



TDR124/2025/2026

THE INSTALLATION, STRIP, REPAIR AND MAINTENANCE OF IRRIGATIONS SYSTEMS FOR MOSSEL BAY MUNICIPALITY

CLOSING DATE: 27 MARCH 2026	CLOSING TIME: 12:00
NAME OF BIDDER*	
TRADING NAME* (if applicable)	
ADDRESS*	
TELEPHONE NUMBER*	
CELLPHONE NUMBER*	
E-MAIL ADDRESS*	
CENTRAL SUPPLIER DATABASE REGISTRATION NR*	
B-BBEE LEVEL OF CONTRIBUTION*	
LOCALITY (Municipal Area/Province where Business is Located) *	
CIDB REGISTRATION NR* (if applicable)	
TENDER AMOUNT (VAT included) *	See pages 32-33

(* - TO BE COMPLETED BY BIDDER)

Prepared by:
Mossel Bay Municipality
PO Box 25
Mossel Bay
6500

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SECTION 1.1: INVITATION TO TENDER

CLOSING TIME: 12:00

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TDR124/2025/2026: THE INSTALLATION, STRIP, REPAIR AND MAINTENANCE OF IRRIGATIONS SYSTEMS FOR MOSSEL BAY MUNICIPALITY

Tenders are hereby invited from contractors with a CIDB grading of 1SH for the installation, strip, repair and maintenance of irrigations systems for Mossel Bay Municipality for Mossel Bay Municipality for a period of three (3) years from ending 1 July 2026 up to 30 June 2029.

Tenders must be submitted on the original documents and remain valid for one hundred and twenty (120) days after the closing date of the tender. Enquiries pertaining to the specifications can be addressed to Mr. Leighton Lawak at telephone (044) 606-5000 or e-mail at llawak@mosselbay.gov.za. Enquiries pertaining to the completion of the documents can be addressed to Mr Deslin Kohler who may be contacted at telephone (044) 606-5192 or e-mail at dkohler@mosselbay.gov.za.

A set of tender documents can be obtained at a non-refundable cost of R264.00 per set from Mr Deslin Kohler who may be contacted at telephone (044) 606-5192 or e-mail at dkohler@mosselbay.gov.za **OR** it can be obtained on our website at www.mosselbay.gov.za free of charge. If you require a hard copy of the tender document, payments must be made at the cashiers at the **Mossel Bay Municipality's Main Building, 101 Marsh Street on the Lower Ground Floor (seaside) or EFT (Banking details and Reference Nr can be obtained from esnyders@mosselbay.gov.za)**, prior to collecting and proof of payment must be provided when collecting the tender document from the Supply Chain Management Offices, 101 Marsh Street, Mossel Bay.

Fully completed tender documents must be placed in a sealed envelope and placed in the **tender box at the Entrance of the Mossel Bay Town Hall, 101 Marsh Street, Mossel Bay by not later than 12h00 on Friday, 27 MARCH 2026** or be posted to reach the **Tender Box, Mossel Bay Municipality, Mossel Bay, 6500** before the specified closing date and time. The envelopes must be endorsed clearly with the number, title and closing date of the tender as above.

The tender is subject to functionality criteria.

Bids will be pre-evaluated on the following functionality criteria and bids that score less than 50 out of 60 points will be considered as non-responsive:

Functionality criteria and weight:

1. Company (or JV) Experience carrying a weight of 45 points.
2. References related to experience carrying a weight of 15 points.

Responsive bids will be evaluated on the 80/20 or 90/10 Preference Points System. A maximum of 20 points (80/20 preference point system) or 10 points (90/10 preference point system) will be allocated for specific goals. 50% of the 20/10 points will be allocated in terms of a bidder's B-BBEE scorecard and other 50% of the 20/10 points will be for a bidder's locality.

The tender box will be emptied just after 12h00 on the closing date as above, hereafter all bids will be opened in public. Late tenders or tenders submitted by e-mail or fax will under no circumstances be accepted.

The Municipality reserves the right to withdraw any invitation to tender and/or to re-advertise or to reject any tender or to accept a part of it. The Municipality does not bind itself to accepting the lowest tender or award a contract to the bidder scoring the highest number of points.

It is expected of all Bidders who are not yet registered on the Central Supplier Database to register without delay on the prescribed form. The Municipality reserves the right not to award tenders to Bidders who are not registered on the Database.

**MR C PUREN
MUNICIPAL MANAGER**

SECTION 1.2: TENDER CONDITIONS AND INFORMATION

1.2.1 General and Special Conditions of Contract

The General Conditions of Contract (GCC) available on the National Treasury website <http://www.treasury.gov.za/divisions/ocpo/sc/GeneralConditions/> will be applicable to this tender as well as Special Conditions of Contract (SCC) (if applicable) forming part of this set of tender documents in addition to the conditions and information. Where the GCC and SCC are in conflict with one another, the stipulations of the SCC will prevail.

1.2.2 Acceptance or Rejection of a Tender

The Municipality reserves the right to withdraw any invitation to tender and/or to re-advertise or to reject any tender or to accept a part of it. The Municipality does not bind itself to accepting the lowest tender or the tender scoring the highest points.

1.2.3 Validity Period

Bids shall remain valid for one hundred and twenty (120) days after the tender closure date.

1.2.4 Cost of Tender Documents

A set of tender documents can be obtained at a non-refundable cost of R264.00 per set from Mr Deslin Kohler who may be contacted at telephone (044) 606-5192 or e-mail at dkohler@mosselbay.gov.za OR it can be obtained on our website at www.mosselbay.gov.za free of charge. If you require a hard copy of the bid document, payments must be made at the cashiers at the **Mossel Bay Municipality's Main Building, 101 Marsh Street on the Lower Ground Floor (seaside) or EFT (Banking details and Reference Nr can be obtained from esnyders@mosselbay.gov.za**), prior to collecting and proof of payment must be provided when collecting the bid document from the Supply Chain Management Offices, 101 Marsh Street, Mossel Bay.

1.2.5 Registration on the Central Supplier Database

It is expected of all prospective service providers who are not yet registered on the Central Supplier Database to register without delay on the prescribed form. The Municipality reserves the right not to award tenders to prospective suppliers who are not registered on this Database.

1.2.6 Completion of Tender Documents

- (a) The original tender document must be fully completed and originally signed in black ink and signed by the authorised signatory to validate the tender. Section 5: DECLARATION must be completed and signed by the authorised signatory and returned. Failure to do so will result in the disqualification of the tender and will not be evaluated.
- (b) Tender documents may not be retyped. Retyped documents will result in the disqualification of the tender and will not be evaluated.
- (c) The complete original tender document must be returned. Missing pages will result in the disqualification of the tender and will not be evaluated.

- (d) No unauthorised alteration of this set of tender documents will be allowed. Any unauthorised alteration will disqualify the tender automatically. Any ambiguity has to be cleared with contact person for the tender before the tender closure.
- (e) The tender document as provided by the Municipality's Supply Chain Management Section will be the prevailing document in the event of an inconsistency between the completed submitted tender document by a bidder and the tender document provided by the Municipality.

1.2.7 Compulsory Documentation

1.2.7.1 Tax Clearance Certificate

- (a) A copy of a Tax Compliance Status Pin, printed from the South African Revenue Service (SARS) website, must accompany the bid documents. The onus is on the bidder to ensure that their tax matters with SARS are in order.
- (b) In the case of a Consortium/Joint Venture every member must submit a separate Tax Compliance Status Pin, printed from the SARS website, with the bid documents.
- (c) If a bid is not supported by a Tax Compliance Status Pin as an attachment to the bid documents, the Municipality reserves the right to obtain such documents after the closing date to verify that the bidder's tax matters are in order. If no such document can be obtained within a period as specified by the Municipality, the bid will be disqualified.
- (d) The Tax Compliance Status Pin will be verified by the Municipality on the SARS website.

1.2.8 Other Documentation

1.2.8.1 Construction Industry Development Board (CIDB) (If applicable)

When applicable, the bidder's CIDB registration number must be included with the tender. The Municipality will verify the bidder's CIDB registration during the evaluation process.

- (a) The conditions of tender are the Standard Conditions of Tender as contained in Annexure F of the CIDB Standard of Uniformity in Construction in Procurement (May 2010) as published in Government Gazette No 31823, Board Notice 11 of 2009 of 30 January 2009. (See www.cidb.org.za)
- (b) Only those tenderers who are registered with the CIDB or are capable of being so prior to the evaluation of submissions, in a contractor grading designation equal to or higher than the contractor grading designation determined in accordance with the sum tendered, or a value determined in accordance with Regulation 25 (1B) or 25 (7A) of the Construction Industry Development Regulations, for a **1 SH** or higher class of construction work, are eligible to have their tenders evaluated.
- (c) Joint Ventures are eligible to submit tenders provided that.
 - Every member of the joint venture is registered with the CIDB.
 - The lead partner has a contractor grading designation in the **1 SH** or higher class of construction work; and
- (d) The combined contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal or higher than a contractor grading designation determined in accordance with the sum tendered for a **1 SH** or higher class of construction work or a value determined in accordance with Regulation 25 (1B) or 25 (7A) of the Construction Industry Development Regulations.

Tender offers will only be accepted if:

- (e) The Bidder is registered with the Construction Industry Development Board (CIDB) in the appropriate CIDB Contractor grading designation before the tender closing date/time.
- (f) The Bidder or any of its directors is not listed in the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business with the public sector.
- (g) The Bidder has not:
 - (i) Abused the Employer's Supply Chain Management System; or
 - (ii) Failed to perform on any previous contract and has been given a written notice to this effect.
- (h) The Bidder has completed the Compulsory Enterprise Questionnaire and there are no conflicts of interest which may impact on the bidder's ability to perform the contract in the best interests of the Employer or potentially compromise the tender process and persons in the employ of the State are permitted to submit bids or participate in the contract.
- (i) The Bidder is registered and in good standing with the compensation fund or with licensed compensation insurer.
- (j) The Employer is reasonably satisfied that the bidder has in terms of the Construction Regulations, 2014, issued in terms of the Occupational Health and Safety Act, 1993, the necessary competencies and resources to carry out the work safely.

1.2.8.2 Municipal Rates, Taxes and Charges

- (a) A copy of the bidder's and those of its director's/members municipal accounts (for the Municipality where the bidder and its director's/members pay their account) for the month preceding the tender closure date must accompany the tender documents. If such a copy does not accompany the bid document of the successful bidder, the Municipality reserves the right to obtain such documents after the closing date to verify that their municipal accounts are in order.
- (b) Any bidder which is or whose directors are in arrears with their municipal rates and taxes or municipal charges due to any Municipality or any of its entities for more than three months and have not made an arrangement for settlement of same before the bid closure date will be unsuccessful. The arrangement for settlement for the outstanding amount (which were done before the closing date of the bid), must also be submitted with the tender document.
- (c) If a bidder and its director's/members rent their premises, the current lease agreement must be submitted with the tender document, which indicates that the rental includes their municipal rates and taxes. If the lease agreement indicates that the bidder or its director's/members are responsible to pay the municipal rates and taxes, the Municipal Account of the leased premises indicated must also be submitted.
- (d) If a bidder and its director's/members, do not own any property, they must submit the following:
 - (i) Affidavit from the bidder and its director's/members, that they do not own any property;
 - (ii) Affidavit from the owner of the property where business is situated/director's/members reside, that the bidder and its director's/members are not liable for the municipal rates and taxes.
- (e) If a bidder or its director's/members, lives outside of South Africa, an affidavit by the Company must be submitted.

1.2.9 Authorised Signatory

- (a) A copy of the recorded Resolution taken by the Board of Directors, members, partners or trustees authorising the representative to submit this bid on the bidder's behalf must be attached to the Bid Document on submission of same.
- (b) A bid shall be eligible for consideration only if it bears the signature of the bidder or of some person

duly and lawfully authorised to sign it for and on behalf of the bidder.

- (c) If such a copy of the Resolution does not accompany the bid document of the successful bidder, the Municipality reserves the right to obtain such document after the closing date to verify that the signatory is in order. If no such document can be obtained within a period as specified by the Municipality, the bid will be disqualified and will not be evaluated.
- (d) If a bidder is a sole proprietor, no such documentation is required, provided that the document was completed and signed by the owner.

1.2.10 Site / Information Meetings

- (a) Site or information meetings, if specified (in the advert), are **compulsory**. Bids will not be accepted from bidders who have not attended the compulsory site or information or online briefing meetings. Bidders that arrive or log in 15 minutes or more after the advertised time the meeting starts will not be allowed to attend the meeting or to sign the attendance register. If a bidder is delayed/have connection problems, he/she must inform the contact person before the meeting commence and will only be allowed to attend the meeting if the chairperson of the meeting as well as all the other bidders attending the meeting, give permission to do so.
- (b) All bidders, including **ALL THE PARTNERS OF A JOINT VENTURE** must attend the compulsory site or information or online briefing meeting.

1.2.11 Samples

Samples, if requested, are to be provided to the Municipality with the tender document or as stipulated.

1.2.12 Quantities of Specific Items

If tenders are called for a specific number of items, the Municipality reserves the right to change the number of such items to be higher/more or lower/less. If the successful bidder does not accept the new scenario, it will be offered to the second-placed bidder.

1.2.13 Submission of Tender

- (a) The tender must be placed in a sealed envelope, or envelopes when the two-envelope system is specified, clearly marked with the tender number, title as well as closing date and time and placed in the **tender box at the Entrance of the Mossel Bay Town Hall, 101 Marsh Street, Mossel Bay Municipality by not later than 12h00 on Friday, 27 MARCH 2026.**
- (b) Faxed, e-mailed and late tenders will not be accepted. Tenders may be delivered by hand, by courier, or posted at the bidder's risk and must be received by the deadline specified above, irrespective of how they are sent or delivered.

1.2.14 Expenses Incurred in Preparation of Tender

The Municipality shall not be liable for any expenses incurred in the preparation and submission of the tender.

1.2.15 Contact with Municipality after Tender Closure Date

Bidders shall not contact the Mossel Bay Municipality on any matter relating to their bid from the time of the opening of the bid to the time the contract is awarded. If a bidder wishes to bring additional information to the

attention of the Mossel Bay Municipality, it should do so in writing to the Supply Chain Management Department of the Mossel Bay Municipality. Any effort made by the firm to influence the Mossel Bay Municipality or any official in evaluation of the bid, bid comparison or contract award decisions may result in the rejection of the bid and further action being taken.

1.2.16 Opening, Recording and Publications of Tenders Received

- (a) Tenders will be opened on the closing date immediately after the closing time specified in the tender documents. If requested by any bidder present, the names of the bidders, and if practical, the total amount of each bid and of any alternative offers will be read out aloud.
- (b) Details of tenders received in time will be recorded in a register which is open to public inspection.

1.2.17 Evaluation of Tenders

Tenders will be evaluated in terms of their responsiveness to the tender specifications and requirements as well as such additional criteria as set out in this set of tender documents.

1.2.18 Procurement Policy

Bids will be awarded in accordance with the Preferential Procurement Regulations, 2007 pertaining to the Preferential Procurement Policy Framework Act, No 5 of 2000 and its amendments as well as the prevailing Municipality's Supply Chain Management and the Municipal Preferential Procurement Policies.

1.2.19 Contract

The successful bidder will be expected to sign the agreement in Section 6 of this bid document. The signing of both Parts of Section 6 of this bid document signifies the conclusion of the contract. The Municipality, at its discretion, may request the signing of an additional Service Level Agreement which, together with the signed tender document, will constitute the full agreement between the Municipality and the successful bidder.

1.2.20 Subcontracting

- (a) The Contractor shall not subcontract the whole of the Contract.
- (b) Except where otherwise provided by the Contract, the Contractor shall not subcontract any part of the Contract without the prior written consent of the Municipality, which consent shall not be unreasonably withheld.
- (c) The contractual relationship between the Contractor and any subcontractors selected by the Contractor in consultation with the Municipality in accordance with the requirements of and a procedure contained within the Scope of Work, shall be the same as if the Contractor had appointed the subcontractor in terms of paragraph (b) above.
- (d) Any consent granted in accordance with paragraph (b) or appointment of a subcontractor in accordance with paragraph (c) shall not imply a contract between the Municipality and the subcontractor, or a responsibility or liability on the part of the Municipality to the subcontractor and shall not relieve the Contractor from any liability or obligation under the Contract and he shall be liable for the acts, defaults and neglects of any subcontractor, his agents or employees as fully as if they were the acts, defaults or neglects of the Contractor, his agents or employees.
- (e) The Contractor shall not be required to obtain such consent for –

- (i) the provision of labour, or
- (ii) the purchase of materials which are in accordance with the Contract, or
- (iii) the purchase or hire of Construction Equipment.

1.2.21 Language of Contract

The contract documents will be compiled in English and the English versions of all referred documents will be taken as applicable.

1.2.22 Extension of Contract

The Municipality reserves the right to negotiate the extension or expansion of a contract with the successful bidder should additional funds become available. This prescribed process in terms of legislation must be followed prior to any agreement being concluded and the vesting of any rights.

1.2.23 Stamp and Other Duties

The successful bidder will be liable for all duties and costs on legal documents resulting in the establishment of a contract and for the surety, guarantees and retentions.

1.2.24 Wrong Information Furnished

Where a contract has been awarded on the strength of the information furnished by the bidder which, after the conclusion of the relevant agreement, is proved to have been incorrect, the Municipality may, in addition to any other legal remedy it may have, recover from the contractor all costs, losses or damages incurred or sustained by the Municipality as a result of the award of the contract.

1.2.25 Past Practices

- (a) The bid of any bidder may be rejected if that bidder or any of its directors, principle shareholders or members have abused the municipality's supply chain management system or committed any improper conduct in relation to such system.
- (b) The bid of any bidder may be rejected if it is or has been found that that bidder or any of its directors, principle shareholders or members influenced or tried to influence any official or councillor with this or any past tender.
- (c) The bid of any bidder may be rejected if it is or has been found that that bidder or any of its directors, principle shareholders or members offered, promised or granted any official or councillor or any of the official's or councillor's close family members, partners or associates any reward, gift, favour, hospitality or any other benefit in any improper way, with this or any past bid.

1.2.26 DOCUMENTATION REQUIRED TO CLAIM POINTS FOR SPECIFIC GOALS

1.2.26.1 Proof of B-BBEE Status Level of Contributor:

- (a) A sworn affidavit as prescribed by the B-BBEE Codes of Good Practice; or
- (b) Any other requirement prescribed in terms of the Broad-Based Black Economic Empowerment Act, as indicated below:

- **If the certificate was issued by a verification agency the following must be on the face of the certificate:**

SANAS logo, unique BVA number, must be an original certificate or certified copy of the original, the name and physical location of the bidder, the registration number and, where applicable, the VAT number of the bidder, the date of issue and date of expiry of the certificate, the certificate number for identification and reference, the scorecard that was used (for example EME, QSE or Generic), the name and / or logo of the Verification Agency, the certificate must be signed by the authorized person from the Verification Agency and the B-BBEE Status Level of Contribution obtained by the bidder.

