hot water pipe and HR is the hot water reverse pipe.

Figure 2 — Thermosiphonic hot water system

Design considerations and positioning of solar collectors

Solar heaters effectively absorb heat from the sun from about 10:00 until about 16:00.

Solar irradiance is at its peak between about 12:00 and 14:00.

However, sufficient quantities of hot water have to be stored for use after 16:00.

A critical factor in the installation of solar heating systems is the position of the collector relative to the movement of the sun.

In the southern hemisphere, collectors should be pointed true north and tilted at an angle above the horizontal equal to the latitude of the site plus 10°.

This angle is chosen mainly to favour the collection of solar heat during winter when the sun is fairly low in the sky, to obtain year round efficiency.

A deviation of up to 45° east or west of north may, however, be acceptable in many cases.

The design of the absorber unit can vary from a simple flat plate to an evacuated tube reflector type absorber.

Ideally, the exposed surface of the collector should absorb the maximum amount of incident solar radiation with a minimum of heat loss.

The transparent cover over the collector prevents ingress of rain, reduces the cooling effect of outside air movement over the collector and restricts re-radiation losses, the latter probably being the most important.

This means that the incident solar radiation has to be transmitted through the transparent cover with a minimum loss of heat energy due to absorption.

Thermosiphonic circulation can be created by placing the absorber at the lowest point of the system.

The resulting circulation pressure is fairly small and any obstruction or an accumulation of air bubbles in the system can impede the natural flow of the water.

The absorber and all pipes are therefore sloped in such a way that air can escape to the tank to be vented off.

While the thermosiphonic system is the most popular one for domestic applications, pumped systems permit greater freedom in the placement of the absorber(s), which can then be situated either above or below the storage tank.

A typical pumped system is shown in figure 3. Pumped systems can be direct (where the potable water itself circulates through the solar collector) or indirect as shown in figure 4, where the potable water is heated via a heat exchanger.

In an indirect system, additives can be added to the solar panel water (or primary circulating water) to control corrosion.

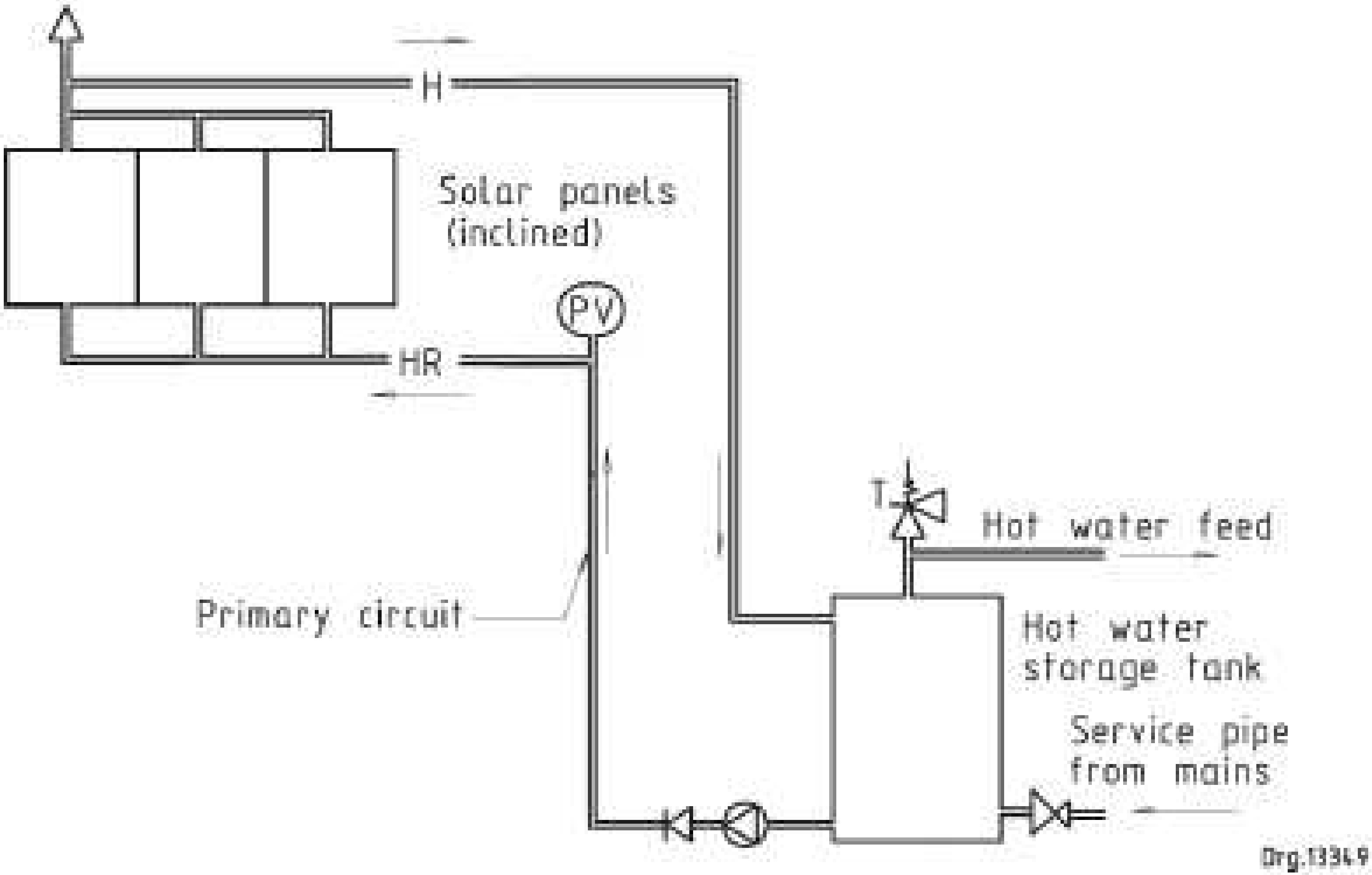


Figure 3 — Pumped direct solar hot water system

Figure 5 shows a more complex arrangement in which a solar installation is used to preheat the feed tester for the main hot water storage tank.

Indirect systems are less efficient than direct systems, owing to losses from the heat exchanger.

Indirect systems do, however, have the following advantages over both thermosiphonic and pumped direct systems:

a) frost damage can be prevented by the use of a suitable heat transfer fluid, usually water with an antifreeze additive;
b) damage due to boiling can be prevented if a suitable heat transfer fluid with a high boiling temperature is selected;

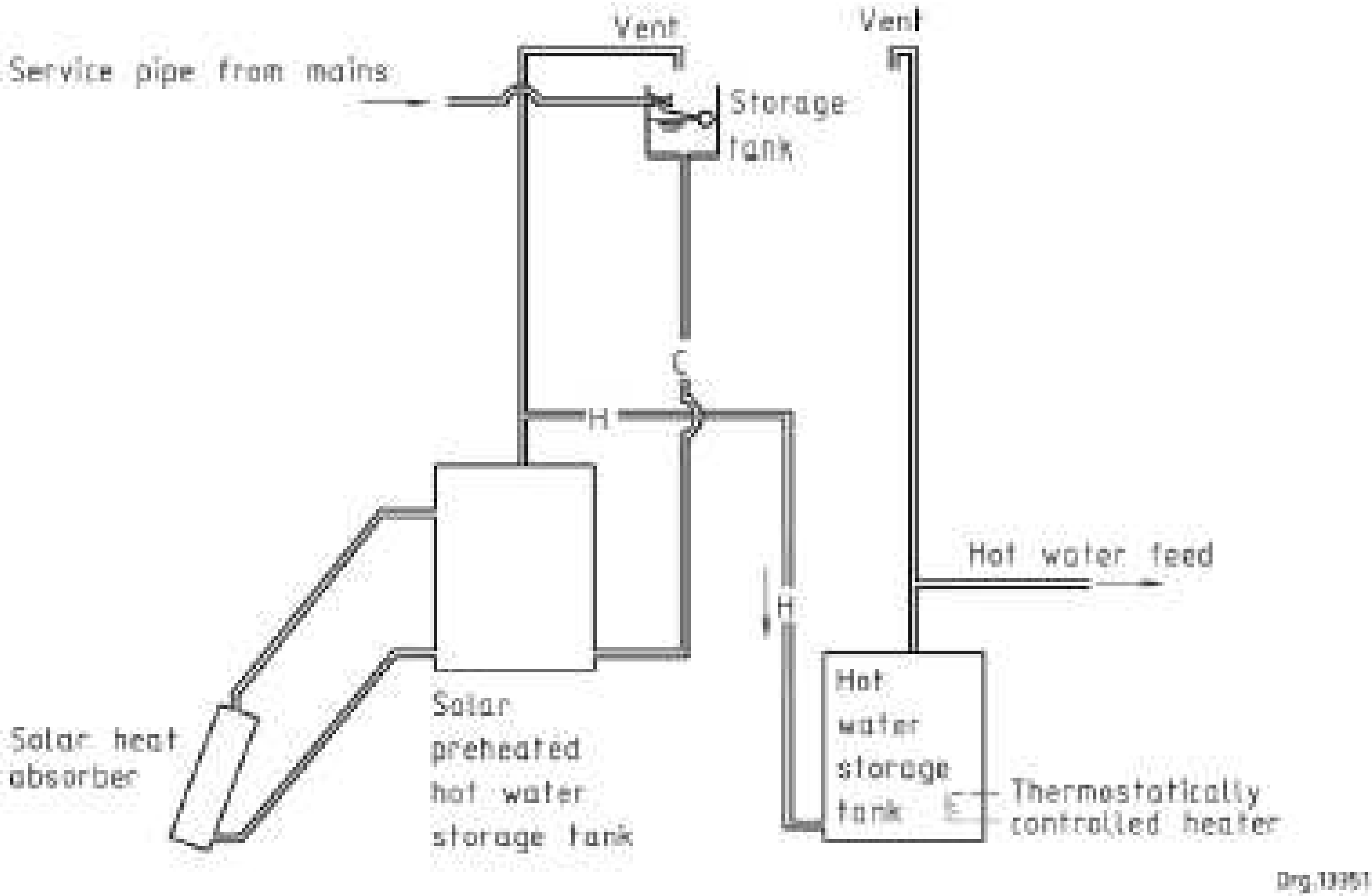


Figure 5 — Solar water heater used for preheating in a hot water system

c) corrosion within the primary system can be minimized by the use of a corrosion-inhibited heat transfer fluid; and

d) scale formation within the primary system can be more effectively controlled.

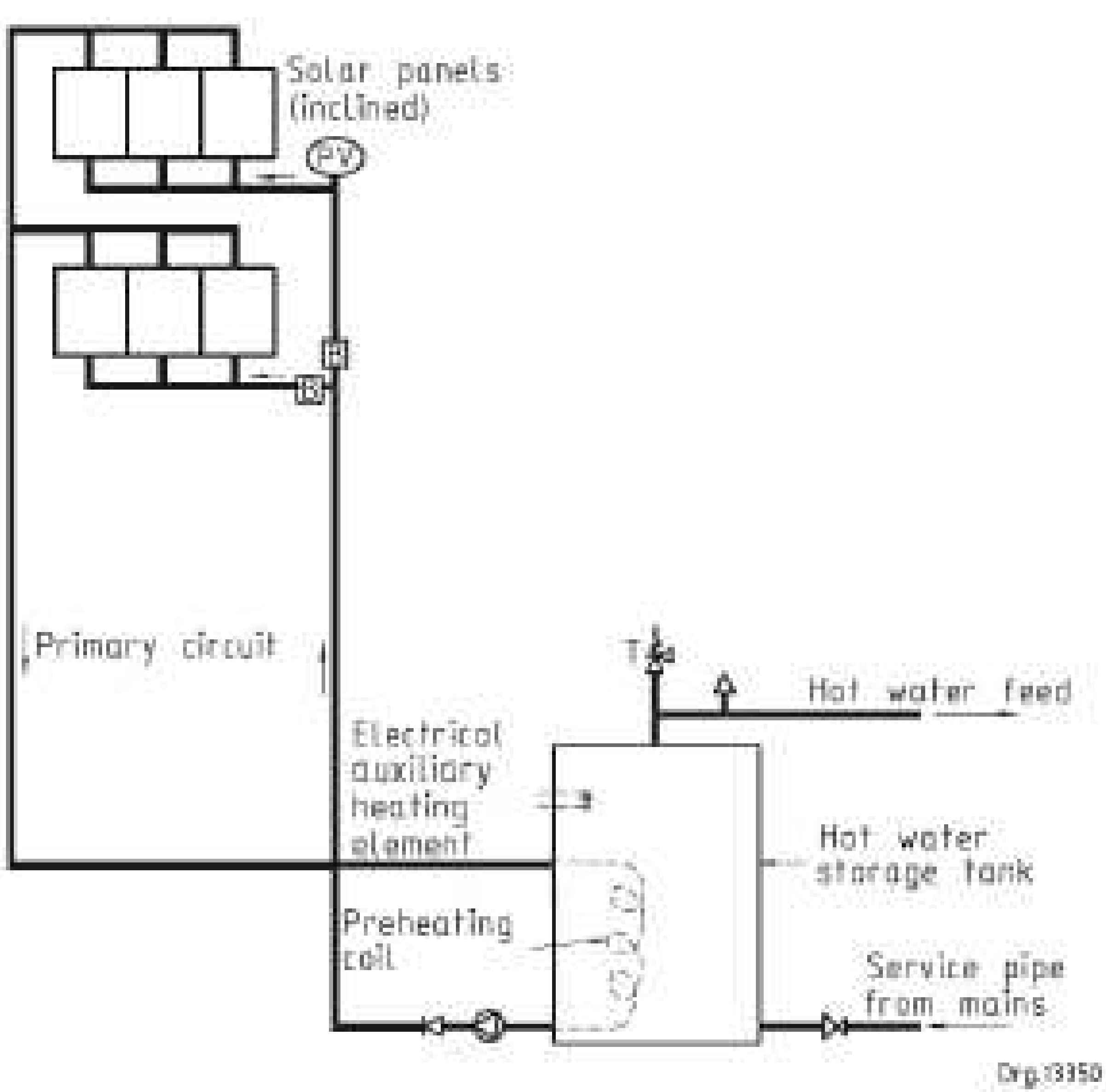


Figure 4 — Pumped indirect solar water system

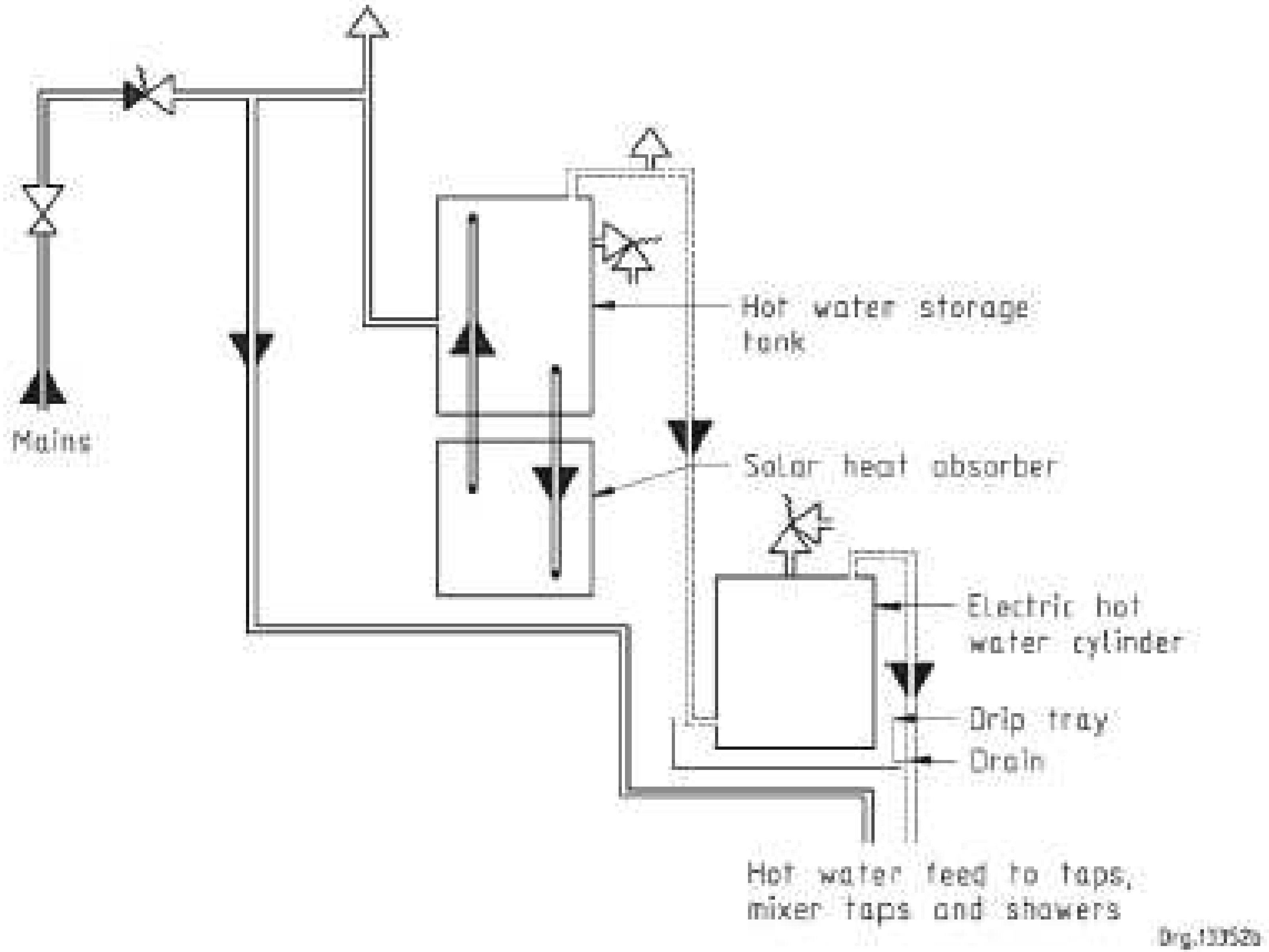


Figure 6 — Solar water heater used as preheater in a hot water system

SANS1352 - The installation, maintenance, replacement and repair of domestic air source water heating heat pump systems