- **If certificate was issued by an Auditor/ Accounting Officers:**

The Accounting Officer's or Registered Auditor's letter head with full contact details, the Accounting Officer's or Registered Auditor's practice numbers, the name and the physical location of the bidder, the registration number and, where applicable, the VAT number of the bidder, the date of issue and date of expiry, the B-BBEE Status Level of Contribution obtained by the measured entity, the total black shareholding and total black female shareholding, the B-BBEE Status Level of Contribution obtained by the bidder and must be an original certificate or certified copy of the original.

- **If the certificate was issued by registered auditors approved by IRBA**

Clearly identify the B-BBEE approved registered auditor by the auditor's individual registration number with IRBA and the auditor's logo, clearly record an approved B-BBEE Verification Certificate identification reference in the format required by the SASAE, reflect relevant information regarding the identity and location of the measured entity, identify the Codes of Good Practice or relevant Sector Codes applied in the determination of the scores, record the weighting points (scores) attained by the measured entity for each scorecard element, where applicable, and the measured entity's overall B-BBEE Status Level of Contribution, reflect that the B-BBEE Verification Certificate and accompanying assurance report issued to the measured entity is valid for 12 months from the date of issuance and reflect both the issuance and expiry date, and the B-BBEE Status Level of Contribution obtained by the bidder and must be an original certificate or certified copy of the original.

1.2.26.2 Proof of Locality in a Specific Province, Region and Municipal Area

- (a) Points for specific goals to promote suppliers or service providers located in a province, district or municipal area / (hereafter referred to as locality).
- (b) Each tender must specify in the invitation to tender that a maximum of 50% of the 20/10 points will be allocated to promote the specific goal of locality.
- (c) Only one of the points as set out below that best describes the enterprise's locality may be awarded if applicable.

No	Requirement	Points for enterprises within Mossel Bay municipal area	Points for enterprises within Garden Route District region	Points for enterprises within the Western Cape Province and other Provinces
1	Procurement under the 80/20 preference points system where the supplier or service provider is located in:	10	6	4

2	Procurement under the 90/10 preference points system where the supplier or service provider is located in:	5	3	2
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(d) Bidders must submit one of the following in order to receive points for the abovementioned criterion.

- (i) Municipal Account of bidder's address as indicated in bid document;
- (ii) If the address as indicated in bid document is not in the name of the bidder, the latest lease agreement for this address or sworn affidavit from the registered owner of the property stating occupancy by the bidder is required.
- (iii) The business address of the bidder as indicated in the MBD6.1 of the bid document as the business premises should be established/leased prior to the advertisement date.
- (iv) Only fully operational business premises will be accepted. All vacant erven, storage units and postal addresses do not qualify as a business premises.

1.2.28 Letter of Good Standing from the Commissioner of Compensation

- (a) A valid AND relevant Letter of Good Standing from the Compensation Commissioner or a copy thereof, must accompany the bid documents.
- (b) In the case of a Consortium/Joint Venture every member must submit a separate valid AND relevant Letter of Good Standing from the Compensation Commissioner or a copy thereof with the bid documents.
- (c) If a bid is not supported by a valid AND relevant Letter of Good Standing from the Compensation Commissioner or a copy thereof, as an attachment to the bid documents, the Municipality reserves the right to obtain such document after the closing date. If no such document can be obtained within a period as specified by the Municipality, the bid will be disqualified.
- (d) If a bid is accompanied by proof of application for valid AND relevant Letter of Good Standing from the Compensation Commissioner, the original or copy thereof must be submitted on/or before the final date of award.
- (e) Should a bidder's Letter of Good Standing from the Compensation Commissioner expire during the contract period, a valid AND relevant certificate must be submitted within an agreed upon time.
- (f) The right is reserved to not award a tender if a valid AND relevant Letter of Good Standing from the Compensation Commissioner or a certified copy thereof is not submitted within the requested time.

1.2.29 Negotiations

Should the tender prices be higher than the available funds of the client, the client reserves the right to negotiate with the successful bidder to limit the work in accordance with the tender specifications in order not to exceed the available budget. These negotiations can be done prior or after the final award.

1.2.30 Joint Ventures

The Joint venture agreement must be submitted as part of the bid documents;

- (a) No amendments to Joint venture agreement may be made without the prior approval of the Municipality; if not accepted by the Municipality and the Joint Venture continues without approval it will be deemed to

be a breach of contract with the Municipality and the Municipality may exercise all legal remedies available to it.

- (b) Joint venture will only qualify for points for their B-BBEE status level as a legal entity, provided that the entity submits, together with the submission of the bid, their B-BBEE status level certificate issued in the name of the Joint venture.
- (c) Joint venture will only qualify for points for Locality as a legal entity, provided that the entity submits the address of the Lead Partner as per the Joint Venture agreement.
- (d) If the joint venture division is 50/50 the points will be allocated according to the closest address.
- (e) All members of the Joint venture must submit, with the bid documents:
 - a valid SARS tax pin, individually;
 - an agreement that clearly provides clarity of Profit and liability sharing; and
 - a resolution taken by the board of directors of the Joint venture and other information that agrees with the Joint venture agreement as detailed on pages 59-61.
- (f) For the evaluation of functionality regarding a Joint venture refer to the functionality section.

1.2.30 Enquiries

Enquiries in connection with this tender, prior to the tender closure date, may be addressed to Mr. Leighton Lawak at telephone (044) 606-5000 or e-mail at llawak@mosselbay.gov.za.

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1.3 GENERAL CONDITIONS OF CONTRACT

1. Definitions

1. The following terms shall be interpreted as indicated:

- 1.1 "Closing time" means the date and hour specified in the bidding documents for the receipt of bids.
- 1.2 "Contract" means the written agreement entered into between the purchaser and the supplier, as recorded in the contract form signed by the parties, including all attachments and appendices thereto and all documents incorporated by reference therein.
- 1.3 "Contract price" means the price payable to the supplier under the contract for the full and proper performance of his contractual obligations.
- 1.4 "Corrupt practice" means the offering, giving, receiving, or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution.
- 1.5 "Countervailing duties" are imposed in cases where an enterprise abroad is subsidized by its government and encouraged to market its products internationally.
- 1.6 "Country of origin" means the place where the goods were mined, grown or produced or from which the services are supplied. Goods are produced when, through manufacturing, processing or substantial and major assembly of components, a commercially recognized new product results that is substantially different in basic characteristics or in purpose or utility from its components.
- 1.7 "Day" means calendar day.
- 1.8 "Delivery" means delivery in compliance of the conditions of the contract or order.
- 1.9 "Delivery ex stock" means immediate delivery directly from stock actually on hand.
- 1.10 "Delivery into consignees store or to his site" means delivered and unloaded in the specified store or depot or on the specified site in compliance with the conditions of the contract or order, the supplier bearing all risks and charges involved until the goods are so delivered and a valid receipt is obtained.
- 1.11 "Dumping" occurs when a private enterprise abroad market its goods on own initiative in the RSA at lower prices than that of the country of origin and which have the potential to harm the local industries in the RSA.
- 1.12 "Force majeure" means an event beyond the control of the supplier and not involving the supplier's fault or negligence and not foreseeable. Such events may include, but is not restricted to, acts of the purchaser in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and freight embargoes.
- 1.13 "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of any bidder, and includes collusive practice among bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the bidder of the benefits of free and open competition.
- 1.14 "GCC" means the General Conditions of Contract.
- 1.15 "Goods" means all of the equipment, machinery, and/or other materials that the supplier is required to supply to the purchaser under the contract.
- 1.16 "Imported content" means that portion of the bidding price represented by the cost of components, parts or materials which have been or are still to be imported (whether by the supplier or his subcontractors) and which costs are inclusive of the costs abroad, plus freight and other direct importation costs such as landing costs, dock dues, import duty, sales duty or other similar tax or duty at the South African place of entry as well as transportation and handling charges to the factory in the Republic where the goods covered by the bid will be manufactured.
- 1.17 "Local content" means that portion of the bidding price, which is not included in the imported content provided that local manufacture does take place.
- 1.18 "Manufacture" means the production of products in a factory using labour, materials, components and machinery and includes other related value-adding activities.
- 1.19 "Order" means an official written order issued for the supply of goods or works or the rendering of a service.
- 1.20 "Project site," where applicable, means the place indicated in bidding documents.
- 1.21 "Purchaser" means the organization purchasing the goods.
- 1.22 "Republic" means the Republic of South Africa.
- 1.23 "SCC" means the Special Conditions of Contract.
- 1.24 "Services" means those functional services ancillary to the supply of the goods, such as transportation and any other incidental services, such as installation, commissioning, provision of technical assistance, training, catering, gardening, security, maintenance and other such obligations of the supplier covered under the contract.
- 1.25 "Supplier" means the successful bidder who is awarded the contract to maintain and administer the required and specified service(s) to the State.
- 1.26 "Tort" means in breach of contract.
- 1.27 "Turnkey" means a procurement process where one service provider assumes total responsibility for all aspects of the project and delivers the full end product / service required by the contract.
- 1.28 "Written" or "in writing" means hand-written in ink or any form of electronic or mechanical writing.

2. Application

- 2.1 These general conditions are applicable to all bids, contracts and orders including bids for functional and professional services (excluding professional services related to the building and construction industry), sales, hiring, letting and the granting or acquiring of rights, but excluding immovable property, unless otherwise indicated in the bidding documents.
- 2.2 Where applicable, special conditions of contract are also laid down to cover specific goods, services or works.
- 2.3 Where such special conditions of contract are in conflict with these general conditions, the special conditions shall apply.

3. General

- 3.1 Unless otherwise indicated in the bidding documents, the purchaser shall not be liable for any expense incurred in the preparation and submission of a bid. Where applicable a non-refundable fee for documents may be charged.
- 3.2 Invitations to bid are usually published in locally distributed news media and on the municipality/municipal entity website.

4. Standards

- 4.1 The goods supplied shall conform to the standards mentioned in the bidding documents and specifications.

5. Use of contract documents and information inspection

- 5.1 The supplier shall not, without the purchaser's prior written consent, disclose the contract, or any provision thereof, or any specification, plan, drawing, pattern, sample, or information furnished by or on behalf of the purchaser in connection therewith, to any person other than a person employed by the supplier in the performance of the contract. Disclosure to any such employed person shall be made in confidence and shall extend only so far as may be necessary for purposes of such performance.
- 5.2 The supplier shall not, without the purchaser's prior written consent, make use of any document or information mentioned in GCC clause 5.1 except for purposes of performing the contract.
- 5.3 Any document, other than the contract itself mentioned in GCC clause 5.1 shall remain the property of the purchaser and shall be returned (all copies) to the purchaser on completion of the supplier's performance under the contract if so, required by the purchaser.
- 5.4 The supplier shall permit the purchaser to inspect the supplier's records relating to the performance of the supplier and to have them audited by auditors appointed by the purchaser, if so, required by the purchaser.

6. Patent Rights

- 6.1 The supplier shall indemnify the purchaser against all third-party claims of infringement of patent, trademark, or industrial design rights arising from use of the goods or any part thereof by the purchaser.
- 6.2 When a supplier developed documentation / projects for the municipality / municipal entity, the intellectual, copy and patent rights or ownership of such documents or projects will vest in the municipality / municipal entity.

7. Performance security

- 7.1 Within thirty (30) days of receipt of the notification of contract award, the successful bidder shall furnish to the purchaser the performance security of the amount specified in SCC.
- 7.2 The proceeds of the performance security shall be payable to the purchaser as compensation for any loss resulting from the supplier's failure to complete his obligations under the contract.
- 7.3 The performance security shall be denominated in the currency of the contract, or in a freely convertible currency acceptable to the purchaser and shall be in one of the following forms: (a) a bank guarantee or an irrevocable letter of credit issued by a reputable bank located in the purchaser's country or abroad, acceptable to the purchaser, in the form provided in the bidding documents or another form acceptable to the purchaser; or (b) a cashier's or certified cheque.
- 7.4 The performance security will be discharged by the purchaser and returned to the supplier not later than thirty (30) days following the date of completion of the supplier's performance obligations under the contract, including any warranty obligations, unless otherwise specified.

8. Inspections, tests and analyses

- 8.1 All pre-bidding testing will be for the account of the bidder.
- 8.2 If it is a bid condition that goods to be produced or services to be rendered should at any stage be subject to inspections, tests and analyses, the bidder or contractor's premises shall be open, at all reasonable hours, for inspection by a representative of the purchaser or organization acting on behalf of the purchaser.
- 8.3 If there are no inspection requirements indicated in the bidding documents and no mention is made in the contract, but during the contract period it is decided that inspections shall be carried out, the purchaser shall itself make the necessary arrangements, including payment arrangements with the testing authority concerned.
- 8.4 If the inspections, tests and analyses referred to in clauses 8.2 and 8.3 show the goods to be in accordance with the contract requirements, the cost of the inspections, tests and analyses shall be defrayed by the purchaser.
- 8.5 Where the goods or services referred to in clauses 8.2 and 8.3 do not comply with the contract requirements, irrespective of whether such goods or services are accepted or not, the cost in connection with these inspections, tests or analyses shall be defrayed by the supplier.
- 8.6 Goods and services which are referred to in clauses 8.2 and 8.3 and which do not comply with the contract requirements may be rejected.
- 8.7 Any contract goods may on or after delivery be inspected, tested or analysed and may be rejected if found not to comply with the requirements of the contract. Such rejected goods shall be held at the cost and risk of the supplier who shall, when called upon, remove them immediately at his own cost and forthwith substitute them with goods, which do comply with the requirements of the contract. Failing such removal, the rejected goods shall be returned at the suppliers cost and risk. Should the supplier fail to provide the substitute goods forthwith, the purchaser may, without giving the supplier further opportunity to substitute the rejected goods, purchase such goods as may be necessary at the expense of the supplier.

- 8.8 The provisions of clauses 8.4 to 8.7 shall not prejudice the right of the purchaser to cancel the contract on account of a breach of the conditions thereof, or to act in terms of Clause 22 of GCC.
- 9. Packing**
- 9.1 The supplier shall provide such packing of the goods as is required to prevent their damage or deterioration during transit to their final destination, as indicated in the contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit, and open storage. Packing, case size weights shall take into consideration, where appropriate, the remoteness of the goods' final destination and the absence of heavy handling facilities at all points in transit.
- 9.2 The packing, marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the contract, including additional requirements, if any, and in any subsequent instructions ordered by the purchaser.
- 10. Delivery and documents**
- 10.1 Delivery of the goods and arrangements for shipping and clearance obligations, shall be made by the supplier in accordance with the terms specified in the contract.
- 11. Insurance**
- 11.1 The goods supplied under the contract shall be fully insured in a freely convertible currency against loss or damage incidental to manufacture or acquisition, transportation, storage and delivery in the manner specified.
- 12. Transportation**
- 12.1 Should a price other than an all-inclusive delivered price be required, this shall be specified.
- 13. Incidental Services**
- 13.1 The supplier may be required to provide any or all of the following services, including additional services, if any:
- (a) performance or supervision of on-site assembly and/or commissioning of the supplied goods;
 - (b) furnishing of tools required for assembly and/or maintenance of the supplied goods;
 - (c) furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied goods;
 - (d) performance or supervision or maintenance and/or repair of the supplied goods, for a period of time agreed by the parties, provided that this service shall not relieve the supplier of any warranty obligations under this contract; and
 - (e) training of the purchaser's personnel, at the supplier's plant and/or on-site, in assembly, start-up, operation, maintenance, and/or repair of the supplied goods.
- 13.2 Prices charged by the supplier for incidental services, if not included in the contract price for the goods, shall be agreed upon in advance by the parties and shall not exceed the prevailing rates charged to other parties by the supplier for similar services.
- 14. Spare parts**
- 14.1 As specified, the supplier may be required to provide any or all of the following materials, notifications, and information pertaining to spare parts manufactured or distributed by the supplier:
- (a) such spare parts as the purchaser may elect to purchase from the supplier, provided that this election shall not relieve the supplier of any warranty obligations under the contract; and
 - (b) in the event of termination of production of the spare parts: (i) advance notification to the purchaser of the pending termination, in sufficient time to permit the purchaser to procure needed requirements; and (ii) following such termination, furnishing at no cost to the purchaser, the blueprints, drawings, and specifications of the spare parts, if requested.
- 15. Warranty**
- 15.1 The supplier warrants that the goods supplied under the contract are new, unused, of the most recent or current models, and that they incorporate all recent improvements in design and materials unless provided otherwise in the contract. The supplier further warrants that all goods supplied under this contract shall have no defect, arising from design, materials, or workmanship (except when the design and/or material is required by the purchaser's specifications) or from any act or omission of the supplier, that may develop under normal use of the supplied goods in the conditions prevailing in the country of final destination.
- 15.2 This warranty shall remain valid for twelve (12) months after the goods, or any portion thereof as the case may be, have been delivered to and accepted at the final destination indicated in the contract, or for eighteen (18) months after the date of shipment from the port or place of loading in the source country, whichever period concludes earlier, unless specified otherwise.
- 15.3 The purchaser shall promptly notify the supplier in writing of any claims arising under this warranty.
- 15.4 Upon receipt of such notice, the supplier shall, within the period specified and with all reasonable speed, repair or replace the defective goods or parts thereof, without costs to the purchaser.
- 15.5 If the supplier, having been notified, fails to remedy the defect(s) within the period specified, the purchaser may proceed to take such remedial action as may be necessary, at the supplier's risk and expense and without prejudice to any other rights which the purchaser may have against the supplier under the contract.
- 16. Payment**
- 16.1 The method and conditions of payment to be made to the supplier under this contract shall be specified.
- 16.2 The supplier shall furnish the purchaser with an invoice accompanied by a copy of the delivery note and upon fulfilment of other obligations stipulated in the contract.
- 16.3 Payments shall be made promptly by the purchaser, but in no case later than thirty (30) days after submission of an invoice or claim by the supplier.
- 16.4 Payment will be made in Rand unless otherwise stipulated.