4.3.5 Locating and positioning of the heat pump unit and components

Notwithstanding any National standard the heat pump unit and components shall be located and installed in accordance with the manufacturer's instructions and in such a manner and position to ensure:

a) the safe and effective operation (both mechanical and electrical) of the system and of each individual component part;
b) the safe, easy, effective and correct removal and replacement of component parts or spare parts during maintenance, replacement or repair,

c) the effective discharge and drainage of condensation water from the heat pump unit;
d) the provision of adequate and sufficient ventilation and airflow stream around the heat pump unit, so as not to impede energy efficiencies or the performance of the heat pump unit (or both);
e) the prevention of the build up of water, snow, ice, dirt and debris;
f) the minimisation of noise transmission of the heat pump unit into the environment especially during the night. The noise transmission of the heat pump unit shall not be greater than 45 decibels between 11:00pm and 7:00am and 55 decibels at other times;
g) that, and not withstanding 5.5.1(a) and 5.5.1(b), the pipe network layout for the heat pump units primary circulation loop shall be such that length and directional changes are minimized;

h) that the heat pump unit can be supplied with electrical power in an effective and safe manner;

i) that the orientation of the heat pump unit should be such that the heat pump unit is exposed to the maximum incident solar radiation;

In the southern hemisphere, to ensure maximum operating efficiency, the heat pump unit should preferably be positioned on the northern side of the dwelling. If this is not possible the heat pump unit should be mounted in order of preference , to (1) either north east or north west side, (2) then on east or west side of the dwelling and then only south east or south west and finally on the (3) South face side of the dwelling.

j) that adverse weather conditions such as high winds and heavy rains or excessive water discharges onto the heat pump unit do not affect the efficient and effective operations of the heat pump unit;

k) when the heat pump unit is positioned above the storage water heater, provision shall be made to prevent the heat pump unit from draining of water.

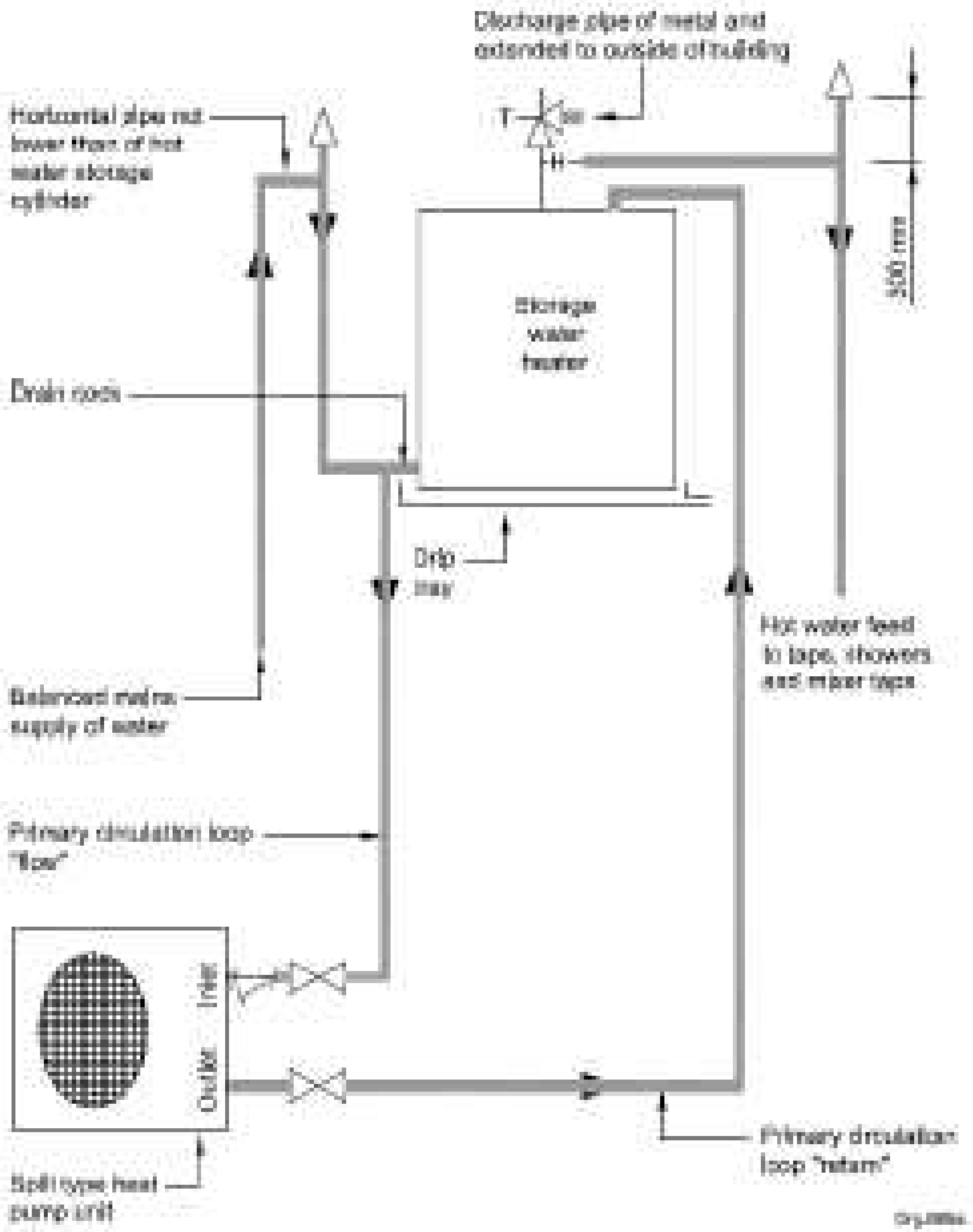


Figure 2 — Split type heat pump heat pump unit with an integrated pressure and temperature safety valve and hot water outlet

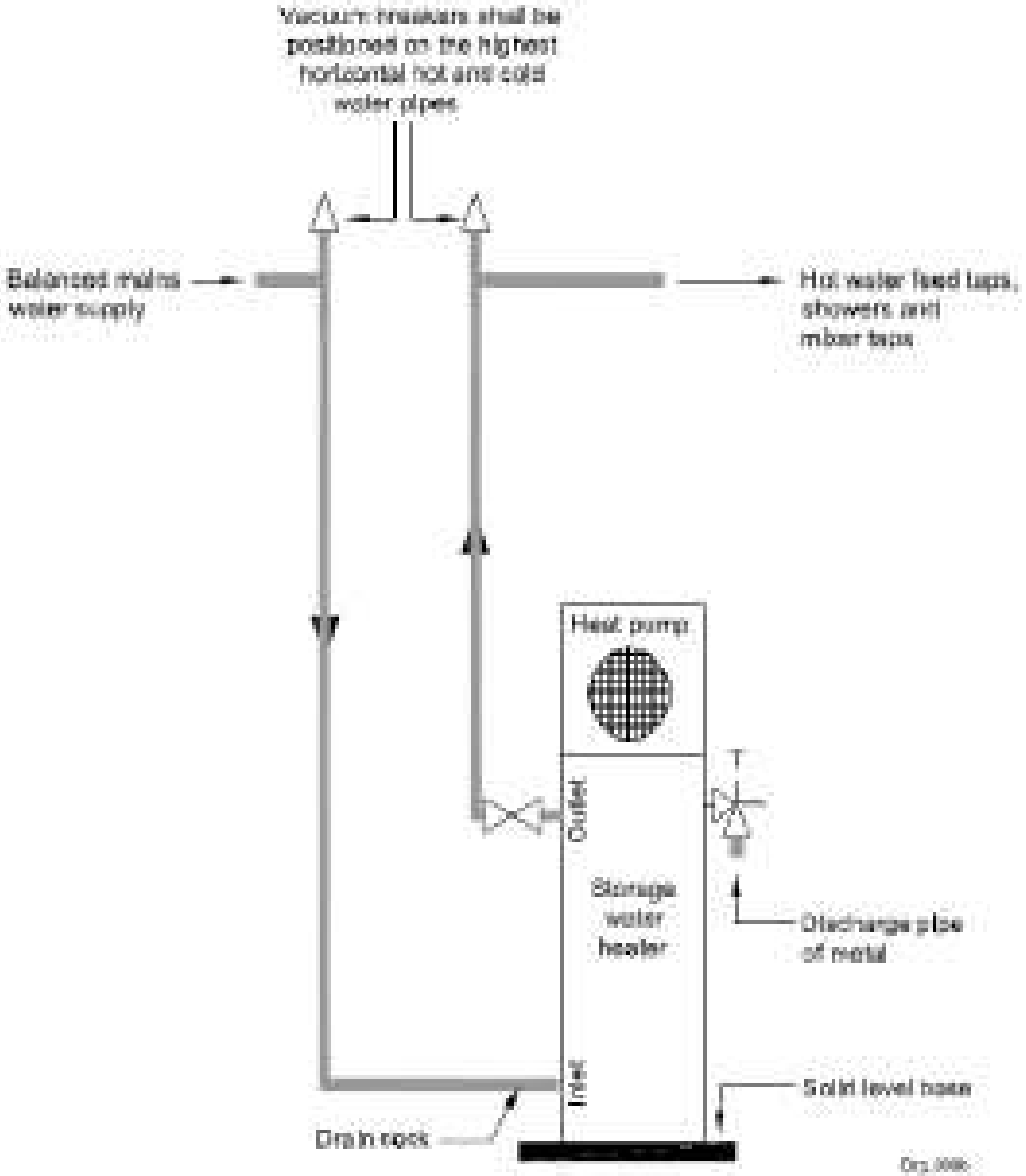


Figure 3 — Integral type heat pump unit (floor mounted)

CAUTION:

Most literature provided with domestic heat pumps state that a COP of 4 will be achieved if correctly installed.

Climatic conditions should be checked before a decision is made to install a heat pump.

The average ambient temperature to achieve the COP of 4 is stated as 20°C which is much higher than the average ambient temperature of most towns in SA.

For example, the average annual temperature in Cape Town is 17ºC, and in Pretoria, 17.5ºC

Pretoria

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. Max Temperature	29	29	28	25	22	21	20	23	27	28	28	28
Avg. Min Temperature	17	17	16	12	7	3	3	7	11	14	15	16
Avg. Rain Days	6	6	4	3	1	0	0	0	2	4	7	4
Avg. Snow Days	0	0	0	0	0	0	0	0	0	0	0	0

Cape Town

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. Temperature	20	20	19	16	14	12	11	12	13	16	17	20
Avg. Max Temperature	27	28	26	25	21	19	18	19	20	23	24	26
Avg. Min Temperature	15	15	13	11	9	7	6	7	8	10	12	15
Avg. Rain Days	3	2	3	4	7	9	9	9	7	6	5	4
Avg. Snow Days	0	0	0	0	0	0	0	0	0	0	0	0

5 Materials, pipes, fittings, components and fixtures

5.1 General

5.1.1 Materials, components, fittings and fixtures shall be so selected that they are suitable for the expected conditions of use.

5.1.2 If required, approval shall be obtained from the local authority regarding the use of specific materials or workmanship in the area concerned.

NOTE The schedule of approved products is normally the Joint Acceptance Scheme for Water Installation Components (JASWIC) acceptance list.

JASWIC ACCEPTANCE COMMITTEE WORKING LIST: ACCEPTED WATER COMPONENTS

Line	Product description	Manufacturer	Catalog reference	Specification	Mark/ comply	Serial
1	Cistern (close coupled)	Vaal Sanitaryware	Lotus 710013	SANS 821	Mark	475 / 1
2	Cistern (close coupled)	Vaal Sanitaryware	Hibiscus 710031	SANS 821	Mark	478 / 2
3	Cistern (concealed)	Geberit International AG	110.945	SANS 821	Mark	537 / 1
4	Cistern (high level)	Dutton Plastics Eng	Elf (11 litre)	SANS 821	Mark	629 / 1
5	Cistern (high level)	Dutton Plastics Eng	Lux (11 litre)	SANS 821	Mark	673 / 1
6	Cistern (high level)	Parker Manufacturing	Puma (9 litre)	SANS 821	Mark	449 / 1
7	Cistern (high level)	Parker Manufacturing	Lynx (9 litre & 11 litre)	SANS 821	Mark	430 / 1
8	Cistern (low level)	Dutton Plastics Eng	Elf (11 litre)	SANS 821	Mark	630 / 1
9	Cistern (low level)	Dutton Plastics Eng	Lux (11 litre)	SANS 821	Mark	674 / 1
10	Cistern (low level)	Parker Manufacturing	Puma (9 litre)	SANS 821	Mark	448 / 1
11	Cistern (low level)	Parker Manufacturing	Lynx (9 litre & 11 litre)	SANS 821	Mark	438 / 1
12	Cistern (low level)	Dutton Plastics Eng	Alpha (9 litre)	SANS 821	Mark	53 / 1
13	Cistern (low level)	Dutton Plastics Eng	National 9 litre Syphonic	SANS 821	Mark	204 / 1
14	Cistern (low level)	Dutton Plastics Eng	Superior	SANS 821	Mark	410 / 1
15	Cistern (low level)	Vaal Sanitaryware	Hibiscus	SANS 821	Mark	478 / 3
16	Cistern (semi-high level)	Vaal Sanitaryware	Hibiscus	SANS 821	Mark	478 / 1
17	Coupling (mechanical)	Thomas Pipe Products	Thomas Unifit Pipe Couplings	SANS1808-2	Comply	1620 / 1
18	Fitting (brass)(compression)	Acteser Enterprises Ltd	Cornap compression fittings	SANS 108711	Comply	1571 / 1
19	Fitting (brass)(compression)	Yuhuan Tongxin Pipe Co	Splashworks brass comp fitting	SANS 108711	Mark	1606 / 1

JASWIC ACCEPTANCE COMMITTEE WORKING LIST: ACCEPTED WATER COMPONENTS

Line	Product description	Manufacturer	Catalog reference	Specification	Mark/ comply	Serial
125	Tap (various)	Cobra Watertech (Pty) Ltd	Canna Series	SANS 226/1&2	Mark	73 / 1
126	Tap (various)	Cobra Watertech (Pty) Ltd	Crutch Series	SANS 226/1&2	Mark	81 / 1
127	Tap (various)	Cobra Watertech (Pty) Ltd	Star Series	SANS 226/1&2	Mark	1051 / 1
128	Tap (various)	Cobra Watertech (Pty) Ltd	Ixion series	SANS 226/2	Mark	398 / 1
129	Tap (various)	Cobra Watertech (Pty) Ltd	Capstan series	SANS 226/2	Mark	793 / 1
130	Tap (various)	Cobra Watertech (Pty) Ltd	Galaxia series	SANS 226/1&2	Mark	893 / 1
131	Tap (various)	Cobra Watertech (Pty) Ltd	Tudor Series	SANS 226/2	Mark	582 / 1
132	Tap (various)	Cobra Watertech (Pty) ltd	Stella Bright Series	SANS 226/2	Mark	563 / 1
133	Tap (various)	Cobra Watertech (Pty) Ltd	Stella Series	SANS 226/1/2	Mark	563 / 2
134	Tap (various)	ISCA (Pty) Ltd	ALPI	SANS 226/2	Mark	943 / 1
135	Tap (various)	ISCA (Pty) Ltd	Antica	SANS 226/2	Mark	943 / 3
136	Tap (various)	ISCA (Pty) Ltd	Windsor	SANS 226/2	Mark	943 / 4
137	Tap (various)	ISCA (Pty) Ltd	Palesa	SANS 226/2	Mark	943 / 5
138	Tap (various)	ISCA (Pty) Ltd	Classic	SANS 226/2	Mark	943 / 6
139	Tap (various)	Cobra Watertech (Pty) Ltd	Capstan Supreme series	SANS 226/1&2	Mark	946 / 1
140	Tap (various)	Cobra Watertech (Pty) Ltd	Matt Chrome 800 Series	SANS 226/2	Mark	946 / 2
141	Tap (various)	Cobra Watertech (Pty) Ltd	Damara series	SANS 1480 & 226/2	Mark	946 / 5
142	Tap (various)	Cobra Watertech (Pty) Ltd	Victoriana Series	SANS 226/1/2	Mark	965 / 1
143	Tap (various)	Cobra Watertech (Pty) Ltd	Metsi series	SANS 226/2	Mark	793 / 2

5.1.3 If it is desired or deemed necessary to use materials, components, fittings or fixtures not covered by this part of SANS 10252 or by an appropriate standard, proof of quality and performance of the material or workmanship shall be established by tests or by reference to other appropriate standards.