- 17. Prices**
- 17.1 Prices charged by the supplier for goods delivered and services performed under the contract shall not vary from the prices quoted by the supplier in his bid, with the exception of any price adjustments authorized or in the purchaser's request for bid validity extension, as the case may be.
- 18. Variation orders**
- 18.1 In cases where the estimated value of the envisaged changes in purchase does not vary more than 15% of the total value of the original contract, the contractor may be instructed to deliver the goods or render the services as such. In cases of measurable quantities, the contractor may be approached to reduce the unit price, and such offers may be accepted provided that there is no escalation in price.
- 19. Assignment**
- 19.1 The supplier shall not assign, in whole or in part, its obligations to perform under the contract, except with the purchaser's prior written consent.
- 20. Subcontracts**
- 20.1 The supplier shall notify the purchaser in writing of all subcontracts awarded under this contract if not already specified in the bid. Such notification, in the original bid or later, shall not relieve the supplier from any liability or obligation under the contract.
- 21. Delays in the supplier's performance**
- 21.1 Delivery of the goods and performance of services shall be made by the supplier in accordance with the time schedule prescribed by the purchaser in the contract.
- 21.2 If at any time during performance of the contract, the supplier or its subcontractor(s) should encounter conditions impeding timely delivery of the goods and performance of services, the supplier shall promptly notify the purchaser in writing of the fact of the delay, its likely duration and its cause(s). As soon as practicable after receipt of the supplier's notice, the purchaser shall evaluate the situation and may at his discretion extend the supplier's time for performance, with or without the imposition of penalties, in which case the extension shall be ratified by the parties by amendment of contract.
- 21.3 The right is reserved to procure outside of the contract small quantities or to have minor essential services executed if an emergency arises, the supplier's point of supply is not situated at or near the place where the goods are required, or the supplier's services are not readily available.
- 21.4 Except as provided under GCC Clause 25, a delay by the supplier in the performance of its delivery obligations shall render the supplier liable to the imposition of penalties, pursuant to GCC Clause 22, unless an extension of time is agreed upon pursuant to GCC Clause 22.2 without the application of penalties.
- 21.5 Upon any delay beyond the delivery period in the case of a goods contract, the purchaser shall, without cancelling the contract, be entitled to purchase goods of a similar quality and up to the same quantity in substitution of the goods not supplied in conformity with the contract and to return any goods delivered later at the supplier's expense and risk, or to cancel the contract and buy such goods as may be required to complete the contract and without prejudice to his other rights, be entitled to claim damages from the supplier.
- 22. Penalties**
- 22.1 Subject to GCC Clause 25, if the supplier fails to deliver any or all of the goods or to perform the services within the period(s) specified in the contract, the purchaser shall, without prejudice to its other remedies under the contract, deduct from the contract price, as a penalty, a sum calculated on the delivered price of the delayed goods or unperformed services using the current prime interest rate calculated for each day of the delay until actual delivery or performance. The purchaser may also consider termination of the contract pursuant to GCC Clause 23.
- 23. Termination for default**
- 23.1 The purchaser, without prejudice to any other remedy for breach of contract, by written notice of default sent to the supplier, may terminate this contract in whole or in part:
 (a) if the supplier fails to deliver any or all of the goods within the period(s) specified in the contract, or within any extension thereof granted by the purchaser pursuant to GCC Clause 21.2; (b) if the supplier fails to perform any other obligation(s) under the contract; or (c) if the supplier, in the judgement of the purchaser, has engaged in corrupt or fraudulent practices in competing for or in executing the contract.
- 23.2 In the event the purchaser terminates the contract in whole or in part, the purchaser may procure, upon such terms and in such manner, as it deems appropriate, goods, works or services similar to those undelivered, and the supplier shall be liable to the purchaser for any excess costs for such similar goods, works or services. However, the supplier shall continue performance of the contract to the extent not terminated.
- 23.3 Where the purchaser terminates the contract in whole or in part, the purchaser may decide to impose a restriction penalty on the supplier by prohibiting such supplier from doing business with the public sector for a period not exceeding 10 years.
- 23.4 If a purchaser intends imposing a restriction on a supplier or any person associated with the supplier, the supplier will be allowed a time period of not more than fourteen (14) days to provide reasons why the envisaged restriction should not be imposed. Should the supplier fail to respond within the stipulated fourteen (14) days the purchaser may regard the supplier as having no objection and proceed with the restriction.
- 23.5 Any restriction imposed on any person by the purchaser will, at the discretion of the purchaser, also be applicable to any other enterprise or any partner, manager, director or other person who wholly or partly exercises or exercised or may exercise control over the enterprise of the first-mentioned person, and with which enterprise or person the first-mentioned person, is or was in the opinion of the purchaser actively associated.

- 23.6 If a restriction is imposed, the purchaser must, within five (5) working days of such imposition, furnish the National Treasury, with the following information:
 (i) the name and address of the supplier and / or person restricted by the purchaser;
 (ii) the date of commencement of the restriction
 (iii) the period of restriction; and
 (iv) the reasons for the restriction. These details will be loaded in the National Treasury's central database of suppliers or persons prohibited from doing business with the public sector.
- 23.7 If a court of law convicts a person of an offence as contemplated in sections 12 or 13 of the Prevention and Combating of Corrupt Activities Act, No. 12 of 2004, the court may also rule that such person's name be endorsed on the Register for Tender Defaulters. When a person's name has been endorsed on the Register, the person will be prohibited from doing business with the public sector for a period not less than five years and not more than 10 years. The National Treasury is empowered to determine the period of restriction and each case will be dealt with on its own merits. According to section 32 of the Act the Register must be open to the public. The Register can be perused on the National Treasury website
- 24. Antidumping and countervailing duties and rights**
- 24.1 When, after the date of bid, provisional payments are required, or anti-dumping or countervailing duties are imposed, or the amount of a provisional payment or anti-dumping or countervailing right is increased in respect of any dumped or subsidized import, the State is not liable for any amount so required or imposed, or for the amount of any such increase. When, after the said date, such a provisional payment is no longer required or any such anti-dumping or countervailing right is abolished, or where the amount of such provisional payment or any such right is reduced, any such favourable difference shall on demand be paid forthwith by the supplier to the purchaser or the purchaser may deduct such amounts from moneys (if any) which may otherwise be due to the supplier in regard to goods or services which he delivered or rendered, or is to deliver or render in terms of the contract or any other contract or any other amount which may be due to him.
- 25. Force Majeure**
- 25.1 Notwithstanding the provisions of GCC Clauses 22 and 23, the supplier shall not be liable for forfeiture of its performance security, damages, or termination for default if and to the extent that his delay in performance or other failure to perform his obligations under the contract is the result of an event of force majeure. 25.2 If a force majeure situation arises, the supplier shall promptly notify the purchaser in writing of such condition and the cause thereof. Unless otherwise directed by the purchaser in writing, the supplier shall continue to perform its obligations under the contract as far as is reasonably practical and shall seek all reasonable alternative means for performance not prevented by the force majeure event.
- 26. Termination for insolvency**
- 26.1 The purchaser may at any time terminate the contract by giving written notice to the supplier if the supplier becomes bankrupt or otherwise insolvent. In this event, termination will be without compensation to the supplier, provided that such termination will not prejudice or affect any right of action or remedy, which has accrued or will accrue thereafter to the purchaser.
- 27. Settlement of Disputes**
- 27.1 If any dispute or difference of any kind whatsoever arises between the purchaser and the supplier in connection with or arising out of the contract, the parties shall make every effort to resolve amicably such dispute or difference by mutual consultation.
- 27.2 If, after thirty (30) days, the parties have failed to resolve their dispute or difference by such mutual consultation, then either the purchaser or the supplier may give notice to the other party of his intention to commence with mediation. No mediation in respect of this matter may be commenced unless such notice is given to the other party.
- 27.3 Should it not be possible to settle a dispute by means of mediation; it may be settled in a South African court of law.
- 27.4 Notwithstanding any reference to mediation and/or court proceedings herein, (a) the parties shall continue to perform their respective obligations under the contract unless they otherwise agree; and
 (b) the purchaser shall pay the supplier any monies due the supplier for goods delivered and / or services rendered according to the prescripts of the contract.
- 28. Limitation of Liability**
- 28.1 Except in cases of criminal negligence or wilful misconduct, and in the case of infringement pursuant to Clause 6; (a) the supplier shall not be liable to the purchaser, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the supplier to pay penalties and/or damages to the purchaser; and (b) the aggregate liability of the supplier to the purchaser, whether under the contract, in tort or otherwise, shall not exceed the total contract price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment.
- 29. Governing language**
- 29.1 The contract shall be written in English. All correspondence and other documents pertaining to the contract that is exchanged by the parties shall also be written in English.
- 30. Applicable law**
- 30.1 The contract shall be interpreted in accordance with South African laws, unless otherwise specified.
- 31. Notices**
- 31.1 Every written acceptance of a bid shall be posted to the supplier concerned by registered or certified mail and any other notice to him shall be posted by ordinary mail to the address furnished in his bid or to the address notified later by him in writing and such posting shall be deemed to be proper service of such notice.

- 31.2 The time mentioned in the contract documents for performing any act after such aforesaid notice has been given, shall be reckoned from the date of posting of such notice.
- 32. Taxes and duties**
- 32.1 A foreign supplier shall be entirely responsible for all taxes, stamp duties, license fees, and other such levies imposed outside the purchaser's country.
- 32.2 A local supplier shall be entirely responsible for all taxes, duties, license fees, etc., incurred until delivery of the contracted goods to the purchaser.
- 32.3 No contract shall be concluded with any bidder whose tax matters are not in order. Prior to the award of a bid SARS must have certified that the tax matters of the preferred bidder are in order.
- 32.4 No contract shall be concluded with any bidder whose municipal rates and taxes and municipal services charges are in arrears.
- 33. Transfer of contracts**
- 33.1 The contractor shall not abandon, transfer, cede assign or sublet a contract or part thereof without the written permission of the purchaser
- 34. Amendment of contracts**
- 34.1 No agreement to amend or vary a contract or order or the conditions, stipulations or provisions thereof shall be valid and of any force unless such agreement to amend or vary is entered into in writing and signed by the contracting parties. Any waiver of the requirement that the agreement to amend or vary shall be in writing, shall also be in writing.
- 35. Prohibition of restrictive practices**
- 35.1 In terms of section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, an agreement between, or concerted practice by, firms, or a decision by an association of firms, is prohibited if it is between parties in a horizontal relationship and if a bidder(s) is / are or a contractor(s) was / were involved in collusive bidding.
- 35.2 If a bidder(s) or contractor(s) based on reasonable grounds or evidence obtained by the purchaser has / have engaged in the restrictive practice referred to above, the purchaser may refer the matter to the Competition Commission for investigation and possible imposition of administrative penalties as contemplated in section 59 of the Competition Act No 89 Of 1998. 35.3 If a bidder(s) or contractor(s) has / have been found guilty by the Competition Commission of the restrictive practice referred to above, the purchaser may, in addition and without prejudice to any other remedy provided for, invalidate the bid(s) for such item(s) offered, and / or terminate the contract in whole or part, and / or restrict the bidder(s) or contractor(s) from conducting business with the public sector for a period not exceeding ten (10) years and / or claim damages from the bidder(s) or contractor(s) concerned.

SECTION 1.4: SPECIAL CONDITIONS OF TENDER

- 1.4.1 The Municipality of Mossel Bay wishes to appoint a Service Provider for the installation, strip, repair and maintenance of irrigations systems of Mossel Bay Municipality for the period **1 July 2026 up to 30 June 2029**.
- 1.4.2 The current irrigation systems are as follows:
- (a) **Sport Fields with full irrigation systems:**
- Greenhaven Sports Ground,
 - D'Almeida Sports Ground,
 - Van Riebeeck Sports Ground,
 - Sonskyn Vallei Sports Ground and;
 - Extension 23 Sports Ground.
- (b) **Parks & Sport Fields with Turf Valves:**
- Friemersheim Sports Ground and;
 - Brandwag Sports Ground.
 - Harry Giddey Park
 - Herbertsdale
- (c) **Municipal Buildings with full irrigation systems:**
- Main Building (101 Marsh Street),
 - Human Resource Building (Santos Beach),
 - Technical Building (George Road) and;
 - K9 Grounds (at SPCA)
- 1.4.3 A preferred and alternative bidder may be appointed depending on the responsiveness of bidders.
- 1.4.3.1 The successful bidder (preferred bidder) must confirm, in writing, within 24 hours after receipt of the order, that the required quantity per order can be delivered. Failure to respond or to make alternative arrangements with the relevant municipal official will result in cancellation of the order and the first alternative bidder will be used.
- 1.4.3.2 The first alternative bidder must confirm, in writing, within 24 hours after receipt of the order, that the required quantity per order can be delivered. Failure to respond or to make alternative arrangements with the relevant municipal official will result in cancellation of the order and the second alternative bidder will be used.
- 1.4.3.3 The second alternative bidder must confirm, in writing, within 24 hours after receipt of the order, that the required quantity per order can be delivered. Failure to respond or to make alternative arrangements with the relevant municipal official will result in cancellation of the order and will be deemed that the items cannot be delivered, and then three (3) quotations and/or formal written quotations (FWQ) process will be followed.
- 1.4.3.4 It must furthermore be noted that should the bidder fail, omit or neglect to respond to an order placed within the specified timeframe indicated in the tender (agreed to in the tender) the order will be cancelled and the alternative bidder, if any will be utilised. Should the bidder fail, omit or neglect to respond on three occasions or respond to an order and then fail, omit or neglect to fulfil an order placed on three occasions the matter will be referred for further action to Compliance Management and/or Legal Services.
- 1.4.4 Payment of services/items will be done within thirty (30) days, after receiving an official invoice or statement.

1.4.5 Key Performance indicators

The following key performance indicators will be applicable to the successful bidder/s and will be measured after each order, to assess the performance:

- **Service Quality Rating**

Standard	The Service Supplied must be of a High Quality without visible defects and rust and according to the requirements set out in the Bid Document.
Target	100 % achievement
Proof of evidence	Comebacks/ brakeage's / quotations and invoices

- **Supplied in Terms of Specifications**

Standard	Goods and Services must be delivered On-Time as agreed.
Target	100 % achievement
Proof of evidence	Product delivered meet tender specifications (brochures)

- **Delivery Time Frame**

Standard	Product/service delivered complies with specifications set in tender/project document.
Target	100 % achievement
Proof of evidence	Completion certificate of work completed within 5 calendar days after confirmed receipt of purchase order.

1.4.6 FUNCTIONALITY

- (a) Tenders will be evaluated on the functionality criteria as set out below. Bidders that score less than **50 out of 60 points** for these criterion will be regarded as non-responsive and will not be evaluated on price, B-BBEE and Locality. Unclear, vague, fragmented or incomplete information provided will result in no points being allocated.
- (b) Bidders must ensure that relevant information is submitted. If information is not submitted or referred to as an attachment, no points will be awarded.
- (c) No information or documentary proof will be requested after closure of the tender, relating to tender functionality.
- (d) The following criteria will be used to calculate points for the functionality of tenders and bidders should ensure that they submit all information in order to be pre-evaluated on the criteria mentioned below:

	CRITERION	MAXIMUM POINTS	BIDDER SCORE
1.	Company (or JV) Experience	45	
2.	References Related to that Experience	15	
	TOTAL	60	

Functionality criterion are further divided as follows and points will be awarded as indicated below:

Criterion 1: Company (or JV) Experience

- (a) A maximum of **45** points will be awarded at the sole discretion of the Municipality's Bid Evaluation Committee based on the information provided. Please note that this section refers to the Company's and its legacy firms past experience. Meaning this section takes into consideration that the company as an entity has gained relevant experience in the past and showcase that the company is in the business of said Scope of Works.
- (b) Relevant experience is defined as the accumulation of knowledge or skill that results from direct participation in relevant/similar events or activities and/or as determined by the Mossel Bay Municipality and/or professional consulting engineer where applicable.

EXPERIENCE REQUIRED: Successfully completed projects related to <u>the installation, strip, repair and maintenance of irrigation systems.</u>	MAXIMUM POINTS	BIDDER SCORE
1 to 5 projects that are related to the experience.	20	
6 to 10 projects that are related to the experience.	35	
11 projects or more that are related to the experience.	45	
	TOTAL	

- (c) In order to claim points for the above, bidders must submit sufficient information as well as documentary proof of experience relating to **Successfully completed projects related to the installation, strip, repair and maintenance of irrigation systems**, by means of **purchase orders or award letters or completion certificates or where a project was undertaken for a private client and no completion certificate was issued, a signed formal letter confirming completion of the works will be accepted as proof.**

A REFERENCE LETTER WILL NOT BE ACCEPTED FOR THIS CRITERION.

- (d) Points will only be awarded for **relevant & completed experience** obtained relevant to the Tender Scope of Works. To be able to gain points the Tenderer must submit proof that the company has obtained the relevant experience for this Tender's Scope of Works & Specifications, and not only parts thereof. If experience is listed, please ensure it is applicable and relevant to the whole of this Tender and not only to parts thereof, otherwise the Bidder will not be awarded the necessary points. **Bidders to provide enough experience to score the total points as prescribed.**

NB: If no information is provided below OR referred to as an additional attachment **NO POINTS WILL BE AWARDED.**

Employer/Client	Nature of work/Scope of work (A full breakdown of the scope to be submitted)	Value of Work (incl. VAT)	Start and completion date (month and year) Duration
			Start Completion Duration

Criterion 2: References related to Experience

Please note that this section refers to the Company's and its legacy firms' references related to the experience. It also takes into account that the references are related & relevant **to the installation, strip, repair and maintenance of irrigation systems**

1. Bidders should provide copies of three (3) questionnaires in relation to the experience gained on projects relevant **to the installation, strip, repair and maintenance of irrigation systems**
2. Please note it is the duty of the Bidder to ensure that the references given are relevant to the Scope of Works.
3. Points allocation
 - A maximum of **15** points will be awarded at the sole discretion of the Municipality's Bid Evaluation Committee based on the information provided and will be split as follows.
 - In order to claim points, bidders must submit, with the tender document, three (**3**) questionnaires to which the abovementioned Experience have been provided.
 - These questionnaires must be current/most recent, relevant and related to the Experience submitted. **The letters must not be older than five (5) years.**
 - It is the bidders' responsibility to ensure that the details provided are correct, before submitting his tender, and that the references will be available and be able to provide additional feedback, if necessary.
 - If the references are unable to validate, verify or provide additional information on the projects, no points will be awarded for that particular reference.
 - 5 points (**as indicated in point 4**) will be awarded for each reference letter or questionnaire which is positive and relevant to the Scope of Works of this contract, subject to the final discretion of the Bid Evaluation Committee.
4. The following detail should be answered:
 - Have this Contractor successfully performed a similar Scope of Works for you in the past. **(1 point)**
 - Was the work completed within the contractual time frame. **(1 point)**
 - Was the work completed within the contract amount? **(1 point)**
 - Did the contractor comply with the Occupational Health & Safety regulations on site **(1 point)**
 - In general were you satisfied with their performance - thus would you recommend them for this Tender considering all of above **(1 point)**
5. The letter should also include who the contact person is with all his/her contact detail.
6. Bidders can provide their references with the attached questionnaire (**see attachment A**), which have to be completed and signed by the references and should contain all detail as stated in point 5 above.
7. The Municipality reserves the right to validate and verify the information from the references or to ask more questions or proof to satisfy the evaluation process.
8. Please note that points will not overlap, meaning points are awarded only once per reference/company/entity *per project experience*. Please refrain from submitting multiple references from the same company on the same project.

NB: If no reference letters or questionnaires are attached NO POINTS WILL BE AWARDED. COMPLETION CERTIFICATES AND/OR APPOINTMENT LETTERS WILL NOT BE ACCEPTED FOR THIS CRITERIA.

ATTACHMENT A

Question to Reference	Reference's Response
1. Detail of the work that have been successfully completed. (1 point)
2. Was the work completed within the contractual time frame? (1 point)	Yes No If No, please state why:
3. Was the work completed within the contract amount? (1 point)	Yes No If No, please state why:
4. Did the contractor comply with the Occupational Health & Safety regulations on site? (1 point)	Yes No If No, please state why:
5. In general were you satisfied with their performance? (1 point)	Yes No If No, please state why:

.....
NAME OF REFERENCE

.....
SIGNATURE

.....
CONTACT PERSON & TELEPHONE NUMBER

.....
DATE

<p>STAMP OF REFERENCE (if available)</p>

SECTION 2.1: SPECIFICATIONS

2.1.1 The following items (equipment etc.) that will be used for new installations as well as repair or replacement or maintenance should be quoted on:

Item	Description	Units/ measurement	Type
1.	Pop-Up Sprayer	1	HUNTER I-25 or similar for sport fields (<i>bidders are welcome to familiarize them of installed equipment at sport grounds and municipal buildings or parks</i>)
2.	Solenoids	1	Hunter or Rainbird or similar (<i>bidders are welcome to familiarize them of installed equipment at sport grounds and municipal buildings or parks</i>)
3.	10 000L Water tanks	1	
4.	12x4m ² concrete foundation for installation of tanks (25/19MPA concrete) (150mm thick)	m ³	
5.	12x4m ² compacted gravel base (100-150mm thick)	m ³	
6.	<u>F72 Mesh Specifications</u>	mm	Wire Diameter (both main and cross wires): 6 mm Mesh Opening (nominal): 200 mm × 200 mm Sheet Dimensions: Width: 2.4 m Length: 6.0 m
7.	25mm Hook - Anchors to anchor tanks on concrete foundation	1	
8.	40mm Ball-Valve	1	
9.	Water Pressure Pump (Outside)	1	Water requirement for pop-up sprinklers ±23.5m ³ /hour Height 55m ±24m ³ /hour (400v 3phase pump) DN Flanges for pump Motor required for pump 7.5Kw 4'' 1MP drive complete in cabinet with 3 setpoints Pumps and motor need protection against theft, climate factors like sun, wind and rain
10.	Water Pressure Pump (Inside) submersible	1	Water requirement for pop-up sprinklers ±23.5m ³ /hour

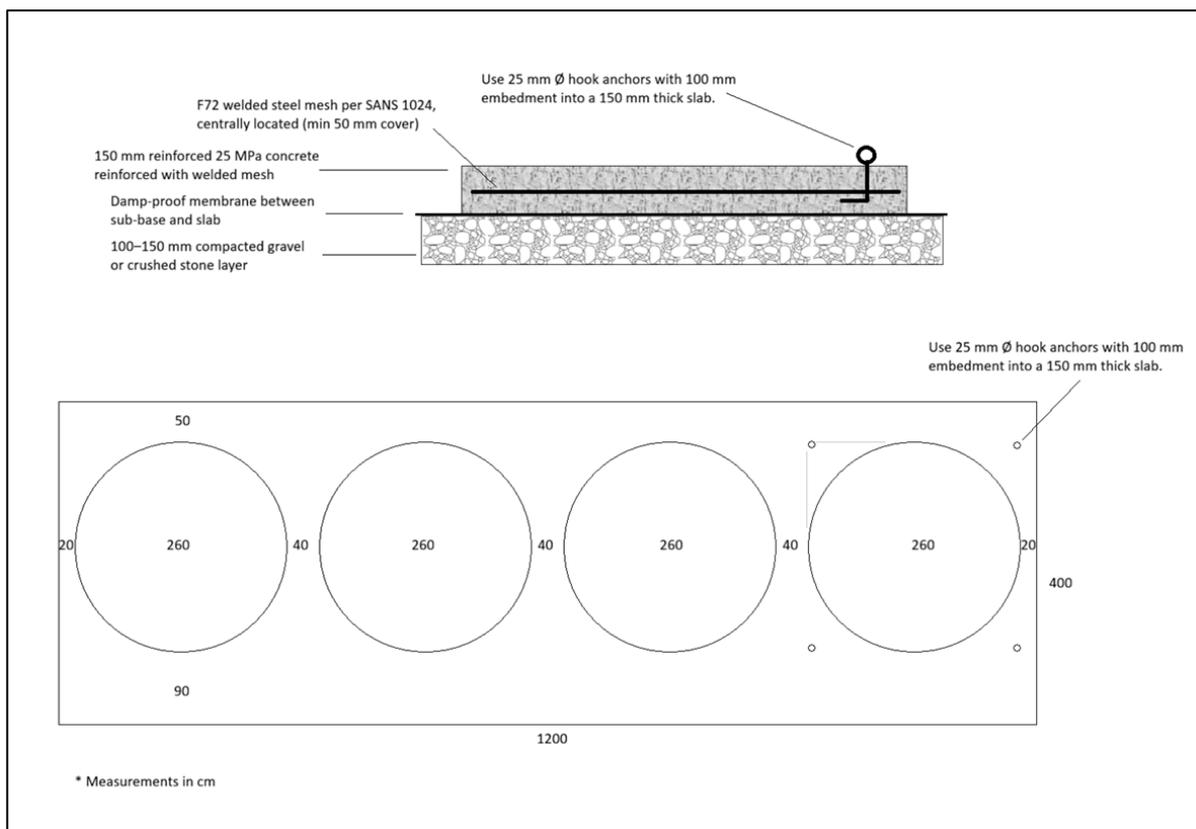
			Height 55m ±24m ³ /hour (400v 3phase pump) DN Flanges for pump Motor required for pump 7.5Kw 4” 1MP drive complete in cabinet with 3 setpoints Pimp and motor need protection against theft?
11.	Turf Valves (Friemersheim, Brandwag & Herbertsdale)	1	
12.	110mm PVC pipe	Per meter	
13.	90mm PVC Pipe	Per meter	
14.	75mm PVC pipe	Per meter	
15.	63mm PVC Pipe	Per meter	
16.	50mm PVC pipe	Per meter	
17.	75mm H.D.P.E. Class 8 Pipe	Per meter	
18.	63mm H.D.P.E Class 8 Pipe	Per meter	
19.	50mm H.D.P.E Class 8 Pipe	Per meter	
20.	40mm H.D.P.E Class 8 Pipe	Per meter	
21.	32mm H.D.P.E Class 8 Pipe	Per meter	
22.	Irrigation control System (Computer) with electrical connection 4 Channel	1	Hunter Systems or similar (Municipal sport fields all currently have hunter systems installed.) <i>(bidders are welcome to familiarize them of installed equipment at sport grounds and municipal buildings or parks)</i>
23.	Irrigation control System (Computer) with electrical connection 6 Channel	1	Hunter Systems or similar (Municipal sport fields all currently have hunter systems installed.)
24.	Irrigation control System (Computer) with electrical connection 8 Channel	1	Hunter Systems or similar (Municipal sport fields all currently have hunter systems installed.)
25.	Irrigation control System (Computer) with electrical connection 12 Channel	1	Hunter Systems or similar (Municipal sport fields all currently have hunter systems installed.)
26.	Module (extension) for Irrigation control System (Computer) with electrical connection that allows for channel extension of up to 32 Channels	1	Hunter Systems or similar (Municipal sport fields all currently have hunter systems installed.)

- 2.1.2 All new items of equipment shall be supplied with a minimum three-year warranty, commencing from the date of final installation and commissioning. Where a warranty is not provided by the original manufacturer or service provider, the obligation to furnish such warranty shall rest with the successful bidder, who must provide the municipality with a valid and enforceable warranty covering the items supplied.
- 2.1.3 Please note that All municipal facilities are currently equipped with Hunter computer systems as well as Hunter pop-up sprayers.
- 2.1.4 The successful bidder shall be responsible for the design, set-up, and submission of a complete irrigation plan and detailed drawings for a new sports field or building, inclusive of system layout, hydraulic calculations where applicable, and integration with existing water supply infrastructure.
- 2.1.5 The successful service provider will be required to carry out repairs & maintenance at various sports grounds and municipal building grounds.
- 2.1.6 **It would be expected of the contractor to report to site within the Municipal area within one (1) hour after being contacted by the Municipality for emergency breakdowns. In the event of Non- or Poor Performance of Service Providers, it will be dealt with in terms of Section 43 of the SCM Policy.**
- 2.1.7 The service provider must be available for **emergency repairs** outside normal working hours and must respond to a site within **2 hours** of notification. from the Director: Community Services or her delegate.
- 2.1.8 Except in emergencies, the service provider must submit a quotation before any work is undertaken.
- 2.1.9 The quotation should include realistic labour time for the specific task and parts (where applicable). Transport to and from the job must be included. **Only one callout fee** per job will be paid. The Municipality will then reserve the right to obtain other quotations if the price is too excessive.
- 2.1.10 Work can only commence once quotation has been received, and order issued by the relevant Municipal Official.
- 2.1.11 The service provider must provide the actual cost of any parts valued at **R500 or more**. The cost of the parts should be substantiated with proof of purchase, and the agreed-upon markup percentage will be applied to determine the final invoiced amount.
- 2.1.12 SANS 10252 -1 are applicable and various section with regards to irrigation should be considered upon installation and maintenance. **(see attachment A)**

Annexure A: Example of the pop-up sprayers currently installed at all our sport grounds. We would prefer and recommend the same for future use.

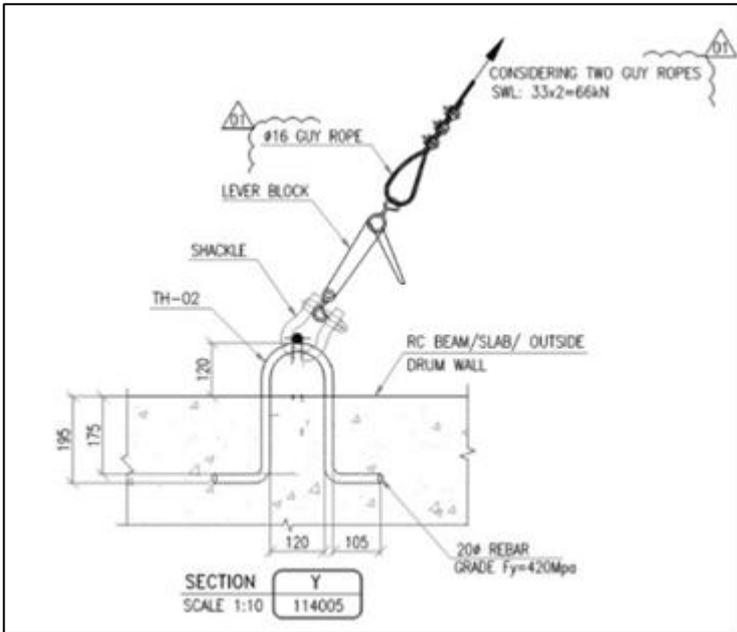


Annexure B: Example of how tanks should be installed with the concrete foundation and specifications included. Tanks should be connected to each other with an outlet on the side.



Annexure C:
Anchor Options:

Anchor positions to be determined on site to allow easy access to ensure easy maintenance and installation of plumbing.



SECTION 2.2: BILL OF QUANTITIES

- 2.2.1 **Bidders MUST tender for each line item in the pricing schedule to be considered for evaluation. Should the bidder fail to tender for each line item as stated, the bidder will not be evaluated, and the bid will be seen as non-responsive. If no rate is charged, please indicate it as N/A or R0.**
- 2.2.2 The tender will be awarded as a rates only tender.
- 2.2.3 Only firm pricing will be accepted, non-firm prices (including prices subject to rates of exchange variations) will not be considered. **The prices for years two (2) and three (3) should include annual escalations.**
- 2.2.4 The bid will be evaluated on the total amount of the contract, in other words the cost per person per unit standard multiplied by the estimate quantities for the period. **Bidders MUST submit a price for each line item in the pricing schedule to be considered for evaluation. Should the bidder fail to submit a price for each line item as stated, the bid will be seen as non-responsive.**
- 2.2.5 Bidders are required to comply with the prescribed pricing schedule below. No pricing schedules other than the pricing schedule as stated will be accepted and **failure to adhere to this section will be seen as submitting a non-responsive bid.**
- 2.2.6 All rates are to be VAT included.
- 2.2.7 Service Providers to allow for all indirect cost, including Indemnity Insurance-, Risk and Liability-insurance, Cost of Foreman, Admin and other Supervision, Cost of Plant and Equipment hire etc., and other Preliminary and General cost not listed.
- 2.2.8 **PAYMENTS**

Employer shall only pay the Contractor for works completed and in terms of the provision of the Contract.

The Contractor shall need to provide documentation for proof of ownership for any claim for Material on Site.

The Contractor needs to provide a statement which he/she considers due to him/her. The Employer Representative will issue a Payment Certificate and Payment Summary for Work completed if in agreement with the Contractor.

The original and signed Payment Certificate and Payment Summary must be handed in to Creditors section together with the Contractor invoice reflecting the amount as on the Payment Certificate. Documentation can be submitted via e-mail to creditors@mosselbay.gov.za or per hard copy at 101 Marsh Street, Mossel Bay.

Invoices will not be approved for payment if the Payment Certificate and Payment Summary is not provided and it remains the responsibility of the Contractor to ensure correct information is provided.

NB: THE ESTIMATE QUANTITIES IS ONLY FOR EVALUATION PURPOSES AND WILL BE USE DURING THE EVALUATION PROCESS. NOT TO BE USED IN THE PRICING SCHEDULE.

Item	Description	Units/ measurement	RATE (Inclusive of 15% VAT, installation, strip, repair and maintenance) YEAR 1 Period ending 01 July 2026 - 30 June 2027	RATE (Inclusive of 15% VAT, installation, strip, repair and maintenance) YEAR 2 01 July 2027 - 30 June 2028	RATE (Inclusive of 15% VAT, installation, strip, repair and maintenance) YEAR 3 01 July 2028 - 30 June 2029
1.	Pop-Up Sprayer	1	R	R	R
2.	Solenoids	1	R	R	R
3.	10 000L Water tanks	1	R	R	R
4.	12x4m ² concrete foundation for installation of tanks (25/19MPA concrete) (150mm thick)	m ³	R	R	R
5.	12x4m ² compacted gravel base (100-150mm thick)	m ³	R	R	R
6.	<u>F72 Mesh Specifications</u> Wire Diameter (both main and cross wires): 6 mm Mesh Opening (nominal): 200 mm × 200 mm Sheet Dimensions: Width: 2.4 m Length: 6.0 m	mm	R	R	R
7.	25mm Hook - Anchors to anchor tanks on concrete foundation	1	R	R	R
8.	40mm Ball-Valve	1	R	R	R
9.	Water Pressure Pump (Outside)	1	R	R	R
10.	Water Pressure Pump (Inside) submersible	1	R	R	R
11.	Turf Valves (Friemersheim, Brandwag & Herbertsdale)	1	R	R	R
12.	110mm PVC pipe	Per meter	R	R	R

13.	90mm PVC Pipe	Per meter	R	R	R
14.	75mm PVC pipe	Per meter	R	R	R
15.	63mm PVC Pipe	Per meter	R	R	R
16.	50mm PVC pipe	Per meter	R	R	R
17.	75mm H.D.P.E. Class 8 Pipe	Per meter	R	R	R
18.	63mm H.D.P.E Class 8 Pipe	Per meter	R	R	R
19.	50mm H.D.P.E Class 8 Pipe	Per meter	R	R	R
20.	40mm H.D.P.E Class 8 Pipe	Per meter	R	R	R
21.	32mm H.D.P.E Class 8 Pipe	Per meter	R	R	R
22.	Irrigation control System (Computer) with electrical connection 4 Channel	1	R	R	R
23.	Irrigation control System (Computer) with electrical connection 6 Channel	1	R	R	R
24.	Irrigation control System (Computer) with electrical connection 8 Channel	1	R	R	R
25.	Irrigation control System (Computer) with electrical connection 12 Channel	1	R	R	R
26.	Module (extension) for Irrigation control System (Computer) with electrical connection that allows for channel extension of up to 32 Channels	1	R	R	R
27.	Set-up/Drawing of new irrigation plan for new sports field or building	1	R	R	R
28.	Call Out (Normal Hours) (7:45-16:15)	Per hour	R	R	R
29.	Call Out (Outside Normal Hours)	Per hour	R	R	R
30.	Materials Percentage Mark-up on other related fittings, not mentioned above (quotation for material must be received with quote & supplier invoice for material must be sent with final invoice)	R500	%	%	%

NB: ESTIMATED QUANTITIES IS ONLY FOR EVALUATION PURPOSES AND NOT AN INDICATION AS TO THE QUANTITIES TO BE ORDERED FOR THE CONTRACT PERIOD.