PRESENTER'NOTE:

The designer needs to prove that the product complies with the minimum testing standards as per the applicable SANS standard.

5.1.4 The following factors shall be considered when materials, components, fittings and fixtures are being selected:

a) life cycle costs;
b) effect on water quality;
c) internal and external corrosion;
d) compatibility of different materials;
e) aging, fatigue and temperature effects;
f) mechanical properties;
g) durability;
h) availability;
i) water quality; and
j) dezincification resistance.

5.1.5 All materials, components, fittings and fixtures in every part of a water installation shall

a) operate effectively under all normal conditions likely to be experienced when the water installation is in service, and

b) withstand, without damage or deterioration, sustained temperatures of

1) up to 40 °C in the case of cold water installations, and
2) up to 60 °C and occasionally up to 100 °C in the case of hot water installations (in order to allow for malfunctions of heated water fittings or components) or to allow for periodic high temperature flushing as part of *Legionella* control regimes.

5.1.6 Selected fittings or components or any other apparatus shall not induce pressure surges that can cause damage to any part of the water installation.

NOTE Quick-closing valves and pressure booster pumps can (for example) induce undesirable pressure surges in a water installation unless special measures are taken to absorb such surges

5.1.7 Materials selected for the manufacture of purpose-made water heaters and storage containers shall be compatible with the quality of the water to be heated or to be stored, and shall comply with the relevant details given in the appropriate of 5.2.

5.1.8 All rubber components that are in contact with potable water, such as joint rings, tap washers and flange packings, shall, in order to control the multiplication of *Legionaella pneumophila* bacteria in water installations, be of a composition that will not promote microbiological growth.

Rubber joint rings that comply with the relevant requirements of SANS 4633 and that have the dimensions, composition and hardness that are suitable for the particular application, shall be deemed to be acceptable.

5.2 Pipes and pipe fittings

NOTE 1 Piping materials used for water installations in buildings include, but not limited to galvanized mild steel, copper, stainless steel, polypropylene, polyethylene, cross-linked polyethylene, PVC-u, chlorinated PVC).

NOTE 2 Metals and metal alloys (such as copper and stainless steel) that rely on the presence of protective surface films for their corrosion resistance are particularly at risk to pitting corrosion under unfavourable conditions.

NOTE 3 Where galvanized mild steel pipes and copper pipes are used in the same system, the corrosion rate of galvanized steel is usually substantially increased by the traces of copper present in the water. Dissolved copper ions can stimulate the corrosion of zinc coatings and bare steel surfaces, either by direct electrochemical exchange reactions or by galvanic attack. Dissolved copper is, however, usually only found in cases where galvanized mild steel hot water outlet pipes are used together with copper domestic water heaters that operate at excessively high temperatures.

NOTE 4 Where galvanized mild steel pipes and copper pipes are to be used in the same system especially at temperatures in excess of 60 °C, it is recommended that the copper pipe is downstream to the galvanized steel pipe.

5.2.1 Copper and copper alloy

5.2.1.1 All copper alloy components in contact with potable water shall comply with the minimum standard when tested in accordance with SANS 6509. The maximum penetration shall not exceed 250µm.

5.2.1.2 Notwithstanding the requirements in 5.2.1.3, the following shall be deemed to be acceptable:

a) copper tubes recommended in SANS 460 for the design conditions;
b) solders, fluxes and the method of soldering described in SANS 460; and
c) copper-based fittings for copper tubes that comply with the requirements of SANS 1067-1or SANS 1067-2, as relevant.

SANS 460 Class 0:

A hard drawn thin-walled tube for use *without bending*, and recommended for above ground use only. Hard drawn tubing is *not recommended for underground use* due to its thin wall and lack of flexibility. Any change of direction using SANS 460 Class 0 should be made using capillary fittings and not compressive fittings.

Local annealing in order to produce a bend, offset or crossover is not recommended. Oxyacetylene brazing of SANS 460 Class 0 using capillary fittings is not recommended.

SANS 460 Class 1:

A half hard thin-walled tube for above ground use only. This tube can be bent using a bending tool with inner and outer formers. Spring bending is not advised due to the spring being too loose in the tube and the walls of the tube collapsing. SABS 460 Class 1 - 28mm to 108mm is ideally suited for the drawing of "T" joints.

SANS 460 Class 2:

A half hard, heavy gauge tube with excellent bending qualities. This class is also used underground under normal conditions i.e. non-aggressive soils. This is the only class that can be bent by using an Internal Bending Spring. Care should be taken when installing tube underground. The tube should be protected against external corrosion using CXP tape. SABS 460 Class 2 - 28mm to 108mm is ideally suited for the drawing of "T" joints

SANS 460 Class 3:

This class is a heavy, thick walled, half hard copper tube with excellent bending qualities, designed specifically for underground use where soil movement takes place. Care should be taken when installing tube underground and it should be protected against external corrosion using CXP tape.

5.2.1.3 Unless the water is suitably treated, copper piping shall not be used where

a) the water can so dissolve an undue amount of copper that an unacceptable green staining is produced, or

b) copper deposits onto aluminium or zinc surfaces will promote galvanic attack.

5.2.1.4 Copper or copper alloy pipes and fittings shall not be used, unless suitably protected against external corrosion, where they might be in contact with materials such as

a) ash,

b) sodium chloride (salt),

c) ammonia, or

d) any compound that consistes of of magnesium oxychloride (magnesite).

5.2.3.7 Plastics pipes and fittings for hot and cold water supply systems shall comply with one of the following standards:

a) for PE-X (cross- linked polyethylene): SANS 15875-1, SANS 15875-2, SANS 15875-3 and SANS 15875-5;
b) for PB (polybutylene): SANS 15876-1, SANS 15876-2, SANS 15876-3 and SANS 15876-5;
c) for PVC-C (chlorinated polyvinyl chloride): SANS 15877-1, SANS 15877-2, SANS 15877-3 and SANS 15877-5;
c) for PE-RT (raised temperature cross linked polyethyelene): SANS 22391-1, SANS 22391-2, SANS 22391-3 and SANS 22391-5; and
d) for PE-X Multi-layer piping systems: SANS 21003-1, SANS 21003-2, SANS 21003-3 and SANS 21003-5.

5.2.3.8 The minimum rating of a polymer pipe used in hot and cold water systems in buildings is class 2, PN16 at 20 °C, 8 bar at 70 °C, and shall be marked as such on the pipe.

5.2.3.9 Algae growth can occur in plastics pipes if there is any translucence. Plastic pipes on hot and cold systems shall only be used inside buildings.

5.2.3.10 For pipes and fittings, guidance on the application of the system shall be found in SANS 4427-5, SANS 15874-5, SANS 15875-5, SANS 15876-5, SANS 15877-5, SANS 22391-5 and SANS 21003-5. Any plastic piping systems for hot water use shall be class 2 (70 °C operating temperature), and shall have a minimum operating pressure (M.O.P) of 600 kPa (6 bar) at 70 °C.

All SANS standards for plastic polymer piping system for hot and cold water supplies are approved for use inside buildings only. All plastics pipes used in hot and cold water installations near external doorways and windows, shall be protected from sunlight.

Unlike metal pipes (steel and copper) that have generic pipe and fitting standards, thermoplastic pipe systems are required to be installed using the fittings and tools that are tested and approved as a complete system, The use of pipes, fittings and tools from other manufacturers or suppliers, that are not the same as the approved system, shall not be acceptable.

SANS 21003-2:2008
SANS 21003-3:2008
SANS 21003-5:2008
TO: MULTILAYER PIPING SYSTEMS FOR HOT AND COLD WATER INSTALLATIONS INSIDE BUILDINGS
PART 2: PIPES
PART 3: FITTINGS
PART 5: FITNESS FOR PURPOSE OF THE SYSTEM

Effective Date	5 July 2012
Expiry Date	19 December 2014
Date of Original Registration	19 December 2008

5.2.5 Iron and steel

5.2.5.1 The following shall be deemed to be acceptable:

a) malleable cast-iron pipe fittings that comply with the requirements in SANS 14;
b) ductile iron pipes that comply with SANS 1835;
c) steel pipes and pipe fittings with a nominal bore up to 150 mm that are suitable for screwing, in accordance with SANS 1109-1 pipe threads, and that comply with the requirements in SANS 62-2;
d) galvanized steel tubes, tubulars and fittings that have been galvanized in accordance with the requirements of SANS 32; and
e) steel pipes and fittings that comply with the requirements of SANS 62-1, SANS 719, SANS 815-1 and SANS 815-2, as applicable.

5.2.5.2 Where buried galvanized steel tubes and fittings can suffer rapid corrosion in acidic soils, special precautions shall be taken to protect such pipes and fittings against external corrosion.

Several coastal local authorities do not allow the use of galvanized steel pipes in water supply installations.

5.3.3 Taps, mixers and showers

5.3.3.1 Taps and mixers

5.3.3.1.1 Metallic water taps and mixers shall comply with the requirements in SANS 226, SANS 1480, SANS 1808-9, SANS 1808-16, SANS 1808-30, SANS 1808-35, SANS 1808-37, or SANS 1808-66, as relevant.

5.3.3.1.2 Draw-off taps shall operate effectively at the internal water pressure recommended by the manufacturer.

5.3.3.1.3 Plastics taps shall comply with SANS 1021.

5.3.3.2 Showers

Showers shall be of a type that can operate effectively at the internal water pressure recommended by the manufacturer.

8.6.3 Pipes laid in or through floors, concrete slabs or walls

8.6.3.1 Where any portion of a pipe is concealed in a floor, concrete slab or wall, the following shall apply:

a) adequate measures shall be taken to protect such portion from external pressure or from the transmission of any load to it;

b) should a leak develop in such portion, the installation shall be such that the portion of the pipe can be removed without danger to the building structure; and

c) plastics pipes shall not be rigidly encased in floors, concrete slabs or walls.

8.6.3.2 Where any portion of a pipe passes through a wall or under a floor, such portion should preferably be installed inside a sleeve of internal diameter of at least 15 mm plus the outside nominal diameter of such portion (see figure 15 and figure 16).

8.6.3.3 Pipes installed within a cavity wall shall be securely fixed. No pipe shall pass through concrete expansion or concrete joints, unless acceptable provisions have been made to the pipework for movement.

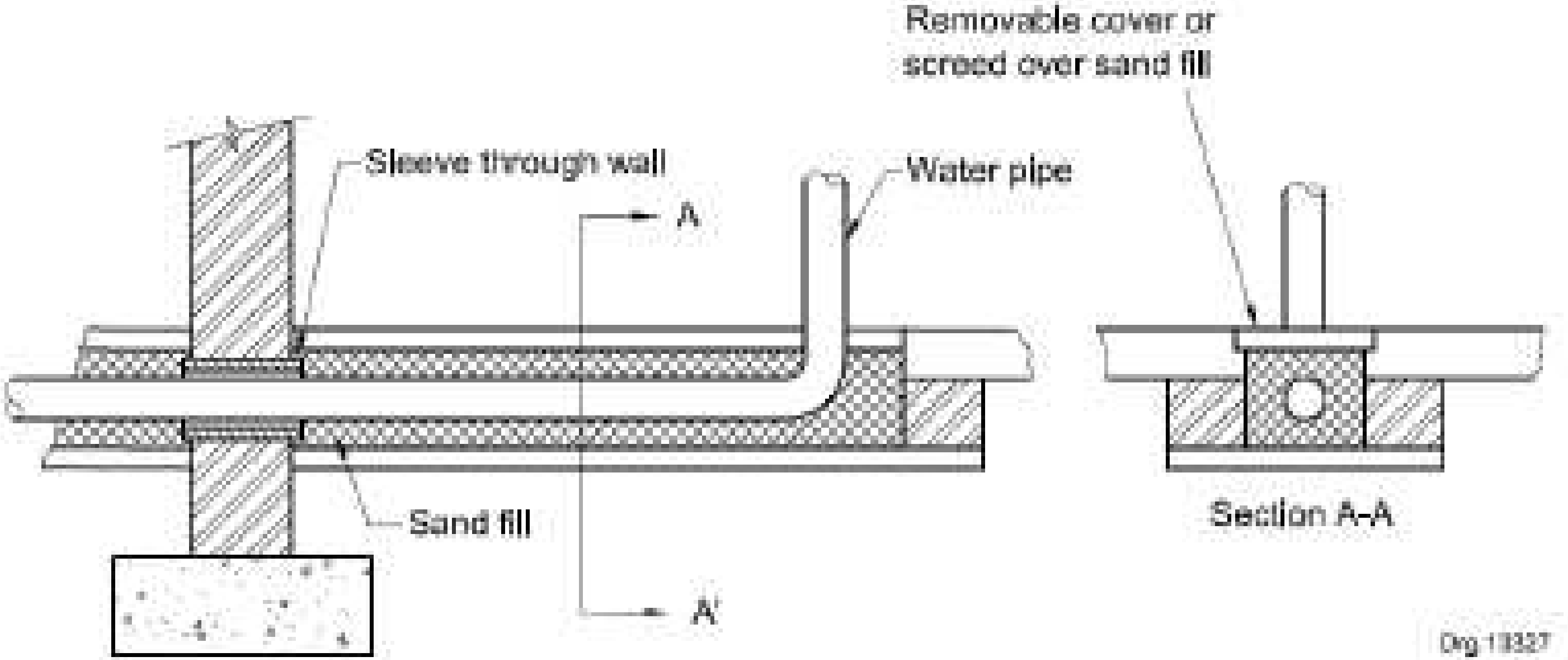


Figure 15 — Example of a duct for installing a water pipe within a surface slab or a floor