Item	Description	Estimate Quantities per Annum
1.	Pop-Up Sprayer	50
2.	Solenoids	20
3.	10 000L Water tanks	10
4.	12x4m ² concrete foundation for installation of tanks (25/19MPA concrete) (150mm thick)	2
5.	12x4m ² compacted gravel base (100-150mm thick)	2
6.	<u>F72 Mesh Specifications</u> Wire Diameter (both main and cross wires): 6 mm Mesh Opening (nominal): 200 mm × 200 mm Sheet Dimensions: Width: 2.4 m Length: 6.0 m	2
7.	25mm Hook - Anchors to anchor tanks on concrete foundation	14
8.	40mm Ball-Valve	10
9.	Water Pressure Pump (Outside)	2
10.	Water Pressure Pump (Inside) submersible	2
11.	Turf Valves (Friemersheim, Brandwag & Herbertsdale)	3
12.	110mm PVC pipe	100m
13.	90mm PVC Pipe	90m
14.	75mm PVC pipe	50m
15.	63mm PVC Pipe	50m
16.	50mm PVC pipe	50m
17.	75mm H.D.P.E. Class 8 Pipe	100m
18.	63mm H.D.P.E Class 8 Pipe	90m
19.	50mm H.D.P.E Class 8 Pipe	50m
20.	40mm H.D.P.E Class 8 Pipe	50m
21.	32mm H.D.P.E Class 8 Pipe	50
22.	Irrigation control System (Computer) with electrical connection 4 Channel	4
23.	Irrigation control System (Computer) with electrical connection 6 Channel	4
24.	Irrigation control System (Computer) with electrical connection 8 Channel	4
25.	Irrigation control System (Computer) with electrical connection 12 Channel	4

26.	Module (extension) for Irrigation control System (Computer) with electrical connection that allows for channel extension of up to 32 Channels	10
27.	Set-up/Drawing of new irrigation plan for new sports field or building	2
28.	Call Out (Normal Hours) (7:45-16:15)	48
29.	Call Out (Outside Normal Hours)	6
30.	Materials Percentage Mark-up on other related fittings, not mentioned above (quotation for material must be received with quote & supplier invoice for material must be sent with final invoice)	R500

SECTION 3.1: MBD1: BID REQUIREMENTS FOR MOSSEL BAY MUNICIPALITY

PART A – INVITATION TO BID

INVITATION TO BID FOR REQUIREMENTS OF THE MOSSEL BAY MUNICIPALITY					
BID NUMBER	TDR124/2025/2026	CLOSING DATE	27 MARCH 2026	CLOSING TIME	12h00
DESCRIPTION	THE INSTALLATION, STRIP, REPAIR AND MAINTENANCE OF IRRIGATIONS SYSTEMS FOR MOSSEL BAY MUNICIPALITY				
THE SUCCESSFUL BIDDER WILL BE REQUIRED TO FILL IN AND SIGN A WRITTEN CONTRACT FORM (MBD7)					

ORIGINAL COMPLETED BID DOCUMENTS MAY BE **POSTED** TO REACH THE TENDER BOX BY CLOSING DATE TO:

**The Tender Box
Mossel Bay Municipality
P O Box 25
MOSSEL BAY
6500**

OR

ORIGINAL COMPLETED BID DOCUMENTS MAY BE **DEPOSITED** IN THE TENDER BOX BY CLOSING DATE AT:

**The Entrance of the Mossel Bay Municipality's Town Hall
101 Marsh Street
MOSSEL BAY**

SUPPLIER INFORMATION	
NAME OF BIDDER	
POSTAL ADDRESS AND CODE	
STREET ADDRESS	
TELEPHONE NUMBER	
ALTERNATIVE NUMBER	
E-MAIL ADDRESS	
VAT REGISTRATION NUMBER	
TAX COMPLIANCE STATUS PIN	
CIDB REGISTRATION NUMBER (if applicable)	

A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE/SWORN AFFIDAVIT (FOR EME'S & QSE'S) MUST BE SUBMITTED IN ORDER TO QUALIFY FOR PREFERENCE POINTS FOR B-BBEE)			
B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE	YES	NO	
B-BBEE STATUS LEVEL SWORN AFFIDAVIT	YES	NO	
ARE YOU THE ACCREDITED REPRESENTATIVE IN SOUTH AFRICA FOR THE GOODS/SERVICES/WORK OFFERED?		YES/NO (if YES, enclose proof)	
ARE YOU'RE A FOREIGN BASED SUPPLIER FOR THE GOODS/SERVICES/WORK OFFERED?		YES/NO (if YES, answer Part B)	
TOTAL NUMBER OF ITEMS OFFERED		MULTIPLE	
TOTAL BID PRICE		PAGES 32 -33	
SIGNATURE OF BIDDER			
DATE			
CAPACITY UNDER WHICH THIS BID IS SIGNED			
BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO:		TECHNICAL ENQUIRIES MAY BE DIRECTED TO:	
DEPARTMENT	SCM	DEPARTMENT	Community Services
CONTACT PERSON	Mr. Deslin Kohler	CONTACT PERSON	Mr. Leighton Lawak
TELEPHONE NUMBER	(044) 606-5192	TELEPHONE NUMBER	(044) 606-5000
E-MAIL ADDRESS	dkohler@mosselbay.gov.za	E-MAIL ADDRESS	llawak@mosselbay.gov.za

PART B – TERMS AND CONDITIONS FOR BIDDING

1. BID SUBMISSION:	
<p>1.1. BIDS MUST BE DELIVERED BY THE STIPULATED TIME TO THE CORRECT ADDRESS. LATE BIDS WILL NOT BE ACCEPTED FOR CONSIDERATION.</p> <p>1.2. ALL BIDS MUST BE SUBMITTED ON THE OFFICIAL FORMS PROVIDED – (NOT TO BE RE-TYPED) OR ONLINE</p> <p>1.3. THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT, THE PREFERENTIAL PROCUREMENT REGULATIONS AND ANY APPROPRIATE MUNICIPAL POLICY. THE GENERAL CONDITIONS OF CONTRACT (GCC) AND, IF APPLICABLE, ANY OTHER SPECIAL CONDITIONS OF CONTRACT.</p>	
2. TAX COMPLIANCE REQUIREMENTS	
<p>2.1 BIDDERS MUST ENSURE COMPLIANCE WITH THEIR TAX OBLIGATIONS.</p> <p>2.2 BIDDERS ARE REQUIRED TO SUBMIT THEIR UNIQUE PERSONAL IDENTIFICATION NUMBER (PIN) ISSUED BY SARS TO ENABLE THE ORGAN OF STATE TO VIEW THE TAXPAYER'S PROFILE AND TAX STATUS.</p> <p>2.3 APPLICATION FOR THE TAX COMPLIANCE STATUS (TCS) CERTIFICATE OR PIN MAY ALSO BE MADE VIA E-FILING. IN ORDER TO USE THIS PROVISION, TAXPAYERS WILL NEED TO REGISTER WITH SARS AS E-FILERS THROUGH THE WEBSITE WWW.SARS.GOV.ZA.</p> <p>2.4 FOREIGN SUPPLIERS MUST COMPLETE THE PRE-AWARD QUESTIONNAIRE IN PART B:3.</p> <p>2.5 BIDDERS MAY ALSO SUBMIT A PRINTED TCS CERTIFICATE TOGETHER WITH THE BID.</p> <p>2.6 IN BIDS WHERE CONSORTIA / JOINT VENTURES / SUB-CONTRACTORS ARE INVOLVED; EACH PARTY MUST SUBMIT A SEPARATE TCS CERTIFICATE / PIN / CSD NUMBER.</p> <p>2.7 WHERE NO TCS IS AVAILABLE BUT THE BIDDER IS REGISTERED ON THE CENTRAL SUPPLIER DATABASE (CSD), A CSD NUMBER MUST BE PROVIDED.</p>	
3. QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS	
<p>3.1. IS THE ENTITY A RESIDENT OF THE REPUBLIC OF SOUTH AFRICA (RSA)?</p> <p>3.2. DOES THE ENTITY HAVE A BRANCH IN THE RSA?</p> <p>3.3. DOES THE ENTITY HAVE A PERMANENT ESTABLISHMENT IN THE RSA?</p> <p>3.4. DOES THE ENTITY HAVE ANY SOURCE OF INCOME IN THE RSA?</p> <p>3.5. IS THE ENTITY LIABLE IN THE RSA FOR ANY FORM OF TAXATION?</p>	<p><input type="checkbox"/> YES <input type="checkbox"/> NO</p>
<p>IF THE ANSWER IS "NO" TO ALL OF THE ABOVE, THEN IT IS NOT A REQUIREMENT TO REGISTER FOR A TAX COMPLIANCE STATUS SYSTEM PIN CODE FROM THE SOUTH AFRICAN REVENUE SERVICE (SARS) AND IF NOT REGISTER AS PER 2.3 ABOVE.</p>	

SIGNATURE OF BIDDER:

CAPACITY UNDER WHICH THIS BID IS SIGNED:

DATE:

SECTION 4.1: MBD4: DECLARATION OF INTEREST

1. No bid will be accepted from persons in the service of the state*.
2. Any person, having a kinship with persons in the service of the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid. In view of possible allegations of favoritism, should the resulting bid, or part thereof, be awarded to persons connected with or related to persons in service of the state, it is required that the bidder or their authorised representative declare their position in relation to the evaluating/adjudicating authority.
3. **In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.**
4. **Bidders are required to declare any change in directorship or membership during the term of this tender should it have had an influence on the award of the bid.**

41	Full Name of Bidder OR his OR her representative	
4.2	Identity Number	
4.3	Position occupied in the Company (director, trustee, shareholder ²)	
4.4	Company Registration Number	
4.5	Tax Reference Number	
4.6	VAT Registration Number	
4.7 The names of all directors/trustees/shareholder's/member, their individual identity numbers and state employee numbers must be indicated in number 4, below.		
4.8 Are you presently in service of the state		YES/NO
4.8.1 If so, furnish particulars		
4.9 Have you been in the service of the state for the past twelve months?		YES/NO
4.9.1 If so, furnish particulars		
4.10 Do you have any relationship (family, friend, other) with persons in service of the state and who may be involved with the evaluation and or adjudication of this bid?		YES/NO
4.10.1 If so, furnish particulars		
4.11 Are you, aware of any relationship (family, friend, other) between a bidder and any persons in the service of the state and who may be involved with the evaluation and or adjudication of this bid?		YES/NO
4.11.1 If so, furnish particulars		

4.12 Are any of the company's directors, managers, principal shareholders or stakeholders in service of the state?	YES/NO
4.12.1 If so, furnish particulars	
4.13 Are any spouse, child or parent of the company's directors, managers, principal shareholders or stakeholders in service of the state?	YES/NO
4.13.1 If so, furnish particulars	
4.14 Do you or any of the directors, trustees, managers, principle shareholders, or stakeholders of this company have any interest in any other related companies or business whether or not they are bidding for this contract?	YES/NO
4.14.1 If so, furnish particulars	

**MSCM Regulations: "in the service of the state" means to be –*

- (a) *a member of –*
 - (i) *any municipal council;*
 - (ii) *any provincial legislature; or*
 - (iii) *the national Assembly or the national Council of provinces;*
- (b) *a member of the board of directors of any municipal entity;*
- (c) *an official of any municipality or municipal entity;*
- (d) *an employee of any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No.1 of 1999);*
- (e) *a member of the accounting authority of any national or provincial public entity; or*
- (f) *an employee of Parliament or a provincial legislature.*

SECTION 4.2: MBD5: DECLARATION FOR PROCUREMENT ABOVE R10 MILLION

For all procurement expected to exceed R10 million (VAT included), bidders must complete the following questionnaire:

4.2.1 Are you by law required to prepare annual financial statements for auditing?	YES/NO
4.2.1.1 If yes , submit audited annual financial statements for the past three years or since the date of establishment during the past three years.	
4.2.2 Do you have any outstanding undisputed commitments for municipal services towards a municipality or any service provider in respect of which payment is overdue for more than 30 days?	YES/NO
4.2.2.1 If no , this serves to certify that the bidder has no undisputed commitments for municipal services towards a municipality or other service provider in respect of which payment is overdue for more than 30 days.	
4.2.2.2 If yes , furnish particulars:	
4.2.3 Has any contract been awarded to you by an organ of state during the past five years, including particulars of any material non-compliance or dispute concerning the execution of such contract?	YES/NO
4.2.3.1 If yes , furnish particulars:	
4.2.4 Will any portion of goods or services to be sourced from outside the Republic and, if so, what portion and whether any portion of payment from the municipality is expected to be transferred out of the Republic?	YES/NO
4.2.3.1 If yes , furnish particulars:	

SECTION 4.3: MBD6.1: PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS, 2022.

This preference form must form part of all tenders invited. It contains general information and serves as a claim form for preference points for specific goals.

NB: BEFORE COMPLETING THIS FORM, TENDERERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF THE TENDER AND PREFERENTIAL PROCUREMENT REGULATIONS, 2022

1. GENERAL CONDITIONS

- 1.1 The following preference point systems are applicable to invitations to tender:
- the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and
 - the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).

1.2 To be completed by the organ of state

- (a) The 90/10 or 80/20 preference point system will be applicable in this tender. The lowest (goods and services) / highest (sales and leases) acceptable tender will be used to determine the accurate system once tenders are received.

- 1.3 Points for this tender (even in the case of a tender for income-generating contracts) shall be awarded for:
- (a) Price; and
 - (b) Specific Goals.

1.4 To be completed by the organ of state:

The maximum points for this tender are allocated as follows:

	POINTS	POINTS
PRICE	80	90
SPECIFIC GOALS	20	10
Total points for Price and SPECIFIC GOALS	100	100

- 1.5 Failure on the part of a tenderer to claim points for specific goals with the tender, will be interpreted to mean that preference points for specific goals are not claimed. The tenderer is however required to submit the proof or documentation required in terms of the specific goals. That documentation may be requested by the municipality.
- 1.6 The organ of state reserves the right to require of a tenderer, either before a tender is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the organ of state.

2. DEFINITIONS

- (a) “**tender**” means a written offer in the form determined by an organ of state in response to an invitation to provide goods or services through price quotations, competitive tendering process or any other method

envisaged in legislation;

- (b) **“price”** means an amount of money tendered for goods or services, and includes all applicable taxes less all unconditional discounts;
- (c) **“rand value”** means the total estimated value of a contract in Rand, calculated at the time of bid invitation, and includes all applicable taxes;
- (d) **“tender for income-generating contracts”** means a written offer in the form determined by an organ of state in response to an invitation for the origination of income-generating contracts through any method envisaged in legislation that will result in a legal agreement between the organ of state and a third party that produces revenue for the organ of state, and includes, but is not limited to, leasing and disposal of assets and concession contracts, excluding direct sales and disposal of assets through public auctions; and
- (e) **“the Act”** means the Preferential Procurement Policy Framework Act, 2000 (Act No. 5 of 2000).

3. FORMULAE FOR PROCUREMENT OF GOODS AND SERVICES

3.1. POINTS AWARDED FOR PRICE

3.1.1 THE 80/20 OR 90/10 PREFERENCE POINT SYSTEMS

A maximum of 80 or 90 points is allocated for price on the following basis:

$$\begin{array}{ccc} \mathbf{80/20} & \mathbf{or} & \mathbf{90/10} \\ \\ \mathbf{Ps} = \mathbf{80} \left(\mathbf{1} - \frac{\mathbf{Pt} - \mathbf{Pmin}}{\mathbf{Pmin}} \right) & \mathbf{or} & \mathbf{Ps} = \mathbf{90} \left(\mathbf{1} - \frac{\mathbf{Pt} - \mathbf{Pmin}}{\mathbf{Pmin}} \right) \end{array}$$

Where

- Ps = Points scored for price of tender under consideration
- Pt = Price of tender under consideration
- Pmin = Price of lowest acceptable tender

3.2. FORMULAE FOR DISPOSAL OR LEASING OF STATE ASSETS AND INCOME GENERATING PROCUREMENT

3.2.1. POINTS AWARDED FOR PRICE

A maximum of 80 or 90 points is allocated for price on the following basis:

$$\begin{array}{ccc} \mathbf{80/20} & \mathbf{or} & \mathbf{90/10} \\ \\ \mathbf{Ps} = \mathbf{80} \left(\mathbf{1} + \frac{\mathbf{Pt} - \mathbf{Pmax}}{\mathbf{Pmax}} \right) & \mathbf{or} & \mathbf{Ps} = \mathbf{90} \left(\mathbf{1} + \frac{\mathbf{Pt} - \mathbf{Pmax}}{\mathbf{Pmax}} \right) \end{array}$$

Where

- Ps = Points scored for price of tender under consideration
- Pt = Price of tender under consideration
- Pmax = Price of highest acceptable tender

4. POINTS AWARDED FOR SPECIFIC GOALS

- 4.1. In terms of Mossel Bay Preferential Procurement Policy, preference points must be awarded for specific goals stated in the tender. For the purposes of this tender the tenderer will be allocated points based on the goals stated in table 1 below as may be supported by proof/ documentation stated in the conditions of this tender:
- 4.2. In cases where organs of state intend to use Regulation 3(2) of the Regulations, which states that, if it is unclear whether the 80/20 or 90/10 preference point system applies, an organ of state must, in the tender documents, stipulate in the case of—
- (a) an invitation for tender for income-generating contracts, that either the 80/20 or 90/10 preference point system will apply and that the highest acceptable tender will be used to determine the applicable preference point system; or
 - (b) any other invitation for tender, that either the 80/20 or 90/10 preference point system will apply and that the lowest acceptable tender will be used to determine the applicable preference point system, then the organ of state must indicate the points allocated for specific goals for both the 90/10 and 80/20 preference point system.

Table 1: Specific goals for the tender and points claimed are indicated per the table below.

(Note to organs of state: Where either the 90/10 or 80/20 preference point system is applicable, corresponding points must also be indicated as such.)

Note to tenderers: The tenderer must indicate how they claim points for each preference point system.

- 4.3. 50% of the 20/10 points will be allocated to promote this goal and points will be allocated in terms of the B-BBEE scorecard as follows.

B-BBEE Status Level of Contributor	Number of Points for Preference (80/20)	50% of Points for Preference
1	20	10
2	18	9
3	16	8
4	12	6
5	8	4
6	6	3
7	4	2
8	2	1
Non-compliant contributor	0	0

B-BBEE Status Level of Contributor	Number of Points for Preference (90/10)	50% of Points for Preference
1	10	5
2	9	4.50
3	8	4
4	5	2.50
5	4	2
6	3	1.50
7	2	1
8	1	0.50
Non-compliant contributor	0	0

- (a) A tenderer must submit proof of its B-BBEE status level contributor [scorecard].
(b) A tenderer failing to submit proof of B-BBEE status level of contributor may only score in terms of the 80/90-point formula for price; and scores 0 points for B-BBEE status level of contributor.

4.3.1 B-BBEE STATUS LEVEL OF CONTRIBUTOR CLAIMED IN TERMS OF PARAGRAPHS 4.1

B-BBEE Status Level of Contributor :

(Only indicate your B-BBEE Status Level of Contributor – the points will be calculated by the Municipality)

4.4. Points for specific goals to promote suppliers or service providers located in a province, district or municipal area / (hereafter referred to as locality)

- (a) Each tender must specify in the invitation to tender that a maximum of 50% of the 20/10 points will be allocated to promote the specific goal of locality.
(b) Only one of the points as set out below that best describes the enterprise's locality may be awarded if applicable.

No	Requirement	Points for enterprises within the Mossel Bay municipal area	Points for enterprises within the Garden Route District region	Points for enterprises within the Western Cape Province and other Provinces
1	Procurement under the 80/20 preference points system where the supplier or service provider is located in:	10	6	4
2	Procurement under the 90/10 preference points system where the supplier or service provider is located in:	5	3	2

- (c) Bidders must submit one of the following in order to receive points for the abovementioned criterion.
 - (i) Municipal Account of bidder's address as indicated in bid document;
 - (ii) If the address as indicated in bid document is not in the name of the bidder, the latest lease agreement for this address or sworn affidavit from the registered owner of the property stating occupancy by the bidder is required.
 - (iii) The business address of the bidder as indicated in the MBD6.1 of the bid document as the business premises should be established/leased prior to the advertisement date.
 - (iv) Only fully operational business premises will be accepted. All vacant erven, storage units and postal addresses do not qualify as a business premises.

4.4.1 LOCALITY CLAIMED IN TERMS OF PARAGRAPHS 4.4

Locality (indicate as per table above) :

(The address provided in 4.5 below, will be used to determine the locality as per 4.4 above)

4.5. MUNICIPAL INFORMATION

Municipality where business is situated :

Registered Account Number :

Stand Number :

DECLARATION WITH REGARD TO COMPANY/FIRM

4.6. Name of company/firm.....

4.7. Company registration number:

4.8. TYPE OF COMPANY/ FIRM

- Partnership/Joint Venture / Consortium
- One-person business/sole propriety
- Close corporation
- Public Company
- Personal Liability Company
- (Pty) Limited
- Non-Profit Company
- State Owned Company

[TICK APPLICABLE BOX]

4.9. I, the undersigned, who is duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the specific goals as advised in the tender, qualifies the company/ firm for the preference(s) shown and I acknowledge that:

- i) The information furnished is true and correct;

- ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form;
- iii) In the event of a contract being awarded as a result of points claimed as shown in paragraphs 1.4 and 4.2, the contractor may be required to furnish documentary proof to the satisfaction of the organ of state that the claims are correct;
- iv) If the specific goals have been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the organ of state may, in addition to any other remedy it may have –
 - (a) disqualify the person from the tendering process;
 - (b) recover costs, losses or damages it has incurred or suffered as a result of that person’s conduct;
 - (c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;
 - (d) recommend that the tenderer or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted from obtaining business from any organ of state for a period not exceeding 10 years, after the *audi alteram partem* (hear the other side) rule has been applied; and
 - (e) forward the matter for criminal prosecution, if deemed necessary.

WITNESSES

1.

2.

.....
SIGNATURE(S) OF BIDDERS(S)

DATE:

ADDRESS:

.....

.....

SECTION 4.4: MUNICIPAL RATES AND TAXES

Names of Directors/Partners/Senior Managers	Physical residential address of the Directors/Partners/Senior Managers	Residential Municipal Account number(s)	Name of Municipality

*Documentation as indicated in Section 1.2.8.2 must be submitted with the tender document.

DECLARATION

I ,THE UNDERSIGNED (NAME and SURNAME)

CERTIFY THAT THE INFORMATION FURNISHED ABOVE IS CORRECT. I ACCEPT THAT THE STATE MAY ACT AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

.....
Signature

.....
Date

.....
Position

.....
Name of Bidder

SECTION 4.6: MBD8: DECLARATION OF BIDDER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES

1. This Municipal Bidding Document must form part of all bids invited.
2. It serves as a declaration to be used by municipalities and municipal entities in ensuring that when goods and services are being procured, all reasonable steps are taken to combat the abuse of the supply chain management system.
3. The bid of any bidder may be rejected if that bidder, or any of its directors have:
 - a. abused the municipality's / municipal entity's supply chain management system or committed any improper conduct in relation to such system;
 - b. been convicted for fraud or corruption during the past five years;
 - c. wilfully neglected, reneged on or failed to comply with any government, municipal or other public sector contract during the past five years; or
 - d. been listed in the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004).
4. In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.

Item	Question	Yes	No
4.1	<p>Is the bidder or any of its directors listed on the National Treasury's database as a company or person prohibited from doing business with the public sector?</p> <p>(Companies or persons who are listed on this database were informed in writing of this restriction by the National Treasury after the audi alteram partem rule was applied).</p> <p>The Database of Restricted Suppliers now resides on the National Treasury's website(www.treasury.gov.za) and can be accessed by clicking on its link at the bottom of the home page.</p>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
4.1.1	If so, furnish particulars:		
4.2	<p>Is the bidder or any of its directors listed on the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004)?</p> <p>The Register Tender Defaulters can be accessed on the National Treasury's website (www.treasury.gov.za) by clicking on its link at the bottom of the home page.</p>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
4.2.1	If so, furnish particulars:		
4.3	Was the bidder or any of its directors convicted by a court of law (including a court of law outside the Republic of South Africa) for fraud or corruption during the past five years?	Yes <input type="checkbox"/>	No <input type="checkbox"/>

4.3.1	If so, furnish particulars:		
4.4	Does the bidder or any of its directors owe any municipal rates and taxes or municipal charges to the municipality / municipal entity, or to any other municipality / municipal entity, that is in arrears for more than three months?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
4.4.1	If so, furnish particulars:		
4.5	Was any contract between the bidder and the municipality / municipal entity or any other organ of state terminated during the past five years on account of failure to perform on or comply with the contract?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
4.5.1	If so, furnish particulars:		

CERTIFICATION

I, THE UNDERSIGNED (FULL NAME)CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM TRUE AND CORRECT.

I ACCEPT THAT, IN ADDITION TO CANCELLATION OF A CONTRACT, ACTION MAY BE TAKEN AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

.....
Signature

.....
Date

.....
Position

.....
Name of Bidder

SECTION 4.7: MBD9: CERTIFICATE OF INDEPENDENT BID DETERMINATION

1. This Municipal Bidding Document (MBD) must form part of all bids¹ invited.
2. Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging).² Collusive bidding is a *pe se* prohibition meaning that it cannot be justified under any grounds.
3. Municipal Supply Regulation 38 (1) prescribes that a supply chain management policy must provide measures for the combating of abuse of the supply chain management system, and must enable the accounting officer, among others, to:
 - a. take all reasonable steps to prevent such abuse;
 - b. reject the bid of any bidder if that bidder or any of its directors has abused the supply chain management system of the municipality or municipal entity or has committed any improper conduct in relation to such system; and
 - c. cancel a contract awarded to a person if the person committed any corrupt or fraudulent act during the bidding process or the execution of the contract.
4. This MBD serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid-rigging.
5. In order to give effect to the above, the attached Certificate of Bid Determination (MBD9) must be completed and submitted with the bid:

¹ Includes price quotations, advertised competitive bids, limited bids and proposals.

² Bid rigging (or collusive bidding) occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices or lower the quality of goods and / or services for purchasers who wish to acquire goods and / or services through a bidding process. Bid rigging is, therefore, an agreement between competitors not to compete.

CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

**TDR124/2025/2026: THE INSTALLATION, STRIP, REPAIR AND MAINTENANCE OF IRRIGATIONS SYSTEMS
FOR MOSSEL BAY MUNICIPALITY**

(Bid Number and Description)

in response to the invitation for the bid made by:

MOSSEL BAY MUNICIPALITY

(Name of Municipality / Municipal Entity)

do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of: _____ that:

(Name of Bidder)

1. I have read and I understand the contents of this Certificate;
2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect;
3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder;
4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign, the bid, on behalf of the bidder;
5. For the purposes of this Certificate and the accompanying bid, I understand that the word "competitor" shall include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who:
 - (a) has been requested to submit a bid in response to this bid invitation;
 - (b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and
 - (c) provides the same goods and services as the bidder and/or is in the same line of business as the bidder
6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium³ will not be construed as collusive bidding.
7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:
 - (a) prices;
 - (b) geographical area where product or service will be rendered (market allocation)

- (c) methods, factors or formulas used to calculate prices;
- (d) the intention or decision to submit or not to submit, a bid;
- (e) the submission of a bid which does not meet the specifications and conditions of the bid; or
- (f) bidding with the intention not to win the bid.

8. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.
9. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.
10. I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No. 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No. 12 of 2004 or any other applicable legislation.

.....
Signature

.....
Date

.....
Position

.....
Name of Bidder

³ Joint venture or Consortium means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract.

SECTION 5: DECLARATION

1. I hereby declare that I have read, understood, agree and comply with all of the sections below, if included, that it shall be deemed to form and be construed as part of this agreement:

- (i) Bidding documents, viz
 - Invitation to bid;
 - Tax Compliance Status Pin;
 - Pricing schedule(s);
 - Technical Specification(s);
 - Preference claims for Broad Based Black Economic Empowerment Status Level of Contribution in terms of the Preferential Procurement Regulations,
 - Points claims in terms of specific goals for locality;
 - Declaration of interest;
 - Declaration of bidder’s past SCM practices;
 - Certificate of Independent Bid Determination
 - Special Conditions of Contract;
- (ii) General Conditions of Contract; and
- (iii) Other (specify)

2. I confirm that I am duly authorised to sign this document.

NAME (PRINT)

CAPACITY

SIGNATURE

NAME OF FIRM

DATE

WITNESSES	
1.
2.
DATE:

SECTION 6: FORM OF OFFER AND ACCEPTANCE

OFFER

The Employer, identified in the Acceptance signature block, has solicited offers to enter into a contract in respect of the following works:

TDR124/2025/2026: THE INSTALLATION, STRIP, REPAIR AND MAINTENANCE OF IRRIGATIONS SYSTEMS FOR MOSSEL BAY MUNICIPALITY

The Tenderer, identified in the Offer signature block, below has examined the documents listed in the Tender Data and addenda thereto as listed in the Tender Schedules, and by submitting this Offer has accepted the Conditions of Tender.

By the representative of the Tenderer, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance, the Tenderer offers to perform all of the obligations and liabilities of the Contractor under the Contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the Conditions of Contract identified in the Contract Data.

THE OFFERED TOTAL OF THE PRICES INCLUSIVE OF VALUED ADDED TAX IS:

R.....Various (Rates only).....(in figures);
.....Various (Rates only)(in words).

This Offer may be accepted by the Employer by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document to the Tenderer before the end of the period of validity stated in the Tender Data, whereupon the Tenderer becomes the party named as the Contractor in the Conditions of Contract identified in the Contract Data.

Signature(s).....

Name(s).....

Capacity.....

For the tenderer.....

.....
(Name and address of organisation)

Name & signature of witness..... Date.....

ACCEPTANCE

By signing this part of this Form of Offer and Acceptance, the Employer identified below accepts the bidder's Offer. In consideration thereof, the Employer shall pay the Contractor the amount due in accordance with the conditions of contract identified in the Contract Data. Acceptance of the bidder's Offer shall form an agreement between the Employer and the bidder upon the terms and conditions contained in this agreement and in the contract that is the subject of this agreement

The terms of the contract, are contained in:

- Part C1 Agreements and Contract Data, (which includes this Form of Offer and Acceptance)
- Part C2 Pricing Data
- Part C3 Scope of Work: Works Information

and drawings and documents (or parts thereof), which may be incorporated by reference into the above listed Parts.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Returnable Schedules as well as any changes to the terms of the Offer agreed by the bidder and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Form of Offer and Acceptance. No amendments to or deviations from said documents are valid unless contained in this Schedule.

Deviations from and amendments to the draft contract as well as any changes to the terms of the Offer agreed by the bidder and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Form of Offer and Acceptance. No amendments to or deviations from said documents are valid unless contained in this Schedule.

Notwithstanding anything contained herein, this agreement comes into effect on the date when the bidder receives one fully completed original copy of this document, including the Schedule of Deviations (if any). Unless the bidder (now **contractor**) within five working days of the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this agreement, this agreement shall constitute a binding contract between the Parties.

Signature(s)

Name(s)

Capacity

for the employer

Name and address of organisation.....
.....

Name and signature of witness Date.....

Schedule of Deviations

The extent of deviations from the tender documents issued by the Employer prior to the tender closing date is limited to those permitted in terms of the Tender Data and the Conditions of Tender.

A Bidder’s covering letter will not necessarily be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid becomes the subject of agreements reached during the process of offer and acceptance; the outcome of such agreement shall be recorded here.

Any other matters arising from the process of offer and acceptance either as a confirmation, clarification or change to the tender documents and which it is agreed by the Parties becomes an obligation of the contract shall also be recorded here.

Any change or addition to the tender documents arising from the above agreements and recorded here shall also be incorporated into the final draft of the Contract.

- 1 Subject
- Details
-
- 2 Subject
- Details
-
- 3 Subject
- Details
-
- 4 Subject
- Details
-
- 5 Subject
- Details
-

By the duly familiarized representatives signing this agreement, the Employer and the bidder agree to and accept the foregoing schedule of deviations as the only deviations from and amendments to the documents listed in the tender data and addenda thereto as listed in the tender schedules, as well as any confirmation, clarification or changes to the terms of the offer agreed by the bidder and the employer during this process of offer and acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the bidder of a completed signed copy of this Agreement shall have any meaning or effect in the contract between the parties arising from this agreement.

SECTION 6.3: THE RESOLUTION TAKEN BY THE BOARD OF DIRECTORS OF A JOINT VENTURE

RESOLUTION of a meeting of the Board of Directors / Members / Partners of

NAME OF TENDERER (Must agree with bidder details)

Held at _____ on _____
(Place) (Date)

RESOLVED THAT:

1. The enterprise submits a Tender to Mossel Bay Municipality in respect of the following:

TDR124/2025/2026: THE INSTALLATION, STRIP, REPAIR AND MAINTENANCE OF IRRIGATIONS SYSTEMS FOR MOSSEL BAY MUNICIPALITY

(list all the legally correct full names and registration numbers, if applicable, of the Enterprises forming the Joint Venture).

_____ and

_____ and

_____ and

_____ and

_____ and

_____ and

2. Mr./Mrs./Ms. _____

In his/her capacity as _____

and who will sign as follows: _____

(SPECIMEN SIGNATURE)

be, and is hereby, authorised to sign the Tender and all other documents and/or correspondence in connection with and relating to the Tender, as well as to sign any contract, and or all documentation resulting from the award of the Tender to the **Joint Venture** enterprise mentioned above.

3. The enterprise in the form of a joint venture accept jointly and several liability, with parties under item 1 above for the fulfilment of the obligations of the joint venture deriving from, and in any way connected with the contract to be entered with the Mossel Bay Municipality in respect of the project described above under item 1.

4. The **Joint Venture** enterprise chooses as its domicilium citandi et executandi for all purposes arising from the joint venture agreement and contract with the Mossel Bay Municipality in respect of the project under item 1:

(Physical Address) _____

Note: The resolution **must be signed by all directors or members / partners** of the bidding enterprise. Should the space provided below not be enough for all the directors to sign, please provide a separate sheet in the same format below:

NB: **COMPULSARY TO BE COMPLETED** IN CASE OF JOINT VENTURE

	NAME	ID NUMBER	DIRECTORS/OWNERS PERSONAL TAX NO	SIGNATURE
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Name of Joint Venture	
Names of Each Enterprise:	
(1) Name and Address of Enterprise:	
(2) Name and Address of Enterprise:	
(3) Name and Address of Enterprise:	
Has an original valid Tax Clearance Certificate been submitted for each enterprise:	Yes <input type="checkbox"/> No <input type="checkbox"/>
CIDB Registration Number(s), if applicable:	

Submit your Joint Venture Agreement together with this tender document. If no Joint Venture Agreement is submitted, the tender will be seen as non-responsive.

SIGNED ON BEHALF OF JOINT VENTURE _____



Mossel Bay

M U N I C I P A L I T Y

MOSSSEL BAY | HARTENBOS | GREAT BRAK RIVER | HERBERTSDALE

CONSTRUCTION HEALTH AND SAFETY SPECIFICATION

Issued in terms of -

Occupational Health and Safety Act, 85 of 1993
and
Construction Regulations, 2014

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1. Definitions

For the purpose of this Construction Health and Safety Specification, the abbreviations or definitions given hereunder shall apply: (other as per legal definition will apply)

- *“CR” Construction Regulations, 2014*
- *“CHSS” this document, the Construction Health & Safety Specification*
- *“OHS” the Occupational Health & Safety Act of 1993*
- *“S” a Section in the Occupational Health & Safety Act of 1993*
- *“HIRA” – Hazard Identification and Risk Assessment*
- *“H&S” Health and Safety*
- *“Agent” occupational health and safety practitioner, appointed by the Municipality to act on its behalf, and who is appointed in writing.*
- *“Client” the Mossel Bay Municipality.*
- *“Regulations” the Regulations issued under the Occupational Health & Safety Act;*
- *“SSHSS” means Site Specific Health and Safety Specifications as per the CR*
- *“Site” the lands and other places, made available by the MBM for the purposes of the Contract, on, under, over, in, or through which the construction work is to be executed or carried out.*
- *“Principal Contractor” means an employer appointed by the client to perform construction work;*
- *“Contractor” means an employer who performs construction work.*
- *“MBM” means the Mossel Bay Municipality*

2. Introduction to the Construction Health and Safety Specification

- *This Construction Health & Safety Specification (CHSS) is published in terms of the Occupational Health & Safety Act of 1993 (OHSA), Construction Regulations 2014, Regulation 5.*
- *The CHSS does not replace the Construction Regulations, 2014, but is a supplementary specification as required in terms of the Regulations. Partial references to or quotes from the Regulations do not imply that the sections not referred to or quoted from are of lesser importance or are not applicable.*
- *The Principal Contractor is, at all times required to and will remain responsible to fully address all requirements and standards of the Occupational Health and Safety Act, Regulations, other relevant applicable regulations and or standards as may apply and the approved Health and Safety Plan, and then ensure the implementation thereof.*
- *The MBM is committed to ensuring that the highest standards of health and safety prevail at the Municipality.*
- *It shall be known within the MBM as the Construction Health & Safety Specification or CHSS.*
- *This CHSS must be included in all tender documents for construction work.*
 - *It may be supplemented on various projects by a Site-Specific Health & Safety Specification which deals with health & safety issues relevant to that specific project only; and*
- *The MBM may appoint an Agent who will (inter alia) be responsible for the approval of all Principal Contractors' H&S Plans based on the CHSS or the SSHSS, for the auditing of the Principal Contractors' implementation thereof, and for maintaining the document control associated with the CHSS / SSHSS.*

3. Limitation of liability

- *The MBM shall not be responsible for any acts or omissions of any Contractor which may directly or indirectly result from the application of the CHSS or any project specific version thereof.*
- *Contractors must always ensure that equipment, machinery, plant, and work practices are compliant to the legal requirements as these apply.*
- *Any other potential responsibility or alternative arrangement shall be dealt with in a Mandatary Agreement, as defined in Section 37(2) of the Act, or the contract.*

4. Purpose of the Construction Health and Safety Specification

- *The purpose of the CHSS is for the specification to be used as the standard on which a Contractors' H&S Plans must be based. The CHSS will be applicable on any construction project for the MBM.*
- *This CHSS shall be incorporated and considered when a SSHSS is developed.*

5. Implementation of the Construction Health and Safety Specification

- *This CHSS forms an integral part of the Contract, and Principal Contractors are required to make it an integral part of their contracts with their contractors and suppliers. It will be disseminated by the MBM to persons responsible for the design of infrastructure, projects and SCM, who will ensure that it is included in the Tender Document(s) issued to prospective Principal Contractors.*

- *The prospective Principal Contractors shall allow in their tenders for the cost of Health and Safety and complying with the requirements of the OHS Act and regulations, other legal requirements, this CHSS or additional SSHSS or other agreements.*
- *This CHSS shall be incorporated and considered when a SSHSS is developed.*
- *The Principal Contractor must provide the CHSS to their contractors.*
- *The Principal Contractor must sign Annexure 1 of this CHSS.*
- *The (an) Contractor must sign Annexure 2 of this CHSS. This would include a contractor of a principal contractor, and a contractor of a contractor. (a.k.a. sub-contractors)*