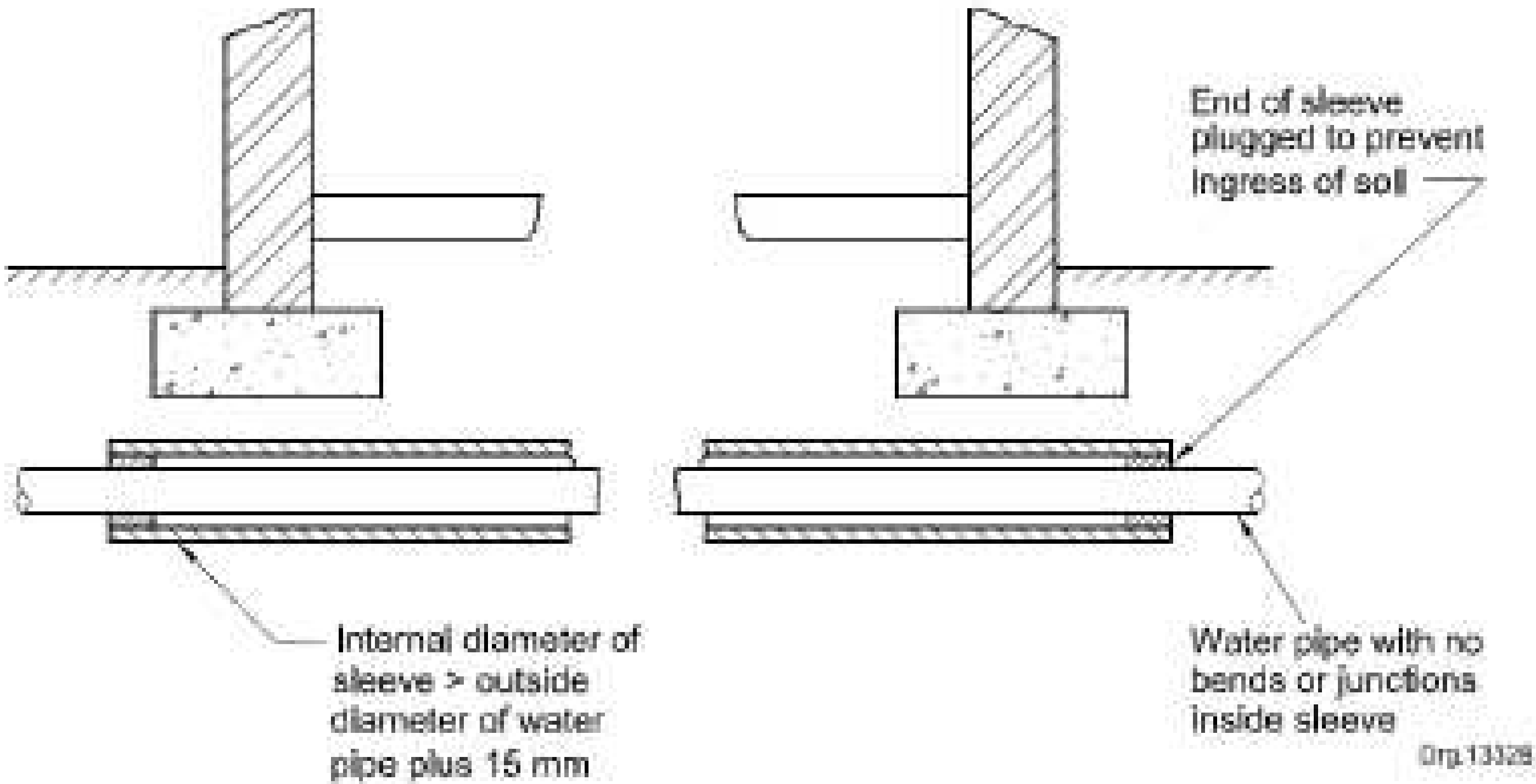


Figure 16 — Sleeve for installing a water pipe under a building or under a surface slab

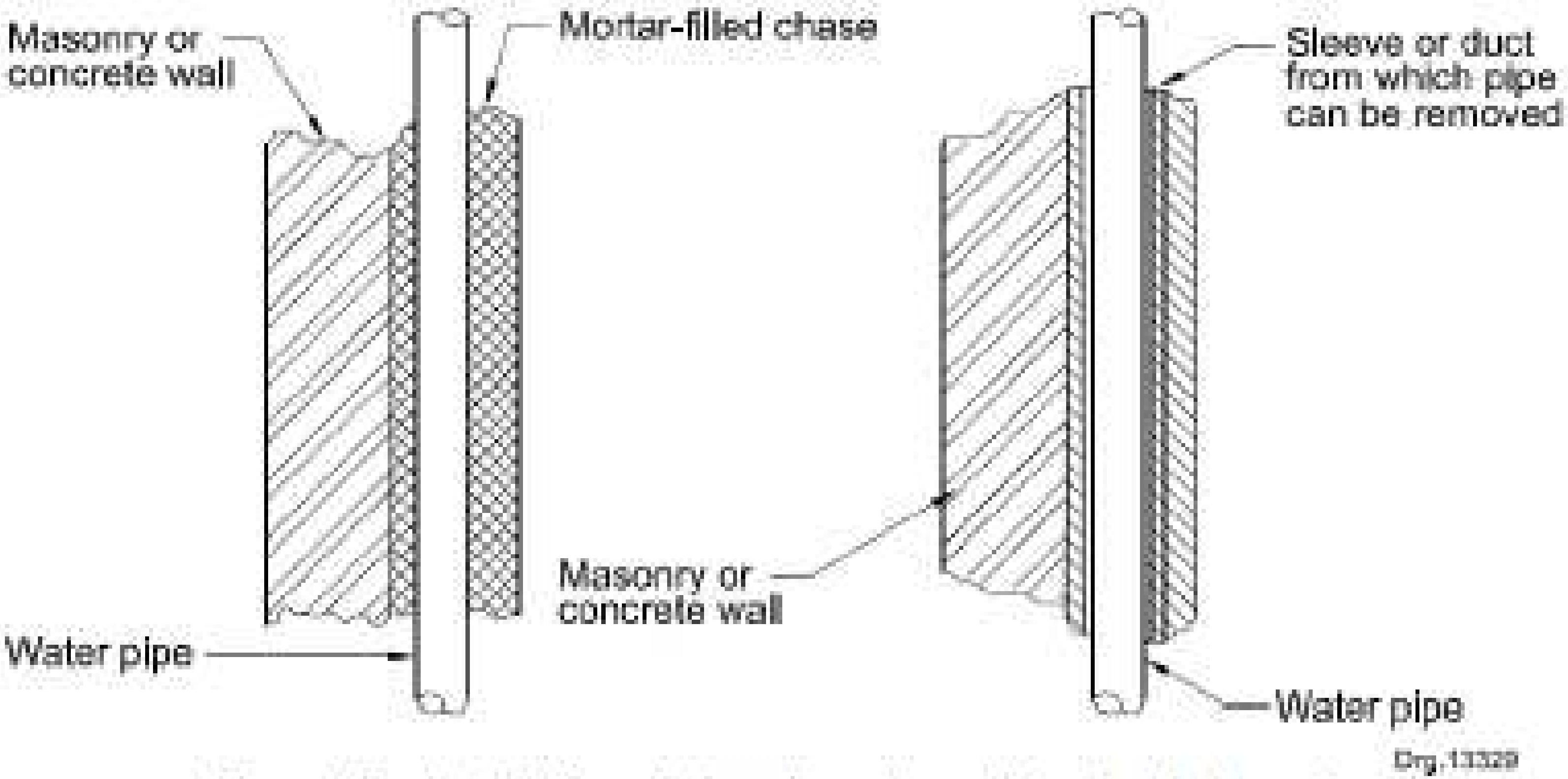


Figure 17— Installation of pipes in walls and structural elements

WATER SYSTEM:

- "Volume" is related to the number of people
- "Flow" is related to number of fixtures simultaneous use
- Size of piping relates to $Q_P = (\sum Q)^N$

4.2.2 Probable (or design) flow demand

4.2.2.1 The probable water flow demand for pipes in installations without automatic shut-off flush valves shall be calculated using the following equation:

$$Qp = (\Sigma Q)^{n}$$

Where

Qp is the probable flow demand, in litres per minute;

ΣQ is the arithmetic sum of the design flow rates of all the individual fittings supplied by the pipe (see table 3 for design flow rates), in litres per minute; and

n is a factor related to the probable simultaneous use of the fittings. Values of *n* are given in table 4.

4.2.2.2 The probable water flow demand for pipes in installations with low-pressure automatic shut-off flush valves shall be calculated using the following equation:

$$Qp = (\Sigma Q)^n + 80$$

4.2.2.3 The probable water flow demand for pipes in installations with high-pressure automatic shut-off flush valves shall be calculated using the following equation:

$$Qp = (\Sigma Q)^n + 45$$

4.2.2.4 The probable water flow demand for pipes in installations where all the fittings supplied by a pipe would probably operate simultaneously (automatic shut-off flush valves excluded) shall be calculated using the following equation:

$$Qp = \Sigma Q$$

4.2.2.5 Equation (4) can be used in all cases for the final two fittings (automatic shut-off flush valves excluded) supplied by a branch pipe. Working upstream from this branch, the calculated value of Qp shall be retained until it is replaced by a new value obtained from using equation (1), (2) or (3).

Table 3 — Flow rates from terminal water fittings

1	2	3	4	5
Sanitary fixture or fitting	Likely maximum flow rate per tap or fitting[a] L/min	Likely minimum flow rate per tap or fitting L/min	Design flow rate per tap or fitting L/min	Design flow pressure at tap or fitting for design flow rate[b] kPa
Wash-hand basin				
15 mm taps (plain outlet)	25	5	10	10
15 mm taps (aerated outlet)	12	5	8	50
Mixer (plain outlet) (hot and cold separately)	25	5	10	15
Mixing valve (aerated outlet) (hot and cold separately)	12	5	9	50
15 mm taps (public facility) (flow controlled)	6	3	4	20
Bath				
15 mm taps (plain outlet)	30	12	15	15
20 mm taps (plain outlet)	40	20	25	15
20 mm taps (aerated outlet)	20	12	12	50
Mixer (plain outlet) (hot and cold separately)	40	12	25	15
Mixing valve (aerated outlet) (hot and cold separately)	25	15	20	50

Table 3 — Flow rates from terminal water fittings

Shower (wall mounted)				
Showerhead (standard) (hot and cold combined)	30	8	15	20 – 50
Showerhead (water saving) (hot and cold combined)	12	6	10	50 – 100
Water closet[c]				
Cistern float valve		3	5	100[d]
Automatic shut-off flush valve (low-pressure pattern)	-	-	110[e]	30 - 50[g]
Automatic shut-off flush valve (high-pressure pattern)	-	-	65[f]	150 - 200[g]
Urinal				
Siphonic type (automatic shut-off flush valve)	-	-	60	30
Wash-down type (automatic shut-off flush valve)	-	-	10	50
Bidet				
Mixer or mixing valve (hot and cold separately or combined)	12	5	9	50

Table 3 — Flow rates from terminal water fittings

1	2	3	4	5
Sanitary fixture or fitting	Likely maximum flow rate per tap or fitting[a] L/min	Likely minimum flow rate per tap or fitting L/min	Design flow rate per tap or fitting L/min	Design flow pressure at tap or fitting for design flow rate[b] kPa
Sink				
15 mm taps (plain oulet)	25	6	12	15
20 mm taps (plain outlet	35	15	20	15
Mixer (plain outlet) (hot and cold separately)	25	10	15	15
Mixing valve (aerated outlet) (hot and cold separately)	12	6	10	50
Wash trough				
15 mm taps (plain outlet)	25	6	2	15
15 mm taps (aerated outlet)	12	5	8	50
20 mm taps (plain outlet)	35	10	15	15
20 mm taps (aerated outlet)	20	10	12	50
Mixer (plain outlet) (hot and cold separately)	25	10	15	15
Mixing valve (aerated outlet) (hot and cold separately)	12	6	10	50

Table 3 — Flow rates from terminal water fittings

Storage tank				
15 mm float valve (3 mm seat bore)	8	3	5	100
15 mm float valve (5 mm seat bore)	18	6	12	100
20 mm float valve (6 mm seat bore)	30	10	20	100
25 mm float valve (10 mm seat bore)	70	23	50	100
38 mm float valve (19 mm seat bore)	200	90	200	100
50 mm float valve (25 mm seat bore)	500	160	330	100
Taps				
15 mm (plain outlet)	25	6	15	15
20 mm (plain outlet)	35	10	25	15

[a] The likely maximum flow that the user of the fixture or fitting would normally allow the tap or fitting to discharge, and not necessarily the maximum flow rate attainable from the tap or fitting.

[b] Values to be used where the flow-pressure curve for the tap or fitting is not available from the manufacturer.

[c] Design flow rates for WC pans should preferably be about 120 L/min for maximum flushing efficiency.

[d] The cistern float valve can operate at lower pressures.

[e] Where a pipe supplies several low-pressure automatic shut-off flush valves, calculate the cumulative flow (Q), using the following flow rates:
1st valve 110 L/min, 2nd valve 85 L/min, 3rd valve 65 L/min, 4th valve 45 L/min, 5th valve 20 L/min, all valves thereafter 5 L/min each.

[f] Where a pipe supplies several high-pressure automatic shut-off flush valves, calculate the cumulative flow (Q), using the following flow rates:
1st valve 65 L/min, 2nd valve 55 L/min, 3rd valve 45 L/min, 4th valve 35 L/min, 5th valve 25 L/min, all valves thereafter 5 L/min each.

[g] Minimum flow pressure.

Table 3 — Flow rates from terminal water fittings

Storage tank				
15 mm float valve (3 mm seat bore)	8	3	5	100
15 mm float valve (5 mm seat bore)	18	6	12	100
20 mm float valve (6 mm seat bore)	30	10	20	100
25 mm float valve (10 mm seat bore)	70	23	50	100
38 mm float valve (19 mm seat bore)	200	90	200	100
50 mm float valve (25 mm seat bore)	500	160	330	100
Taps				
15 mm (plain outlet)	25	6	15	15
20 mm (plain outlet)	35	10	25	15

[a] The likely maximum flow that the user of the fixture or fitting would normally allow the tap or fitting to discharge, and not necessarily the maximum flow rate attainable from the tap or fitting.

[b] Values to be used where the flow-pressure curve for the tap or fitting is not available from the manufacturer.

[c] Design flow rates for WC pans should preferably be about 120 L/min for maximum flushing efficiency.

[d] The cistern float valve can operate at lower pressures.

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[f] Where a pipe supplies several high-pressure automatic shut-off flush valves, calculate the cumulative flow (Q), using the following flow rates:
1st valve 65 L/min, 2nd valve 55 L/min, 3rd valve 45 L/min, 4th valve 35 L/min, 5th valve 25 L/min, all valves thereafter 5 L/min each.

[g] Minimum flow pressure.

7.7.1.3 Unless otherwise stated, the length of an unheated pipe (dead leg) conveying water direct from a fixed water heater to a terminal water fitting, or from the point of take-off from a hot water circulating system to a terminal water fitting, shall be such that the internal volume of that pipe does not exceed 4ℓ. The internal volume of pipes and permissible lengths in terms of the 4ℓ volume limit are given in table 19 and recommended limits are given in table 20.

Table 19 — Internal volume of pipes

1	2	3	4
Type of pipe	Nominal diameter mm	Internal volume L/m	Length of pipe containing 4 L of water m
Galvanized mild steel (medium)	15 20 25 32	0,196 0,356 0,581 1,012	20,4 11,2 6,9 4,0
Copper (class O)	15 22 28 35 42 54	0,150 0,330 0,547 0,835 1,232 2,091	26,7 12,1 7,3 4,8 3,2 1,9

NOTE Apart from the volume limit, more than just the internal volume of the pipe might have to be run to waste before water of sufficient temperature emerges from the tap, since the hot water has to heat up the pipe. For example, a tap in a wash basin supplied by a 15 mm diameter galvanized mild steel pipe 12 m in length and discharging at a rate of 6 L/min, would have to run for 1 min to 2 min before the temperature of the water entering the basin is adequately hot. Thus, the volume of water run to waste would be 6 L to 12 L, whereas the actual internal volume of the pipe is only 2,4 L. The designer should therefore attempt to ensure that where practicable, the lengths of such pipes are well below those given in column 4 of this table.