6. Scope

- *This CHSS covers the general requirements for addressing and mitigating Occupational Health and Safety related risks, problems, incidents, and injuries on projects constructed or executed for the MBM.*
- *The scope addresses legal compliance, hazard identification and risk assessment, promoting a health and safety culture amongst those working on MBM projects and those affected by the activities taking place in and around them.*
- *This CHSS serves as a guide and is not limited, i.e., the contractor must add as may be necessary to ensure safety and compliance based on their scope and associated risk and site / conditions.*
- *The CHSS contains clauses that are generally applicable to building and construction and imposes controls associated with activities that impact on human health and safety.*
- *The Principal Contractor is required to comply with the provisions of the OHSA, all applicable Regulations (in particular the CR), other relevant legislation and associated standards, this CHSS or additional SSHSS or additional agreements made.*
- *The MBM or its agent will monitor the Principal Contractor's legal compliance and the requirements of the CHSS / SSHSS their H&S Plan.*

7. Compensation of Occupational Injuries and Diseases Act

- *The Principal Contractor shall submit proof of registration as an employer, and proof of Good Standing with the COID Fund, prior to starting the work.*
- *A copy of the valid Letter of Good Standing with the COID Fund must be included in the H&S Plan and an updated copy kept in the H&S File.*

8. Application for Construction Work Permit

- *When required, this shall be managed as per CR 3 by an appointed Pr. CHSA.*
- *A copy of the permit must be placed in the H&S File and*
- *The permit number must be displayed on site.*

9. Notification of Intention to Commence Construction Work

- *After receipt of the Letter of Acceptance from the MBM the Principal Contractor shall notify the Provincial Director of the Department of Labour of a notifiable project, 7 days before work commences as per CR 4(1).*
- *The notification shall be similar in format to Annexure 2 of the Construction Regulations.*
- *The acknowledgement letter from DoEL and a copy of the notification to the Provincial Director must form part of the H&S File.*
- *Should the project go past the planned end-date the principal contractor must apply for extension of the notification and place such proof in the H&S File.*

10. Risk Assessment for Construction Work

- *The contractor shall ensure that a risk assessment as per CR 9 is in place*
 - *Conducted by a competent person.*
 - *in terms of an acceptable and documented methodology.*
 - *Site specific based on the scope of works, site, method statements and anticipated plant, machinery, and equipment.*
 - *Consider other applicable regulations as and where required.*
- *Risk assessments of all activities shall form an integral part of the Health and Safety plan and the foundation on which control measures and safe work procedures are based to effectively manage risk and ensure the health and safety of all persons.*
- *The HIRA, as performed by the appointed competent risk assessor is always kept up to date and on site and revised should there be a change in scope of work, an incident occurs or the request of the client or a DoEL inspector.*
- *As part of the risk management process ensure a competent person conduct DSTI's (daily safe task instructions) and consider the daily conditions, planned work and related hazards, and ensure the necessary controls are in place. This must be communicated to the team present on site.*
- *Our Baseline Risk Table, Annexure 7, is attached for your information.*

11. Principal Contractor's Health & Safety Plan

- *The Principal Contractor shall submit a site and scope specific health and safety plan, in accordance with the legal requirements, prior to work starting.*
- *This plan must be presented and approved by the MBM OHS Department or its agent prior to the site being handed over to the Principal Contractor.*
- *Besides the legal requirements, the health and safety plan shall be structured as Per Annexure 5.*
 - a. *The front page shall allow place for signature of the CEO or assistant (OHSA 16.1 / 16.2), Construction Manager (CR 8.1), Construction Supervisor (CR8.7)*
 - b. *Scope and site specific*
 - c. *Additional documents as may be required may be added at the end.*

12. Health & Safety File

- *The Principal Contractor shall provide and maintain on the construction site, a H&S File, containing all the documents as proscribed in the OHSA and Regulations and all documents referred to in the H&S plan and require the same of their contractors.*
- *The H&S File shall be available for inspection by the MBM, its Agent, or a Department of Employment and Labour Inspector.*
- *The H&S File shall be structured as Per Annexure 4.*
 - a. *Additional documents as may be required may be added at the end.*

Consolidated H&S File: At Project Completion in terms of CR 7(1)(e)

- *The Principal contractor shall compile a consolidated H&S File and hand this to The Client's Project Manager at the end of the construction work project that include a record of the drawings, designs, materials use and other similar information concerning the completed structure.*
- *The consolidated H&S File shall be in soft-copy format (USB)
The consolidated H&S File shall include:*

- 1) *A list of all responsible persons appointed in statutory positions for the duration of the project.*
- 2) *The comprehensive list of all the contractors on site accountable to the Principal Contractor, including a list of the agreements between the parties and the type of work being done.*
- 3) *A copy of the approved H&S Documentation such as:*
 - a. *H&S Plan of the Principal Contractor.*
 - b. *Fall Protection Plan*
 - c. *Risk Register and Risk assessments*
- 4) *Designer inspections/assessments and confirmation of conformance.*
- 5) *A reference record of all drawings, designs and materials used*
- 6) *A reference record of H&S statutory certificates required by the owner; this reference record shall indicate the designated person of the Principal Contractor who is responsible for the document and The Client-designated person to whom the document has been handed.*
Reference records applicable to this project may include, but not limited to:
 - a. *Electrical certificate of compliance*
 - b. *Plumbing certificate*
 - c. *Structural certificate / design etc*
- 7) *A list / reference of all safety meetings held and related agenda.*
- 8) *A list of any concerns raised, or urgent matters recorded in the site diary.*
- 9) *Records of Site Inspections / Audits*
- 10) *All documents relating to any reportable injury or disease during the construction work, as defined in Section 24 and 25, of the Occupational Health and Safety Act.*
- 11) *Employee list and proof of inductions, SA ID document and Medical certificate of fitness.*

13. *Cost of occupational health and safety*

- *The budgeted cost of resources specifically aimed at Health and Safety compliance with this project must be documented in the Health and Safety Plan.*
- *Budgeting estimates must, amongst other, reflect:*
 - *Cost of training for statutorily defined Health and Safety appointees and competency's as may be required.*
 - *Cost of safety equipment / processes / procedures*
 - *Cost of Personal Protective Equipment*
 - *Cost for medical surveillance and medical certificates of fitness as per CR 7(8)*

14. *Induction*

- *The Principal Contractor must develop and conduct induction training pertaining to the hazards prevalent to their site / scope.*
- *The Principal Contractor shall ensure that all employees have gone through the induction training before commencing duties on site and that is relevant to the hazards present at the time of entry.*
- *The Principal Contractor shall place and keep an updated a copy of the attendance register in the H&S file.*

15. *Health and Safety Training*

- *See CR 1 Definitions: Competent Person*

- a. *where required training shall be Unit Standard Accredited, and*
 - b. *that the competent persons be familiar with the OHSA and applicable regulations.*
 - i. *It is advised that all persons be made familiar with the act and applicable regulations so that they may better understand the requirements posed.*
- *Employees must be trained:*
 - a. *Relevant to their scope and identified hazards*
 - b. *On relevant specific method statements*
 - c. *On relevant specific safe work procedures / safe work instructions etc.*
- *Employees must receive communication of:*
 - a. *The H&S plan and other relevant plans e.g., Fall Protection Plan, traffic management plan etc.*
 - b. *The site risk assessment (identified hazards and associated controls)*
 - c. *Site induction*
 - d. *Site emergency procedures.*
 - e. *Other site / company procedures*
 - f. *Anything that may impact the Health and safety of the employees or others (including public) that may be affected by the actions of the contractor or because of the scope of work of the contract.*
- *Toolbox talks or similar are considered general awareness and is recommended for continual safety reminders.*
- *The Principal Contractor shall ensure that daily pre-task health and safety instructions are given to all employees.*

16. *General Inspection, Monitoring and Reporting*

- *The Principal Contractor must appoint the relevant persons as may be required to ensure that they shall carry out daily safety inspections on the site (or more frequent, where so required in the Regulations), and shall take steps to rectify any unsafe condition of which he is aware.*
 - a. *No “make-shift” / “sub-standard” repairs on equipment / tools / machinery or plant shall be allowed.*
- *The Construction Manager must ensure that continuous competent supervision and monitoring of work takes place.*
- *Report any incident to the MBM OHS Department or our agent.*

17. *Incidents*

- *All incidents must be reported to the MBM OHS Department or our appointed agent on the same day.*
 - a. *Telephone call and followed up with an email.*
- *All incidents must be recorded and investigated and reported on email, to the MBM OHS Department or our appointed agent.*
- *A competent person with sufficient knowledge, training and experience must investigate any serious incident, or where more than 7 days man-hours are lost, or if otherwise requested by MBM OHS Department or our appointed agent, or DoEL.*
- *A record of all incidents and investigations shall be kept in the H&S File.*
- *The Contractor shall ensure to maintain compliance and communication with Compensation Assurance (e.g., DoEL / FEM) regarding the necessary incident management.*

18. Audits / Compliance Management and Monitoring

- *Should the need arise (e.g., as in the case of the Principal contractor appointing another contractor) the Principal Contractor shall ensure that internal audits are conducted in terms of CR 7(1)(c)(vii)*
- *As required in terms of CR 5 duties we, MBM OHS Department or our appointment H&S Agent, shall conduct regular health & safety audits (at least once a month) to ensure compliance with the OHSA, its regulations and the approved H&S Plan.*
- *Records of audits must be kept, and non-conformance reported, investigated and corrective action must be taken to prevent re-occurrence.*

19. Fire Precautions and Fire Fighting Equipment

- *In compliance with CR 29 manage fire risk appropriately and therefore must be included in the risk assessment.*
- *Monitor and inspect a workplace prior to assess for fire / explosion risk and if required contact the MBM OHS department for assistance.*
- *Open fires are not allowed on site unless permission obtained from the MBM OHS Department / Fire Department and or our Agent.*
- *Smoking is prohibited unless in a designated area.*
- *The Principal Contractor shall provide and maintain suitable fire extinguishers, which shall be serviced regularly, in accordance with the manufacturer's recommendations.*
 - a. *And ensure that persons are available on site trained in the use and operation of a fire extinguishing equipment.*
- *Safety signage shall be prominently displayed in all areas where fire extinguishers are located.*
- *Combustible materials may not accumulate on site.*
- *Hot work done only after necessary pre-cautions have been taken.*
 - a. *At times a hot work permit may apply.*
- *An evacuation plan is available with clear egress routes to an assembly-point and a means of siren/fire alarm.*
- *The monthly fire extinguisher inspection register must form part of the H&S File.*

20. Personal Protective Equipment (PPE) and Clothing

- *The Principal Contractor shall ensure that every employee is issued with and wear SABS-approved PPE, based on associated risks, consisting of, at least: a hard Hat, steel-capped safety boots, a reflective vest and an overall.*
- *Clothing must show the company name of the contractor.*
- *Other specific PPE that may apply must be listed in the H&S plan according to the scope of works and risk assessment.*
- *The contractor must ensure that each person is familiar with the use and limits of each PPE item issued to them.*
- *Ensure to monitor the use of PPE by the employees.*

21. Occupational Health and Safety Signage

- *The Principal Contractor shall display and maintain quality safety signage.*
- *The signage shall include, but not be limited to:*
 - a. *A Site construction safety board / sign*

- i. *warning on construction activities.*
- ii. *Access restrictions.*
- iii. *Emergency phone number(s)*
- iv. *Minimum PPE to be worn.*
- v. *Where falling objects may occur, relevant warning signs must be displayed.*
- b. *Any other such signage as may be determined in the risk assessment*

22. Contractors

- *As per CR 7 - The Principal Contractor shall ensure that all contractors under his control comply with their own approved H&S Plans, based on the CHSS, the requirements of the OHSA and all other relevant legislation.*
- *Monthly audits of all Contractors must be conducted, and records filed in the H&S file, and made available to the MBM or our Agent.*
- *The principal contractor to ensure that the contractor is competent to perform the work and that they have the means for necessary OHS compliance.*
- *Ensure that competent supervision is present.*
- *The principal contractor to bring to the attention of the client / MBM OHS Department or our agent of any incident, non-compliance and or challenges that they might experience from a contractor.*
- *Provide the contractor with this specification and ensure they sign Acknowledgement of the Specification. Attachment 4.*

23. Fall Protection

Should there be any fall risk:

- *The Principal Contractor shall submit the name and the curriculum vitae of the competent person who has been appointed to prepare a fall protection plan, in terms of CR 10.*
- *The signed appointment letter and proof of competency must be included in the H&S File and submitted with the H&S Plan approval.*
- *The fall protection plan shall be as per the requirements set out in the regulations and be site and scope specific.*

24. Excavation Work

Should there be any excavations:

- *The Principal Contractor shall submit the name and the curriculum vitae of the competent person who has been appointed to supervise all excavation work, in terms of CR 13.*
- *Should there be any uncertainty regarding the stability of the soil, the opinion of a professional engineer or professional technologist be sought, the Principal Contractor shall submit the name and the curriculum vitae of the said professional.*
- *And include that where required / applicable a Geotech report be made available.*
- *Proof of competency and the appointment letters must form part of the H&S File.*
- *The records of the inspections contemplated in CR 13(2)(h) shall be maintained in the health and safety file.*
- *The Principal Contractor shall be responsible to and ensure that:*
 - a. *Provision is made in his tender for all shoring, dewatering or drainage of any excavation unless otherwise stipulated elsewhere in the Contract.*
 - b. *The excavations are inspected before the shift starts and that a record is kept.*
 - c. *There are no unguarded excavations, regardless of depth.*

- d. *The safe working instruction has been communicated to the workers; and is enforced and always maintained by the Principal Contractor.*
- e. *all excavated faces are maintained in a safe condition to protect any person and related works and to prevent injury or delays caused by slope failure.*
- f. *No excavation shall be left open during the Contractor's holiday (December and January) and long weekends or other extended no-work periods.*
- g. *All excavations which have not been finally backfilled and compacted at the commencement of the said holiday period shall be temporarily backfilled and compacted to a standard which shall:*
 - i. *Prevent damage occurring to the excavations or any other part of the Works.*
 - ii. *Prevent damage to or physical loss to property of any persons; and*
 - iii. *Eliminate the risk of injury to any person.*

25. Explosives and Blasting

- *The Principal Contractor shall ensure that the use of explosives and blasting (where required) be undertaken in accordance with the Explosive Regulations, 2002. by a competent specialist, with proven track record in the type of work to be performed.*
- *The letter of appointment and proof of competency must be included in the H&S file after prior submission to the MBM OHS Department or our agent for review.*
- *This includes explosive actuated fastening devices*
 - a. *Ensure compliance to CR21*
- *Prior notification and approval to the MBM OHS department and our agent is required should any form of explosive be used.*

26. Demolition Work

Prior to any demolition work being carried out, the Principal Contractor shall submit the following as part of his H&S Plan:

- *The name, letter of appointment and the curriculum vitae of the competent person who has been appointed to supervise all demolition work, in terms of CR 14.*
- *A safe working procedure and a detailed engineering survey of the structures to be demolished*
- *The Principal Contractor shall ensure that demolition work always complies with CR 14.*

27. Asbestos Work

The Principal Contractor shall for any Asbestos Related work (during the dismantling and removal of asbestos containing material, including all asbestos fibre-cement products) ensure:

- *Compliance with the Asbestos Abatement Regulations, 2020.*
- *Determine if it is type 1, 2 or 3 asbestos work and comply accordingly.*
 - a. *Not perform any asbestos related work of which they are not permitted / compliant.*
- *That all asbestos waste is disposed of only on sites specifically designated for the purpose of Asbestos in terms of the Environment Conservation Act, 1989, and the National Environmental Management: Waste Act, 2008; and*
- *A certificate(s) of disposal is provided to the client MBM OHS Department or our agent.*
- *Asbestos work might require an additional safety specification.*

28. Underground Services

- *The Principal Contractor shall prior to any form of digging / excavation / piling / drilling etc ensure that all reasonably possible means have been used to assess and determine if there are any underground electrical / other services.*
- *The Principal Contractor shall not allow or permit any of his personnel to manhandle any exposed electrical cable, unless directly authorised or instructed / requested to.*
- *All electrical cables shall be assumed to be “live”, and the Principal Contractor shall take adequate steps to ensure that members of the public are prevented for accessing any electrical cables.*

29. Temporary Works

- *Temporary Works includes all as per the Construction Regulations 1 definition. – compliance with each type shall be as per the applicable regulation or a combination thereof.*
- *Compliant to CR12 - The Principal Contractor shall submit the necessary appointment letters and proof of competency for the appointed / designated competent persons. e.g.*
 - a. *Temporary works Designer / Inspector*
 - b. *Temporary works Supervisor*
 - c. *Scaffolding Erector / Inspector*
 - d. *Excavation Supervisor*
- *A method statement shall be included in the H&S plan, addressing all aspects of safety management of erection, dismantling, and working on and around scaffolding.*
 - a. *The Principal Contractor shall ensure that all scaffolding complies with the legal requirements and safety standards.*
- *A method statement shall be included in the H&S plan, addressing all aspects of safety management during erection, use of and dismantling of false work, form work and support work.*
- *A method statement shall be included in the H&S plan, addressing all aspects of safety management during erection, use of and dismantling of any temporary structures / temporary works.*

30. Ladders – GSR 13A

- *The Principal Contractor must develop and communicate a safe work procedure to all their applicable workers.*
- *All ladders used to be fit for purpose, and*
 - *only be used for the purpose for which they are designed*
- *All ladders shall be maintained in a good and safe condition.*
 - *No “make-shift” / “sub-standard” repairs shall be allowed.*
- *Ladders shall be compliant to the statutory requirements / safety standard as may apply.*
- *Ladders shall be inspected visually before use and monthly recorded on a register kept in the H&S File.*
- *Ladders shall extend at least 90 cm above any level or opening accessed with the ladder.*
- *No vertical ladders shall be accessed by any person unless firmly attached at the bottom and top or held in place by a fixed installation or a buddy.*
 - *A drop-zone or similar be identified under and around the ladder work.*

31. *Piling / Drilling (Rig)*

- *The Principal Contractor shall ensure that where rig operations for piling or drilling is undertaken, it is done so by a competent specialist contractor or a Contractor with proven record in the type of work to be performed.*
- *Based on the Risk assessment, task and area specific method statements and safe work procedures shall be submitted as part of the H&S Plan and must be communicated to all person before start of activity.*
- *Recent (not older than 6 months) service records of equipment must be provided in the H&S File.*

32. *Construction Vehicles and Mobile Plant (including Hired Plant)*

- *The Principal Contractor shall ensure that all construction vehicles and mobile plant, whether owned or hired, complies with the applicable legislation and requirements of the OHSA and applicable regulations.*
- *Use and operation there-of shall be done only within the legal limits and standards by a competent person.*
- *The Principal Contractor shall inspect and keep records of inspections of Construction Vehicles and Mobile Plant and equipment used on site.*
- *Operated by a competent operator - Only competent and authorised persons (appointed) with a valid competency and a valid medical certificate of fitness are to operate Construction Vehicles / Plant and Machinery, and as may be required under competent supervision.*
- *Appropriate safety equipment and clothing shall be provided for the operators and always maintained in good condition.*