Table 20 — Recommended maximum lengths of dead-leg piping from a storage heater, or from the point of take-off from a hot water circulation system to a terminal water fitting

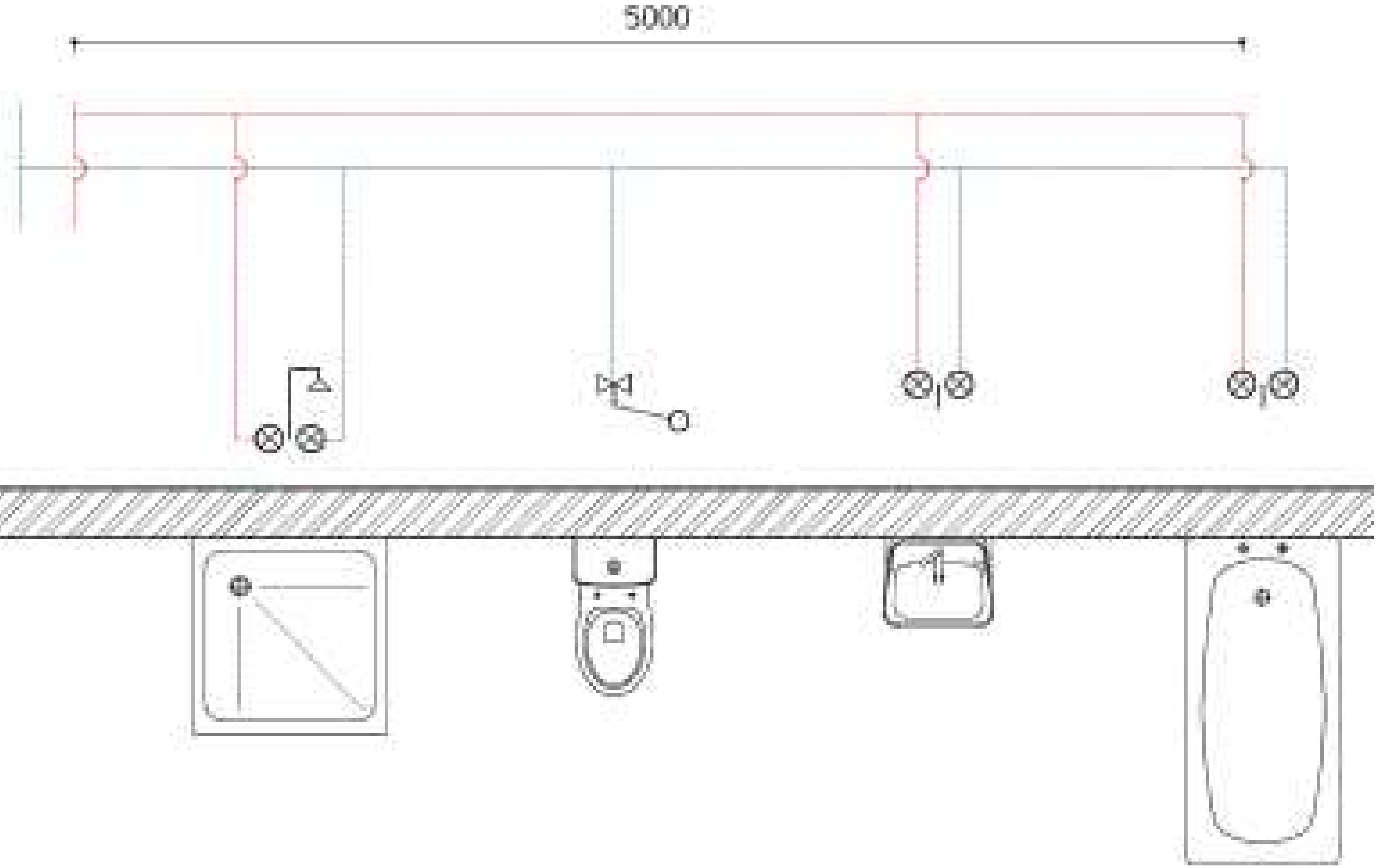
1	2
Internal diameter of pipe mm	**Maximum length of pipe** m
≤ 19 > 19 and ≤ 24 > 24	12 8 3

Table 4 — Values of n^a

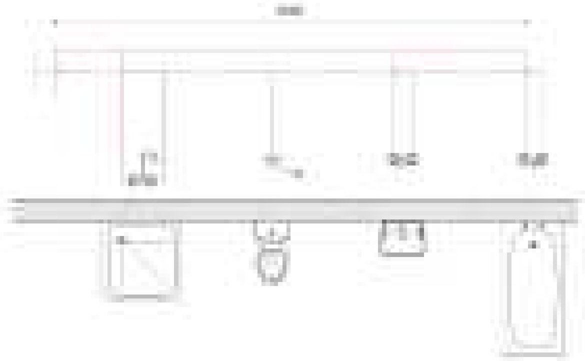
1	2
Nature of use of building	**Value of n^a**
Dwellings (economic)	0,5 – 0,70
Dwellings (low-cost)	0,5 – 0,75
Offices	0,5 – 0,70
Shops	0,5 – 0,70
Hostels	0,75 – 0,80
Public facilities	0,75 – 0,80
Kitchens	0,70 – 0,80
Hotels	0,5 – 0,75
Factory ablutions	0,75 – 0,80
Day school ablutions	0,5 – 0,80

[a] In large installations, the value of *n* adopted for the main supply pipes shall, in general, be less than that adopted for branch pipes. Where the flow exceeds 60 000 L/min, the value of *n* shall not exceed 0,7.

EXERCISE



DESIGN FLOW RATES (Table 3)



Showerhead (standard)	15ℓ/min
Cistern float valve	5ℓ/min
Wash-hand basin mixer	10ℓ/min
Bath mixer	25ℓ/min

COLD WATER

$$
\begin{aligned}
Qp &= (\Sigma Q)^n \\
&= (15 + 5 + 10 + 25)^{0.7} \\
&= 55^{0.7} \\
&= 16{,}53 \ell/\text{min}
\end{aligned}
$$

HOT WATER

$$
\begin{aligned}
Qp &= (\Sigma Q)^n \\
&= (15 + 10 + 25)^{0.7} \\
&= 50^{0.7} \\
&= 15{,}46 \ell/\text{min}
\end{aligned}
$$

The flow rate required for the bath mixer is 25ℓ/min which is more than 16,53ℓ/min or 15,46ℓ/min

Use 25ℓ/min

Go to manufacturer's data

TABLE 1 Comparison between SANS 460/0 copper tube (Cu) and Polypropylene (PP) showing bore area, percentage difference and comparative flow rates.

Nominal Tube Size (mm)	Nominal wall thickness (mm)		Bore area mass (mm2)		Copper's greater area (%)	Flow Rate (l/m) at 2.5m/sec (mm2)		Pressure drop in kpa per 10m length	
	PP	Cu	PP	Cu		PP	Cu	PP	Cu
15	1.8	0.5	102	154	50	15.5	[illegible]	88.0	55.0
22	2.7	0.6	216	346	60	32.[illegible]	52.0	[illegible]6.5	33.5
28	3.4	0.6	35.3	546	59	53.0	[illegible]	41.0	24.5

Ø22 ND Class 0 Copper

The total length of the dead leg (hot water) is less than 8m (Table 20) – less than 4ℓ of water will be wasted before water is hot at tap - therefore no HWR required.

In the case of dwelling houses, it will usually not be necessary to carry out a detailed exercise to size the pipes for the installation. For the internal hot and cold water supply systems, certain basic pipe sizes will be generally applicable.

The service pipe between the boundary and the house should be sized.

Where automatic shut-off flush valves are used in lieu of cisterns for WCs, it will be necessary to size the pipes supplying such valves.

Table F.1 — Recommended pipe sizes for in-house installations that incorporate a mains-fed of a type 3 standard water heater (see SANS 151)

1	2	3
Pipe	**Pressure rating of water heater**	
	Not exceeding 200 kPa	**Exceeding 200 kPa**[a]
	Recommended pipe size (average internal diameter)	
Branch from service pipe to water heater	Larger of 19 mm and the service pipe	Smaller of 19 mm and the service pipe
Cold water feed to first branch		
Hot water feed from water heater to first branch		
All other pipes		

[a] Pressure rating of pressure control valve controlling supply to water heater exceeds 200 kPa.

The recommended pipe sizes for installations that incorporate a storage tank and a type 3 standard water heater as given in SANS 151, are given in table F.2.

Table F.2 — Recommended pipe sizes for installations that incorporate a storage tank and vented water heater

1	2
Pipe	**Recommended pipe size** (nominal internal diameter) mm
Branch from service pipe to storage tank	13 to 19
Cold water feed from service pipe to first branch	Smaller of 19 and the service pipe size
Pipe from storage tank to water heater	19 to 21
Low-pressure cold water feed to first branch	13 to 19
Hot water feed from water heater to first branch and vent	19 to 21
All other pipes	13 to 19

Residual water pressure in our domestic water systems is determined by gravity, pipe size, elevation, water volume and distance from source.

Residual water pressure is defined as the water pressure in the line when water is flowing, as opposed to static pressure, which is the pressure of the water when it is not flowing.

In cases of domestic demand (how water gets into our home), water pressure is never static because the system is always being drawn on from somewhere.

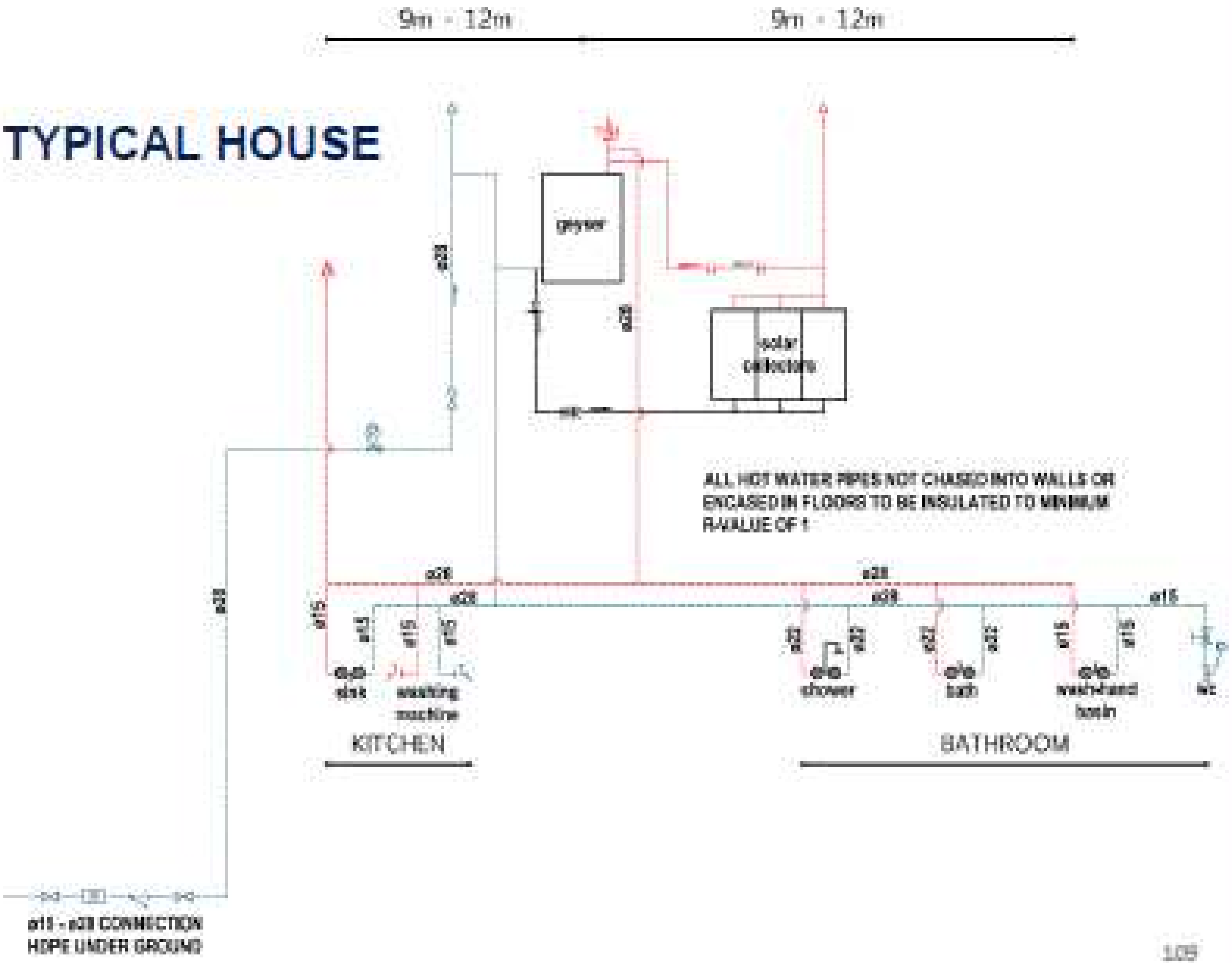
Drag and pipe friction reduces residual water pressure. This is the same as any other material traveling by another. Think about dragging your feet across the floor. It requires more effort to drag your feet across the floor than it does to lift them through the air. This is because there is less friction and drag in the air than on the solid floor.

Most domestic water supply systems use gravity to maintain water pressure and deliver water to homes. If residual water pressure is low, it could be caused by a low volume of water in the system, pipes being clogged and pipes that are too small. Pipes that are too small reduce the amount of pressure that can travel through the system. Long periods of small pipes in a system will reduce the volume of water passing through, making water pressure drop regardless of the strength of supply pressure.

Another determination of residual water pressure is elevation. It is a given that it would take more pressure to run water uphill, and the further away from the pressure source you are, the more your elevation will affect your water pressure.

1 atm (Atmosphere)	= 101 300 Pa (101.3kPa)
	= 1.013 Bar
	= 14.7 psi
	= 10.3m water
	= 760 mm Hg

TYPICAL HOUSE



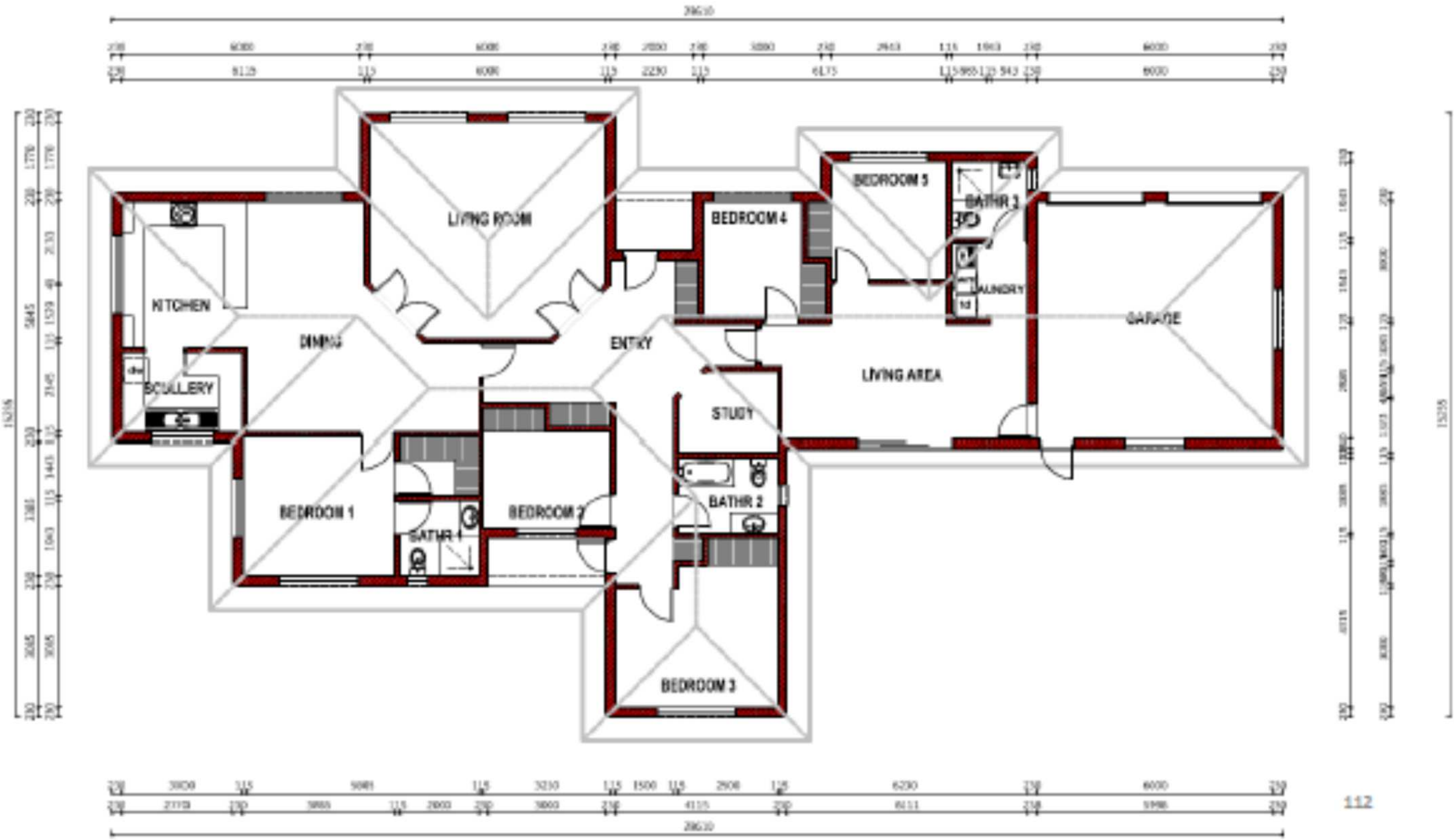
AREA	FIXTURE	STANDARD	DESIGN FLOW RATE
KITCHEN	Sink mixer plain outlet hot and cold separately	226	15
	Tap (plain outlet)	226	15
	Tap (plain outlet)	226	15
BATHROOM	Shower mixer standard	226	15
	Bath mixer standard	226	15
	Wash-hand basin mixer standard hot and cold separately	226	10
	Cistern	821	5

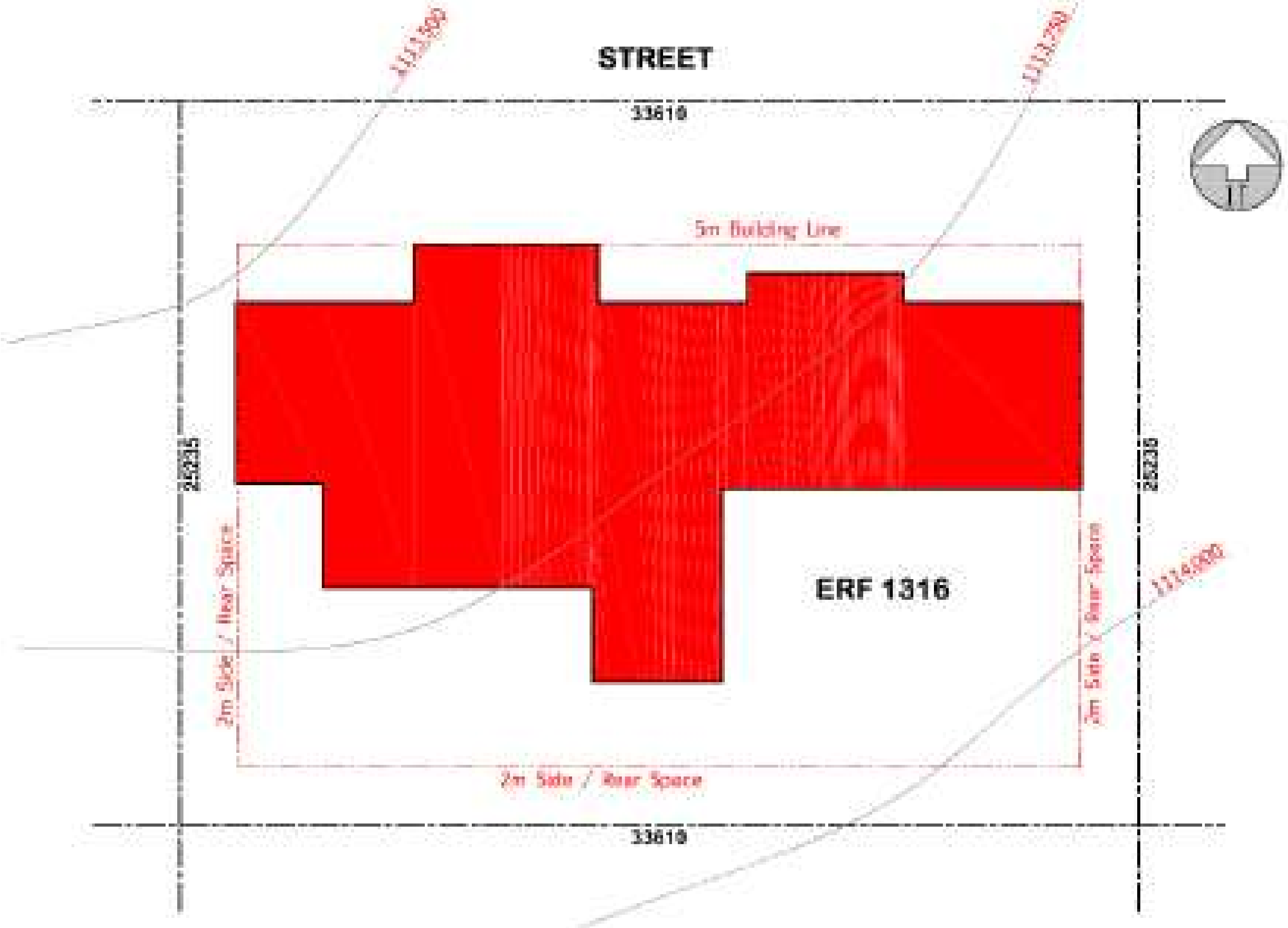
EXERCISE

Typical dwelling
- 5 bedrooms
- 3 bathrooms
- 1 kitchen
- Laundry
- Scullery

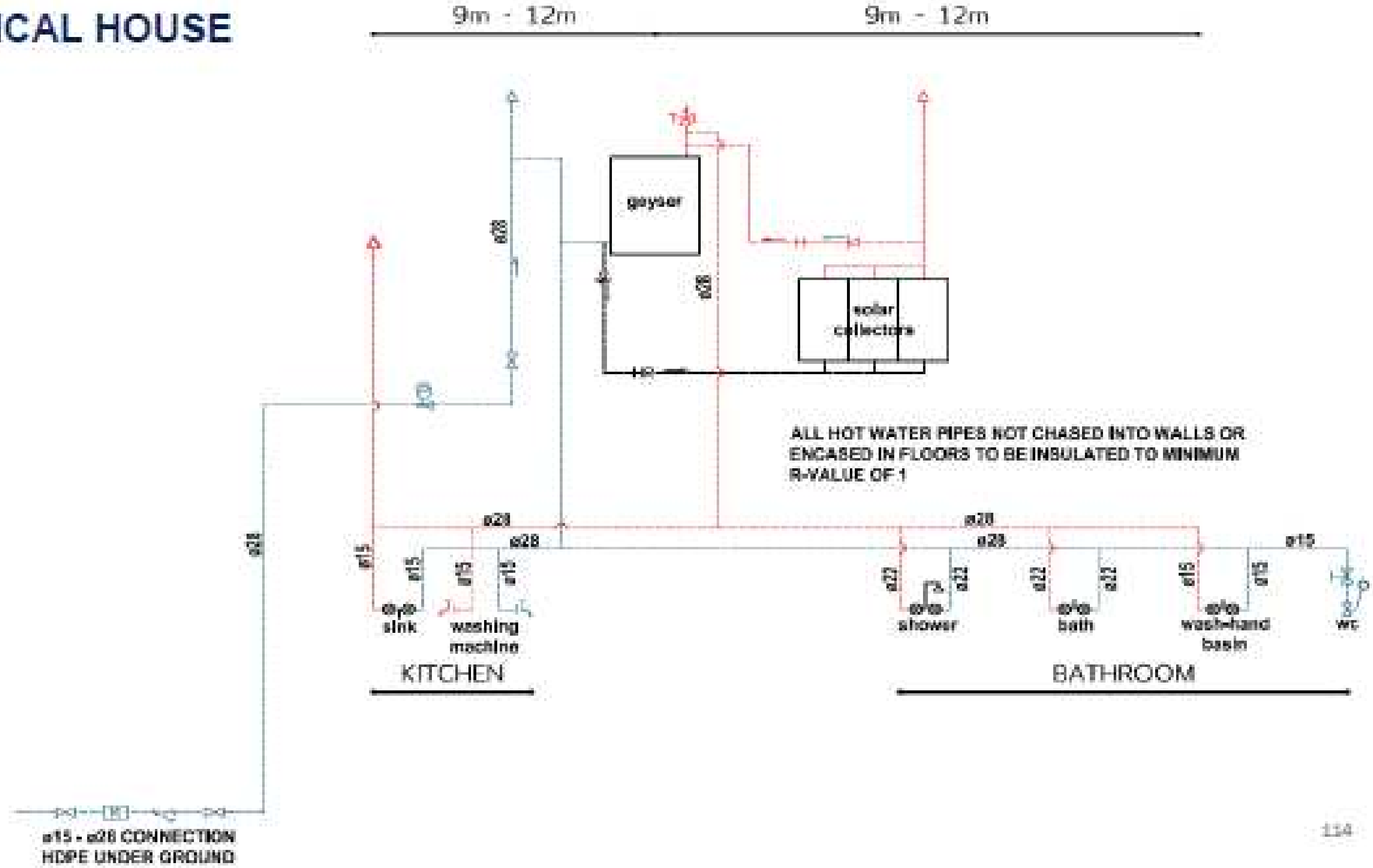
Solar geyser(s) with electrical backup element will be used.

1. Determine the capacity of the storage required for a efficient installation.
2. What will be the minimum storage capacity required to satisfy Regulation XA2?
3. Provide a schematic water reticulation layout plan.


LIVING ROOM
KITCHEN
DINING
SCULLERY
ENTRY
BEDROOM 4
BEDROOM 5
BATHR 3
LAUNDRY
GARAGE
LIVING AREA
STUDY
BATHR 2
BEDROOM 1
BEDROOM 2
BATHR 1
BEDROOM 3
28610


STREET
33610
5m Building Line
25235
25235
ERF 1316
2m Side / Rear Space
2m Side / Rear Space
2m Side / Rear Space
33610

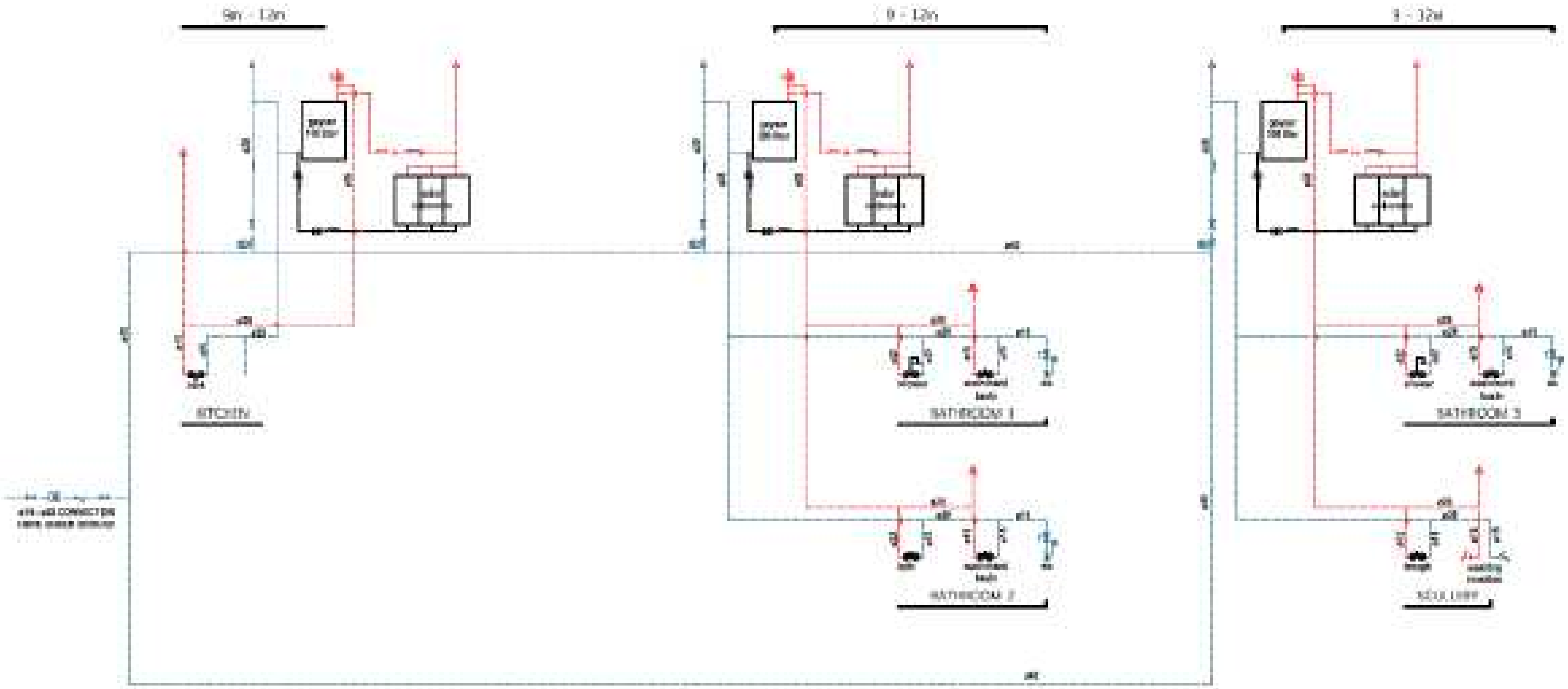
TYPICAL HOUSE

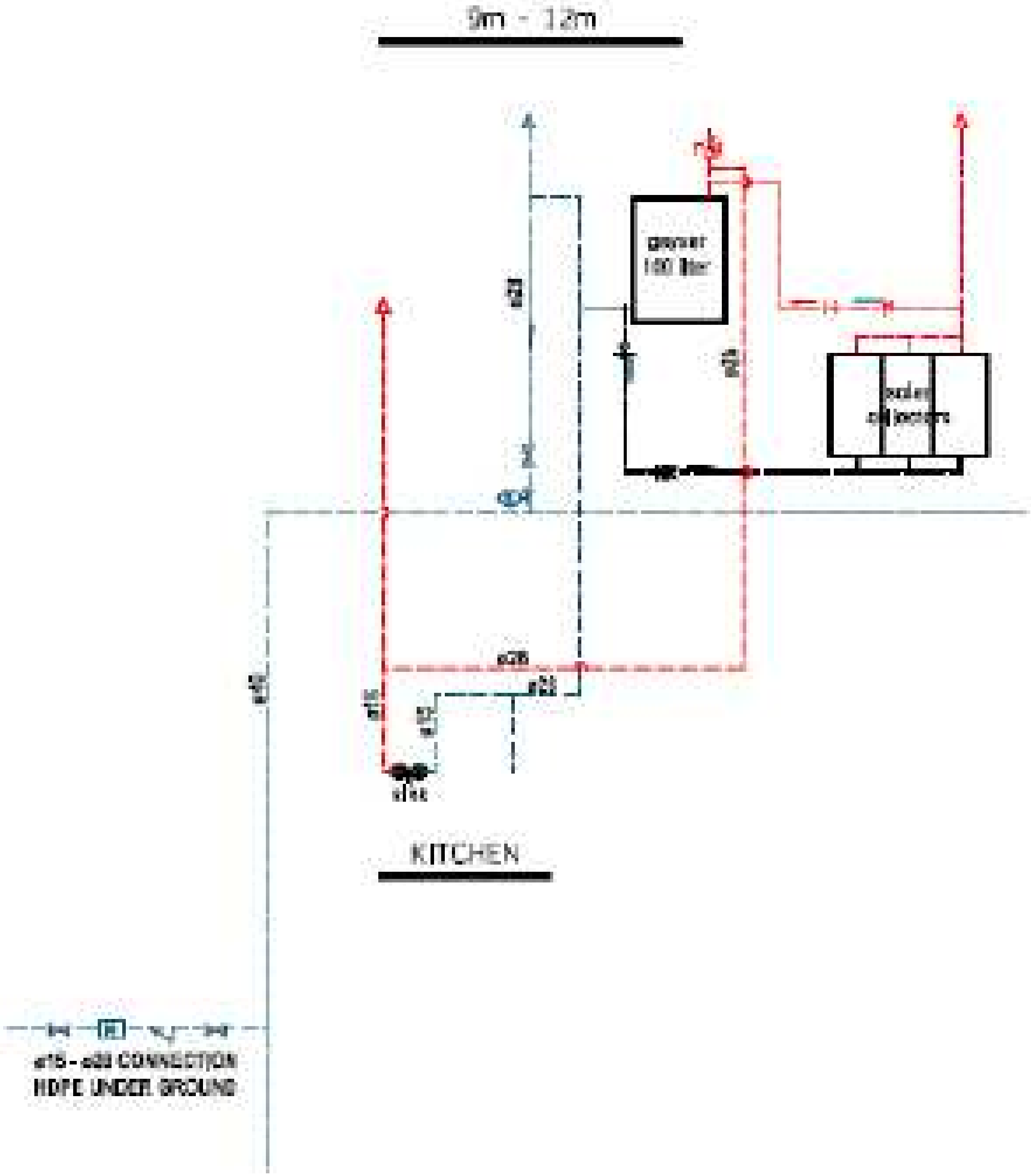


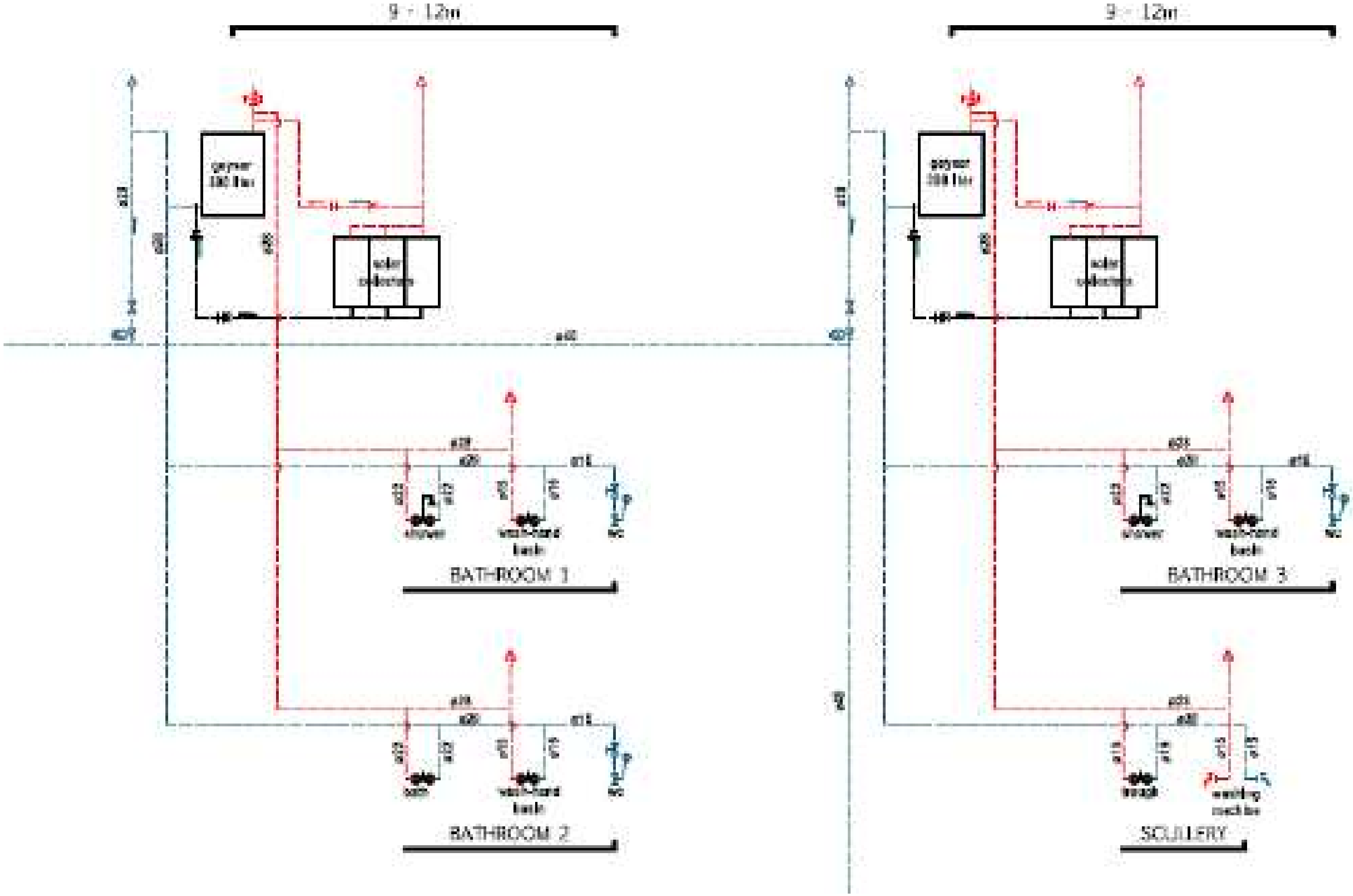
A20 Classification:	H4
A21 Occupancy:	2 persons/bedroom
Type of hot water generation:	Solar with back-up element
Hot water demand (SANS10252-1):	140ℓ per day per person
Number of Bedrooms:	5
Total demand:	5 × 2 × 140 = 1400ℓ
Hot water storage capacity required:	1400 × 50% = 700ℓ(50% XA2)
Capacity provided:	300ℓ + 300ℓ + 100ℓ

Direct Solar Water Heating System

	[illegible] Liter	[illegible] Liter	[illegible] Liter	[illegible] Liter
Cylinder Materials	Stainless steel for high pressure / temperature applications Grade 441, 1.5 mm	Stainless steel for high pressure / temperature applications Grade 441, 1.5 mm	Stainless steel for high pressure / temperature applications Grade 441, 1.5 mm	Stainless steel for high pressure / temperature applications Grade 441, 1.5 mm
Insulation	High density polyurethane	High density polyurethane	High density polyurethane	High density polyurethane
External Casing	Aluminium	Aluminium	Aluminium	Aluminium
External Cone	UV protected fibre-reinforced resin	UV protected fibre-reinforced resin	UV protected fibre-reinforced resin	UV protected fibre-reinforced resin
Backup element *	2 kW	3 kW	3 kW	4 kW
Working Pressure	400 kPa	400 kPa	400 kPa	400 kPa
Diameter	[illegible] mm	575 mm	570 mm	573 mm
Length	741 mm	1280 mm	1877 mm	2021 mm
Configuration **	Horizontal	Horizontal	Horizontal	Horizontal
Inlets / Outlets	3/4" BSP Male	3/4" BSP Male	3/4" BSP Male	3/4" BSP Male
Heat Exchanger	Nil	Nil	Nil	Nil
Weight Empty	35 Kg	50 Kg	70 Kg	100 Kg
Weight Full	[illegible] Kg	[illegible] Kg	[illegible] Kg	[illegible] Kg


KITCHEN
BATHROOM 1
BATHROOM 2
BATHROOM 3
shower
bath
washing
machine


9m - 12m
geyser
100 liter
solar collectors
KITCHEN
ø15 - ø20 CONNECTION
HDPE UNDER GROUND



9 - 12m
9 - 12m
shower
wc
BATHROOM 1
bath
wc
BATHROOM 2
shower
wc
BATHROOM 3
SCULLERY

Plumbing Certificate of Compliance
PLUMBING INDUSTRY
123456
SAMPLE
Plumbing Certificate of Compliance
123456

PLUMBING COC

- The Plumbing Industry registration Board CoC is a system and process whereby a licensed plumbing practitioner will self-certify their plumbing work by issuing of a plumbing certificate of compliance to the relevant owner, municipality, local authority and/or insurance company. Through the process the licensed plumber shall take ownership for their plumbing work and be held accountable for the said works.

- Plumbing Certificates of Compliance are issued by licensed plumbers to certify that their plumbing work complies with all regulatory installations requirements.

- A plumbing certificate of compliance will be issued for most plumbing work, including:
  - Where the total value of work, including materials, labour and VAT, is more than R1500.00 (material costs must be included, regardless of whether the materials were supplied by another person)
  - The installation, relocation or replacement of any Electric Water Heating System, regardless of the cost
  - For every separate installation on a site.

- A plumbing certificate of compliance will be issued for most plumbing work, including:
  - The construction, installation or alteration of any above or below ground sanitary drain; regardless of the cost
  - The installation, relocation or replacement of any Hot Water Solar Water Heating System
  - The installation, relocation or replacement of any Heat Pump Water Heating System

- A Plumbing certificate of compliance shall be issued to the relevant owner with five working days of the completion of the said plumbing works. Only a licensed plumber may purchase and issue compliance certificates.

- It is illegal for any person who works on plumbing installation if he/she is not a qualified plumber or not working under the adequate supervision of a qualified plumber. Registered persons under the category of qualified plumbers are qualified plumbers and may carry out plumbing works and may supervise non-qualified plumbers or plumbing learners, however they will not be allowed to purchase or issue Plumbing Certificate Compliance for plumbing installations.

WATER RETICULATION IN BUILDINGS

FIRE INSTALLATIONS

4.1 General

The functional regulation **W3** contained in part W of the National Building Regulations shall be deemed to be satisfied where

a) fire installations comply with the requirements of 4.2, 4.3, 4.4 and 4.5,

b) a supply of water is provided in each division for the effective operation of the number of hose reels, hydrants and sprinkler heads that are required in accordance with SANS 10400-T and which may be operated or come into operation simultaneously, and

c) the fire installation is either

1) the subject of a rational design prepared by a competent person (wet services) or a competent person (fire engineering) in accordance with the general principles and requirements contained in SANS 10252-1 and, if relevant, SANS 10287, or

2) in accordance with the requirements of 4.6 where the area in which the building is located is serviced by a fire brigade, contains no sprinkler system, and serves not more than three fire hydrants in a division.

4.2 Communication pipe

A fire installation shall be connected to a communication pipe provided by the local authority and located at a position and depth as determined by such local authority.

4.3 Water meter

Where so required by the local authority, provision shall be made in a fire installation for the supply and installation, by the local authority, of a water meter. Such meter and any related valve(s) shall not significantly restrict the flow of water.

4.4 Isolating valves

An isolating valve shall be fitted in a fire installation at a position that is not more than 1,5 m inside the boundary of the site, and shall be clearly marked as such.

4.5 Fire pump connections

4.5.1 In any fire installation

a) any pipe which serves any hydrant or an automatic sprinkler installation, shall be provided with a twin pumping connection; and

b) any pipe fitted with one or more fire-pump connections, unless such pipe discharges directly into a storage tank, shall be fitted with a pressure gauge reading up to 2 500 kPa and a non-return valve so located as to shut off automatically the direct supply of water from the local authority system to such installation whenever and for so long as any such fire pump connection is in use.

4.5.2 Any pumping connection shall be

a) situated in a readily accessible position outside the building at ground level,

b) mounted on the face of the building in an accessible position, and

c) clearly marked as such.

4.5.3 No non-return valve in a fire installation shall be so positioned as to prevent or hinder the flow of water from a fire-booster connection to a fire installation.

4.6 Pipework

4.6.1 In any fire installation

a) the nominal diameter of

1) a communication pipe serving such installation shall be not less than 75 mm,

2) a service pipe supplying water to a fire hydrant shall be not less than 75 mm, and

3) a service pipe supplying water to a hose reel installation shall be not less than 25mm;

b) the pressure head (*PF*), when calculated in accordance with the following formula, shall equal or exceed

1) at any hose reel within a building or any division within a building: 30 m

2) at the fire pump connection: 5 m

$$PF \geq PM - (HF - HC) - PL$$

where

PM is the static pressure head, in metres, at the juncture between the communication pipe and the service pipe, and which, unless otherwise directed by the local authority, is the minimum head measured at a point in time;

HF is the elevation of the fire pump connection or hose reel, in metres, above a common datum (see figure 1);

HC is the elevation of the communication pipe at the juncture with the service pipe, in metres, above or below, or on the same level as the common datum (see figure 1). If the elevation is below the common datum, the volume between *HF* and *HC* shall be added and not subtracted;

PL is the sum, in metres, of all the products of the length of service pipe of a particular diameter serving the fire pump connection or hose reel, and the friction factor obtained from table 1 based on the following:

a) fire hydrants: the simultaneous use of all hydrants within a division; or

b) fire hose reels: the simultaneous use of all fire hose reels within a division.

4.6.2 All fire installation pipework shall be constructed in accordance with the relevant requirements of SANS 2001-DP2 or SANS 2001-DP6 and shall have a pressure rating of not less than 1 200 kPa.

4.6.3 All fire installation pipework installed above ground or within the structure of a building shall comprise metallic pipes and suitable metallic couplings which comply with the relevant requirements of SANS 2001-DP2 or SANS 2001-DP6.

Table 1 — Friction factors associated with a particular diameter of service pipe serving a specified number of fire hydrants and fire hose reels

1	2	3	4	5	6	7	8	9	10
Nominal diameter of pipe	Friction factor for service pipes								
	Number of hose reels served by a service pipe						Number of fire hydrants served by a service pipe		
mm	1	2	3	4	5	6	1	2	3
25	0,11	0,41	0,86	1,47	2,21	3,11	*	*	*
32	0,05	0,18	0,38	0,65	0,98	1,38	*	*	*
40	0,02	0,05	0,10	0,18	0,27	0,37	*	*	*
50	0,01	0,02	0,04	0,06	0,10	0,13	*	*	*
75	0	0	0	0	0,01	0,02	0,53	1,91	4,05
100	0	0	0	0	0	0	0,11	0,39	0,83
150	0	0	0	0	0	0	0,02	0,05	0,11

* Not permitted

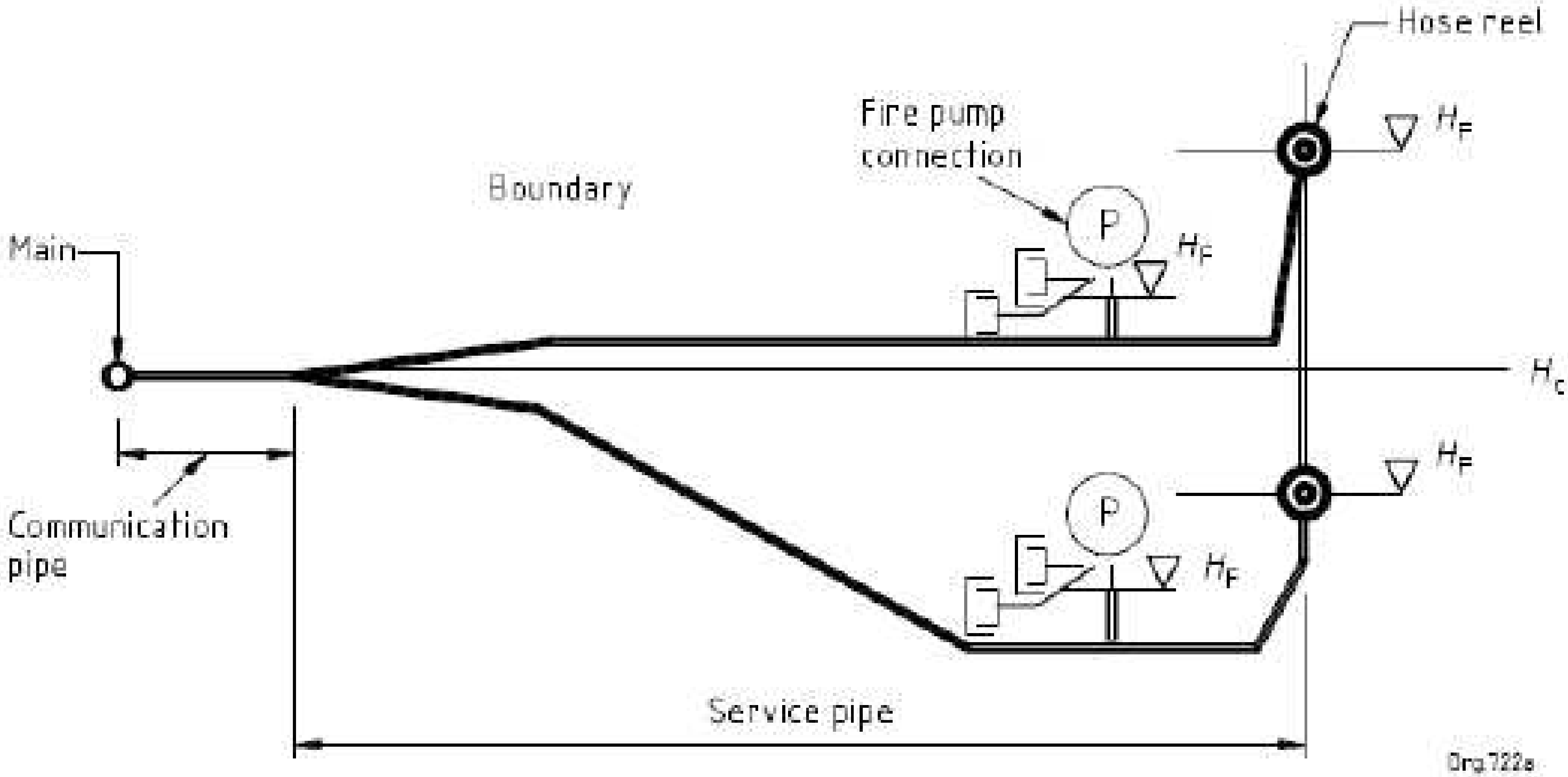


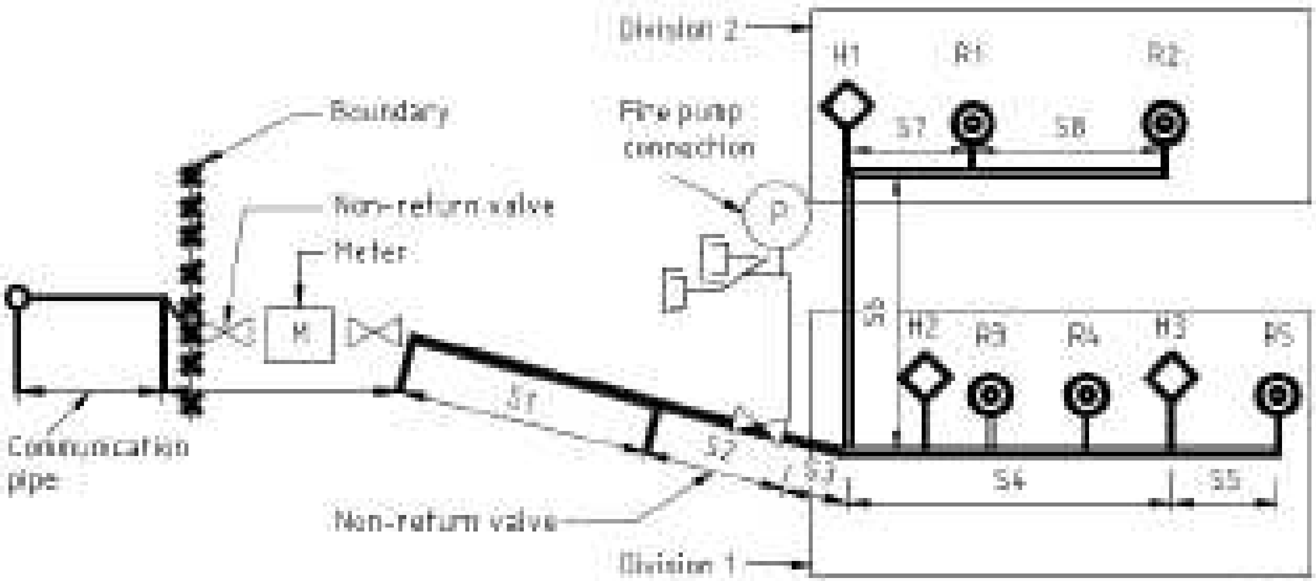
Figure 1 — Schematic layout of service pipes serving a fire pump connection of hose reel

Example of a calculation for sizing pipework

A double-storey building has two fire divisions: one with one fire hydrant and two hose reels, and the other with two fire hydrants and three hose reels.

The static head is measured as being 36 m.

The lengths of service pipes and the elevations of the various hydrants and hose reels are as shown in the figure.



Installation data

Hose reel	Relative elevation m
R1	12
R2	12
R3	7
R4	8
R5	6

Hydrant	Relative elevation m
H1	12
H2	7
H3	8

Connection	Relative elevation m
Fire pump connection	8
Service pump - communication pipe junction	10

Service pipe	Length m	Minimum pipe diameter permitted mm
S1	60	75
S2	30	75
S3	5	75
S4	30	75
S5	30	25
S6	5	75
S7	20	25
S8	10	25

	Fire hydrant
	Hose reel

Service pipe to fire pump connection

The head loss in the service pipe from the communication pipe to the fire pump connection (S1 + S2) for the maximum fire load of the two fire hydrants, is as follows for a 75 mm diameter pipe:

$PF \geq PM - (HF - HC) - PL$

$= 36 - (5 - 10) - (60 \times 1{,}91 + 30 \times 1{,}91)$

$= -130{,}9$ m

(< 5 m is unacceptable (see 4.6.1(b)))

If S1 and S2 are increased to 100mm diameter:

$PF \geq PM - (HF - HC) - PL$

$= 36 - (5 - 10) - (60 \times 0{,}39 + 30 \times 0{,}39)$

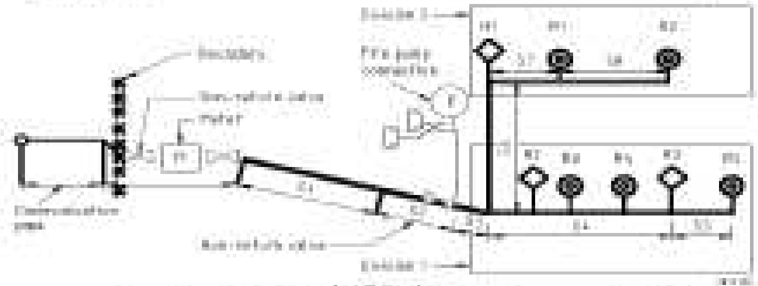
$= 5{,}9$ m

(> 5 m is acceptable (see 4.6.1(b)))

Table 1 — Friction factors associated with a particular diameter of service pipe serving a specified number of fire hydrants and fire hose reels

1	2	3	4	5	6	7	8	9	10
Nominal diameter of pipe	Friction factor for service pipes								
	Number of hose reels served by a service pipe						Number of fire hydrants served by a service pipe		
mm	1	2	3	4	5	6	1	2	3
25	0,11	0,41	[illegible]	1,42	2,21	[illegible]	*	*	*
32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	*	*
40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	*	*
50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	*	*
75	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100	0	0	0	0	0	0	[illegible]	[illegible]	[illegible]
150	0	0	0	0	0	0	[illegible]	[illegible]	[illegible]

* Not permitted.



Installation data

Hose reel	Relative elevation m
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Hydrant	Relative elevation m
H1	[illegible]
H2	[illegible]
H3	[illegible]

Connection	Relative elevation m
Fire pump connection	[illegible]
[illegible]	[illegible]

Service pipe	Length m	Minimum pipe diameter mm
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]	Fire hydrant
[illegible]	Hose reel

Service pipe from fire pump to hose reels in division 1

The head loss in service pipes from the communication pipe to hydrant H3 (S1 + S2 + S3 + S4) for three hose reels is 0 as the friction factor for 75 mm and 100 mm diameter service pipes supplying three hose reels is 0 (see table 1).

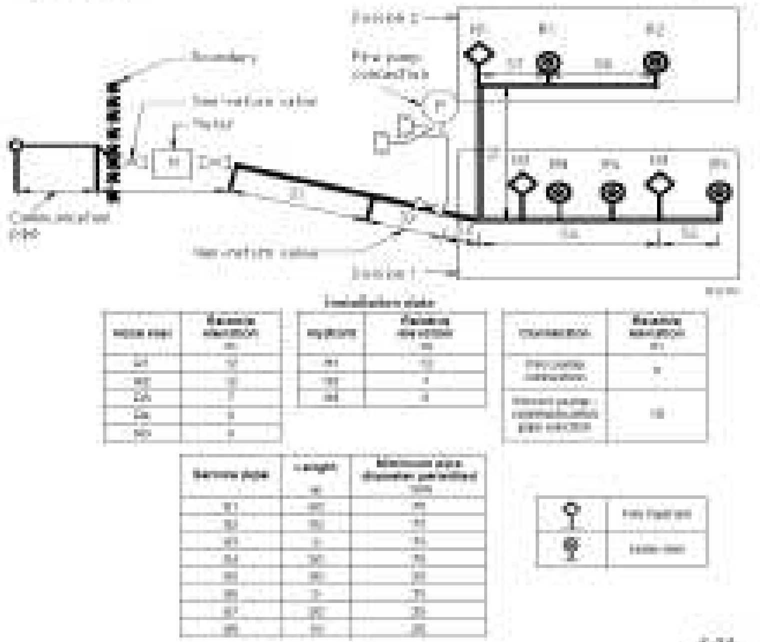
At R3: $PF \geq PM - (HF - HC) - PL$
$= 36 - (7 - 10) - 0$
$= 39$ m
(> 30 m is acceptable (see 4.6.1(b)))

At R4: $PF \geq PM - (HF - HC) - PL$
$= 36 - (6 - 10) - 0$
$= 40$ m
(> 30 m is acceptable (see 4.6.1(b)))

Table 1 — Friction factors associated with a particular diameter of service pipe serving a specified number of fire hydrants and fire hose reels

1	2	3	4	5	6	7	8	9	10
Nominal diameter of pipe	Friction factor for service pipes								
	Number of hose reels served by a service pipe						Number of fire hydrants served by a service pipe		
mm	1	2	3	4	5	6	1	2	3
25	0,11	0,41	0,85	1,47	2,21	3,1	*	*	*
32	0,03	0,13	0,36	0,63	0,96	1,36	*	*	*
40	0,02	0,05	0,12	0,18	0,27	0,37	*	*	*
50	0,01	0,02	0,04	0,06	0,10	0,13	*	*	*
75	0	0	0	0	0,01	0,02	[illegible]	[illegible]	[illegible]
100	0	0	0	0	0	0	0,11	[illegible]	[illegible]
110	0	0	0	0	0	0	[illegible]	[illegible]	0,11

* Not permitted



At R5: $PF \geq PM - (HF - HC) - PL$

$= 36 - (6 - 10) - 30 \times 0{,}11$

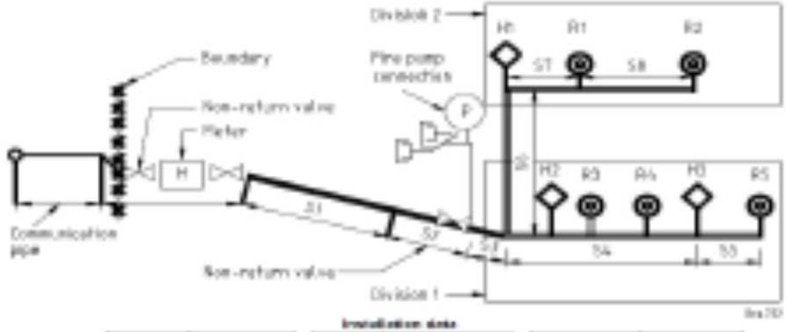
$= 36{,}7$ m

(> 30 m is acceptable (see 4.6.1(b))) (25 mm diameter pipe is acceptable and there is no need to increase the pipe size)

Table 1 — Friction factors associated with a particular diameter of service pipe serving a specified number of fire hydrants and fire hose reels

1	2	3	4	5	6	7	8	9	10
Nominal diameter of pipe	Friction factor for service pipes								
	Number of hose reels served by a service pipe						Number of fire hydrants served by a service pipe		
mm	1	2	3	4	5	6	1	2	3
25	0,11	0,41	0,86	1,47	2,21	3,11	*	*	*
32	0,05	0,18	0,38	0,65	0,98	1,38	*	*	*
40	0,02	0,09	0,10	0,18	0,27	0,37	*	*	*
50	0,01	0,03	0,04	0,06	0,10	0,13	*	*	*
75	0	0	0	0	0,01	0,02	0,53	1,91	4,05
100	0	0	0	0	0	0	0,11	0,39	0,89
150	0	0	0	0	0	0	0,02	0,05	0,11

* Not permitted



Installation data

Hose reel	Relative elevation m
R1	12
R2	12
R3	7
R4	6
R5	5

Hydrant	Relative elevation m
H1	12
H2	7
H3	6

Connection	Relative elevation m
Fire pump connection	6
Service pump - communication pipe junction	16

Service pipe	Length m	Minimum pipe diameter permitted mm
S1	65	75
S2	35	75
S3	6	75
S4	55	75
S5	35	25
S6	6	75
S7	25	25
S8	16	25

Service pipe from fire pump to hose reels in division 2

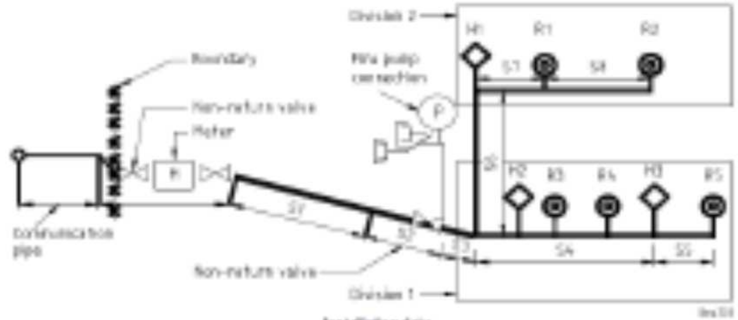
The head loss in service pipes from the communication pipe to hydrant H3 (S1 + S2 + S3 + S6) for two hose reels is 0 as the friction factor for 75 mm and 100 mm diameter service pipes supplying two hose reels is 0 (see table 1).

At R1: $PF \geq PM - (HF - HC) - PL$
$= 36 - (12 - 10) - 20 \times 0{,}41$
$= 25{,}8$ m
(< 30 m is unacceptable (see 4.6.1(b)))

Table 1 — Friction factors associated with a particular diameter of service pipe serving a specified number of fire hydrants and fire hose reels

1	2	3	4	5	6	7	8	9	10
Nominal diameter of pipe	Friction factor for service pipes								
	Number of hose reels served by a service pipe						Number of fire hydrants served by a service pipe		
mm	1	2	3	4	5	6	1	2	3
25	0,11	0,41	0,88	1,47	2,21	3,11	*	*	*
32	0,05	0,16	0,38	0,65	0,98	1,36	*	*	*
40	0,02	0,05	0,10	0,16	0,27	0,37	*	*	*
50	0,01	0,02	0,04	0,06	0,10	0,15	*	*	*
75	0	0	0	0	0,01	0,02	0,53	1,91	4,28
100	0	0	0	0	0	0	0,11	0,39	0,83
150	0	0	0	0	0	0	0,02	0,05	0,11

* Not permitted



Installation data

Hose reel	Relative elevation m
R1	12
R2	12
R3	7
R4	6
R5	6

Hydrant	Relative elevation m
H1	12
H2	7
H3	6

Connection	Relative elevation m
Fire pump connection	5
Service pump – communication pipe junction	[illegible]

Service pipe	Length m	Minimum pipe diameter permitted mm
S1	60	75
S2	30	75
S3	4	75
S4	56	75
S5	56	25
S6	3	75
S7	26	25
S8	10	25

(symbol)	Fire hydrant
(symbol)	Hose reel

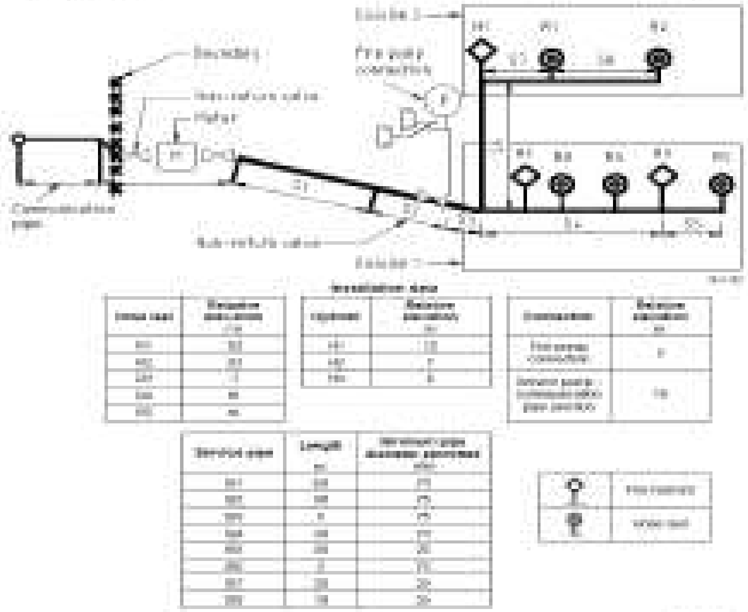
Therefore, if *S7* is increased to 40 mm diameter:

At R1: $PF \geq PM - (HF - HC) - PL$
$= 36 - (12 - 10) - 20 \times 0{,}05$
$= 33$ m
(> 30 m is acceptable (see 4.6.1(b)))

At R2: $PF \geq PM - (HF - HC) - PL$
$= 36 - (12 - 10) - (20 \times 0{,}05 + 10 \times 0{,}11)$
$= 31{,}9$ m
(> 30 m is acceptable (see 4.6.1(b)))
(25 mm diameter pipe is acceptable
and there is no need to increase the pipe size)

Table 1 — Friction factors associated with a particular diameter of service pipe serving a specified number of fire hydrants and fire hose reels

1	2	3	4	5	6	7	8	9	10
Nominal diameter of pipe	Friction factor for service pipes								
	Number of hose reels served by a service pipe						Number of fire hydrants served by a service pipe		
mm	1	2	3	4	5	6	1	2	3
25	0,11	0,41	[illegible]	1,47	2,21	[illegible]	*	*	*
32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	*	*
40	[illegible]	[illegible]	[illegible]	[illegible]	0,27	[illegible]	*	*	*
50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	*	*	*
75	0	0	0	0	0,01	[illegible]	[illegible]	[illegible]	[illegible]
100	0	0	0	0	0	0	[illegible]	[illegible]	[illegible]
150	0	0	0	0	0	0	[illegible]	[illegible]	[illegible]
* Not permitted									



Summary

The pipe sizes in the table are required.

1	2	3
Service pipe	**Length** m	**Pipe diameter** mm
S1	60	100
S2	30	100
S3	5	75
S4	30	75
S5	30	25
S6	5	75
S7	20	40
S8	10	25