33. *Electrical Installations and Machinery*

- *The principal contractor shall always ensure compliance to CR24.*
- *The Principal Contractor shall survey and identify the work area for any services. This may include underground, surface or overhead, and*
 - shall appoint a competent person to (in the vicinity of or related to the work area)*
 - identify and inspect all underground cables, overhead cables, and any electrical installations such as transformers or distribution boxes, to ensure that these are not a hazard to employees or to members of the public.*
- *The Principal Contractor shall develop and implement a method statement for the identification and safeguarding of all electrical services during the construction work.*
- *The Principal Contractor shall appoint a competent electrician who shall ensure zero potential of all electrical reticulations worked on and who shall ensure that dedicated power sources are safely installed for the use during the construction.*
- *The Competent electrician shall also be responsible to ensure safe and compliant electrical installations in the sections of scope of the project and issue a required CoC.*
- *The letters of appointment, proof of competency and inspection registers shall be included in the H&S File.*
- *All electrical cables shall be assumed “live” and, where applicable, the Principal Contractor shall take adequate steps to ensure that employees and members of the public are prevented from accessing any electrical cables and or installations.*

- *The Principal Contractor shall calculate and plan and include a method statement on the safe use of electrical reticulations of the MBM and avoid any overloading or shorting of the system.*
- *No live energy work shall be performed without prior acknowledgment from the MBM responsible person.*
- *Contractors must ensure that all energy is brought to zero potential, that residual energy is purged, that energy sources are switched off and locked out by all employees working in the danger zone and are tagged, prior to any work being performed on the energy source, reticulation or machinery.*
- *The contractor shall include a zero Potential, Lock Out and Tag Out method statement and safe work instruction(s) in the H&S File.*
- *No electrical machinery / tools shall be allowed to have any unsafe joined leads.*
- *The principal Contractor shall ensure that all electrical testing equipment to be used on site has a valid calibration and that the calibration sticker is affixed to the equipment, clearly indicating the calibration date and the next due date.*
- *Any unsafe condition shall immediately be reported to the MBM OHS Department, MBM responsible person or our agent and the contractor shall take immediate steps to prevent employees or members of the public from gaining access to the dangerous installation and the area surrounding it.*
- *The Principal Contractor shall appoint a competent person to inspect all portable electrical tools, including leads.*
- *The letter of appointment and template of the inspection register shall be included in the H&S File.*
- *The Principal Contractor shall include a method statement for the safe use of portable electrical tools, including the management of the hazards of extension leads and temporary electrical installations.*
- *A COC for all installations shall be provided; for temporary installations, the COC shall be placed in the H&S File on site.*

34. Public Health and Safety

- *The contractor is informed that the MBM at time may have certain scope of work / contract / tender or project that directly exposes public and or our staff.*
- *There are frequent visitors (as public) to our municipal premises or facilities (including use of infrastructure, services, facilities) and the contractor must ensure to assess and safeguard any person or property that may be exposed in any manner due to the scope of work given.*
- *Contractors are in their own entity as an employer obligated under the OHS Act Section 9 to ensure that persons are not exposed to hazards that may harm their health or safety.*
 - a. *MBM takes pride in ensuring to maintain a top-class construction site that always promotes good health and safety practices and aim to achieve this, thus requiring each contractor to do the same.*
- *Public are at times inquisitive and the contractors must therefore plan, apply and maintain:*
 - a. *Appropriate health and safety signage / lights / warning at all times.*
 - b. *Effective and physical access restriction to the construction site, in particular any drop / fall risk areas and moving plant / vehicles / machinery at all times;*
 - c. *Effective risk management – e.g., consider traffic, pedestrians, daily operations, weather etc.*
 - d. *Competent supervision*

- *When work needs to be conducted on public roads, the Principal Contractor must ensure effective traffic management in accordance with the South African Road Traffic Signs Manuel, in particularly Volume 2, Chapter 13.*
- *The Principal Contractor shall ensure that each person visiting the site (with the necessary reason / authority) shall be inducted to the site and such induction shall outline the hazards likely to arise from on-site activities and the precautions to be observed to avoid or minimise those risks.*
- *Even though environmental laws apply, in the context of public health & safety your actions / activities that may affect the environment must also be accounted for. E.g., Illegal disposal of waste / rubble shall not be tolerated.*
- *Consider noise pollution to those in the vicinity and manage accordingly.*

35. Night Work

- *Night work (after 18:00 and before 06:00 the next day) may not be performed, unless authorised by the MBM relevant project manager or our Agent.*
- *Ensure a suitable specific risk assessment is conducted for performing the task at night and that adequate controls are in place.*
- *The Principal Contractor shall ensure that adequate lighting is provided for all night work.*
- *It shall be discussed with the employees and determined if the employees are medically fit to perform night work.*
 - a. *And manage fatigue accordingly.*
- *All persons shall be issued with the required PPE for night work.*
- *Consider noise pollution to those in the vicinity and manage accordingly.*
- *Consider low light conditions*
- *Consider traffic management*

36. Storage of flammable liquids

- *Ensure compliance to GSR 4 and CR 25 and 29*
- *Flammable substances must be stored, used, and applied in such a manner that it does not create a fire or explosion hazard and that the workplace is properly ventilated.*
- *Ensure that as may be required every person involved are provided with suitable PPE.*
- *No smoking around any flammable substances.*
- *The H&S Plan shall include a method statement detailing the safe use, storage, decanting and spill controls for all flammable liquids used or stored on site.*
- *No excessive amounts of a flammable substance may be kept on site. I.e., no more than what is necessary at a particular time.*
- *Storage management must also comply with Environmental legislation.*

37. Hazardous Chemical Agent Management

- *Ensure compliance with Regulations for Hazardous Chemical Agents, 2021*
- *With respect to Hazardous Chemical Agents used, the contractor shall ensure that:*
 - *All SDS are included in the H&S file.*
 - *The safe use, storage, emergency procedures and safe disposal of hazardous agent are addressed in a method statement/s, included in the H&S Plan.*
 - *Proof of competency and signed letters of appointment of the person responsible for chemical handling, is included in the H&S file.*

- *That first aiders are made aware of first aid procedures*
- *Any hazardous chemical agent intended to be applied on site during the project (i.e., after approval of the H&S Plan) shall be subject to an issue-based risk assessment and method statement, which must be presented to the MBM or our agent prior to the substance being introduced on site.*
- *No excessive amounts of an HCA be kept on site. I.e., no more than what is necessary at a particular time.*

38. Emergency and First Aid Management

- *The Principal Contractor shall ensure that adequately trained first aiders are on site at all times when construction employees are on site; this applies even if less than 10 employees are on site.*
- *First aiders shall be identifiable and shall have immediate access to a comprehensively stocked first aid box.*
 - *Such first aid box shall be stocked to include all first aid equipment as per the minimum requirements listed under General Safety Regulation 3, and any additional items identified in the risk assessment, for the area and scope of work.*
- *The Principal Contractor shall ensure that first aid employees are familiar with the rescue procedures from anticipated incidents and accidents.*
 - *E.g., may include technical rescues, fall rescues, confined spaces, water environments etc.*
- *The Principal Contractor shall assess the types and likelihood of incidents / emergency that may occur and ensure that adequately trained competent persons are available to assist with such emergencies.*
 - *E.g., may include technical rescues, fall rescues, confined spaces, water environments etc.*
- *Unless a unique or uncommon risk / scope and type of emergency is anticipated the contractor may not by default rely on the emergency services of the municipality.*
 - *Should the assistance of the MBM emergency Services be anticipated it must be requested, discussed, and agreed to in writing and the right remains reserved.*
- *The MBM OHS Department and MBM Emergency Services, must be notified of any anticipated high-risk scope of work and possible serious emergencies.*
- *All the above controls shall be documented in the H&S Plan.*

39. Facilities for employees

- *The Principal Contractor shall ensure compliance to CR 30 and the Facility Regulations as may apply and,*
 - a. *Provide facilities for safekeeping, e.g., lockers etc. for each employee;*
 - b. *Ensure that employees requiring to change on site can do so in privacy;*
 - c. *Ensure drinking water is available*
 - d. *Provide shade and*
 - e. *sheltered suitable eating area*
 - f. *Soap and a place to wash and dry hands*
- *The principal Contractor shall provide and maintain sufficient sanitary facilities on site in ratio as per CR 30(1)(b)*
- *And ensure that all is kept in a clean and hygienic condition.*
- *Ensure that good housekeeping is maintained, and the waste does not accumulate, and it is removed at regular intervals.*

40. COVID-19 Management

- The *Principal Contractor and its contractors* must confirm to comply with the Code of practice Managing exposure to SARS-Cov-2 in the Workplace, and aid to assist us in best managing the SARS-COV-2 (COVID-19) spread by following requirements as may apply.
- At all times as best possible practices safe social distancing
- Educate and enforce mutual respect for the health of others. E.g., do not come to work if you are sick.
- Ensure all you workers are provided with and wear required PPE.
- Ensure to provide your employees with the required sanitisers.
- Manage COVID-19 according to the National Health Act (NHA), the Code of practice: Managing exposure to SARS-Cov-2 in the Workplace, and applicable regulations in conjunction with all other relevant legislation.
- Immediately notify the MBM OHS department should you have an employee that (has been to any of our “municipal areas”) show COVID-19 like symptoms or test positive for COVID-19.

41. Penalties

- Penalty Fee for OHS Non-Compliance will amount to R2000.00 per incident to the maximum of 10% of the total Contract Value including VAT.
- OHS Penalty Fee of R2000.00 will be applicable per incident, per site, per day, per area, per works, per non-compliance incident.
- Penalty Fee issued by the MBM OHS Department Officer, will be deducted from the Payment Certificate issued for work completed.

**Acknowledgement by
Principal Contractor**

Construction Health and Safety Specification

issued in terms of the Occupational Health and Safety Act, 1993

Principle Contractor: _____

Project / Contract name: _____

Project / Contract number: _____

I, _____ (Name and Surname),

representing _____ (The Principal Contractor)

have satisfied myself with the content of this Construction Health and Safety Specification and shall ensure that we and any Contractor / supplier comply with it.

Principal Contractor
16(1) / 16(2)

Date

**Acknowledgement by
subcontractor**

Construction Health and Safety Specification

issued in terms of the Occupational Health and Safety Act, 1993

Contractor: _____

Project / Contract name: _____

Project / Contract number: _____

I, _____ (Name and Surname),

representing _____ (subcontractor name)

have satisfied myself with the content of this Construction Health and Safety Specification and shall ensure that we and any subcontractor / supplier comply with it.

Contractor
16(1) / 16(2)

Date

Annexure 3 - Signed Mandatory Agreement S37(2)

MANDATORY AGREEMENT

In terms of Section 37 (1) (2)
of the
Occupational Health and Safety Act (85 of 1993)

AGREEMENT BETWEEN:

Mossel Bay Municipality (MBM)

&

_____ MANDATARY (Contractor)

WITH Compensation Fund Policy Number: _____

FOR the following Project / Contract / Tender: _____

1. Whenever an employee does or omits to do any act which it would be an offence in terms of this Act for the employer of such employee or a user to do or omit to do, then, unless it is proved that-
 - a. in doing or omitting to do that act the employee was acting without the connivance or permission of the employer or any such user.
 - b. it was not under any condition or in any circumstance within the scope of the authority of the employee to do or omit to do an act, whether lawful or unlawful, of the character of the act or omission charged; and
 - c. all reasonable steps were taken by the employer or any such user to prevent any act or omission of the kind in question,
2. The employer or any such user himself shall be presumed to have done or omitted to do that act and shall be liable to be convicted and sentenced in respect thereof; and the fact that he issued instructions forbidding any act or omission of the kind in question shall not, in itself; be accepted as sufficient proof that he took all reasonable steps to prevent the act or omission.
3. The provisions of subsection (1) shall "mutatis mutandis" apply in the case of a mandatory of any employer or user, except if the parties have agreed in writing to the arrangements and procedures between them to ensure compliance by the mandatory with the provisions of this Act.

Definition of Mandatary (OHSA S1)

Includes an agent, a contractor or Contractor for work, but without derogating from his status in his own right as an employer or user.

AGREEMENT

In terms of the provisions of section 37(2) of the Occupational Health and Safety Act (85 of 1993)

I, _____ (name) representing / acting for and on behalf of

_____ (Mandatary) undertake to ensure that the requirements and provisions of the Act and all applicable regulations, the safety specification issued, and other agreements made are complied with.

Signature of Mandatory

Date

Signature of MBM

Date

NB: Signature of this Agreement means that the Mandatory has read and understands the "Requirements of Mandatories" addendum attached.

**REQUIREMENTS FOR MANDATORY / PRINCIPAL CONTRACTORS
ADDENDUM TO THE PRO FORMA "MANDATORY AGREEMENT"**

As we are fully committed to the Health and Safety of persons, and to as far as is reasonably practicable comply with the requirements of the Occupational Health and Safety Act (85 of 1993) (OHS Act) and any other applicable OHS (Occupational Health & Safety) legislation and standards, we require of our Mandatories / Principal Contractors to:

1. Sign a written "Agreement with Mandatory" as required by Sect 37(1)(2) of the Act before commencing any work on site.
2. Ensure that all your employees receive the necessary Induction Training and have proof thereof in your OHS File.
Note: You must ensure that all employees under your control are informed, instructed and trained by a competent person regarding any hazard and the related work procedures before any work commences.
3. Provide the MBM OHS Department with your H&S File – *Note: You are responsible for providing your own legal safety documents and registers to comply with the requirements.*
4. Ensure that Method Statements, Risk Assessments and Safe Work Procedures are done and available specific to the scope and your employees are informed of the content.
5. Provide the MBM OHS Department with written appointment of the person who is going to Supervise the Work. As per OHSA 8(2)(i)
6. If required - Provide the MBM OHS Department with written designation of your nominated Health and Safety Representative as per Section 17(1).
7. If you employ more than five (5) persons, you are required to provide your own First Aid Box (GSR 3(2)).
8. If you employ more than ten (10) persons, you are required to provide your own qualified First Aider as per GSR 3(4)
9. When working with Hazardous Chemicals, comply with Regulations for Hazardous Chemical Agents, 2021. *Note: Asbestos and Lead dealt with separately.*
10. Construction work is excluded and shall be dealt with separately in compliance with Construction Regulations, 2014.
11. When using Lifting Machines and Lifting Tackle, comply with DMR 18 *Note: You may be required to appoint a Banksman to control Lifting/Slinging operations*
12. When installing / repairing air-conditioning, comply with DMR 16.
13. When accessing fall risk areas – ensure to compliance with GSR 6 and 13A. Scaffolding comply with the requirements of SANS-10085 "Access Scaffolding"
14. When doing Electrical work, comply with the requirements of EIR and EMR Construction *Note: Provide copy of registration as required*
15. When working over or near (in close proximity to) Water, comply with Construction Reg. 26
16. Ensure that good Housekeeping, Stacking and Storage principles are applied.
17. Ensure that appropriate measures are taken to avoid the risk of Fire/Explosion.
18. If you are going to work at heights a Fall Protection Plan must be submitted (roof work included) as per requirements of Construction Reg. 10

19. When using Explosive Powered Tools, comply with Construction Reg 21
20. When Welding, Flame Cutting/Soldering, comply with GSR 9
21. When working in Confined Spaces, comply with GSR 5
22. You are required to comply with General Safety Regulations 2 and provide your employees with:
personal protective equipment which will allow them to carry out their work in a safe manner.
23. Reporting, Recording and Investigations of Incidents or Occupational Diseases shall be done as per General Admin. Regulation 8 / 9 (Also see Sect 24 of the Act) – none the less always be reported to the MBM OHS Department.
24. You are required to provide proof of registration with the Compensation Commissioner/ Federated Employer(s) Mutual when signing this agreement. If you are not registered, we may deduct the necessary amounts from your progress payments and pay it over to the Commissioner to ensure that you are insured. See Section 80 and 89 of the COID Act.
25. Manage SARS-COV-2 (COVID-19) as per the latest current legislation and comply with the requirements posed by the MBM.

Annexure 4 – Health and Safety File Index

- Cover Page (Contract Award Letter / Appointment Letter) Project details – Name Company details etc)
 - Index of the H&S File (*This Annexure 4*)
1. Notification of Construction Work (annexure2) and proof of delivery or if required Construction work Permit
 2. Letter of good standing COIDA
 3. Occupational Health and Safety Policy
 4. Relevant drawings / designs
 5. Risk Management
 - a. Issue Based Risk Assessments, & DSTI Template
 - b. Risk monitoring and review records
 6. H&S Plan (*Annexure 5*) - Including Plan Approval Letter from MBM.
 7. Fall Protection Plan
 8. Method Statements / SWI
 9. Permission / agreement letters (for when special permission required from client) e.g., night work.
 10. HR Management
 - a. Organogram
 - b. List of Appointments (*Annexure 6*) & signed letters of appointments
 - c. Evidence of competency (registrations, qualifications, and other proof of competency)
 - d. Employee lists
 - e. Medical Certificates of Fitness
 11. Contractor Management
 - a. List of Contractors
 - b. Their appointment letters
 - c. Their H&S File / Plan Approvals
 12. Training Management
 - a. Competency Training Matrix
 - b. Training records / Certificates (other than for specific appointments)
 - c. Risk Assessment, H&S Plan, Fall Protection etc. communication
 - d. Training registers of Method statements, SWP's / SWI's etc
 13. CH&S Induction (Staff and Visitors)
 - a. Induction Content
 - b. Records of inductions (Staff & Visitors)
 14. Emergency, Accident, and Incident Management Plan
 - a. Emergency Plan / Incident Management
 - b. Incident Register
 - c. First aid treatment (this can be in the first aid kit)
 - d. Investigation reports & COIDA
 15. H&S Inspection & Maintenance Registers
 16. PPE Management
 - a. Issue Register
 - b. Training records
 - c. Inspection records
 17. Audits & Including Corrective / Preventive Action plans for audits
 - a. Internal Audits
 - b. Contractor Audits
 - c. Client Audits

- d. DoEL Audits
- 18. Signed Section 37(2) agreements (*Annexure 3*)
 - a. Agreement between The Client and the Principal Contractor
 - b. Agreement between the Principal Contractor and each Contractor
- 19. HCA Management
 - a. List of Hazardous Chemicals / Agent or Products that contain HCA's and their SDS's
 - b. Communication records
 - c. First aider familiarisations records
- 20. Waste Management
 - a. Plan / Process / Procedure
 - b. Disposal Records
- 21. This CHSS & Signed Acknowledgement of CHSS (*Annexure 1 or Annexure 2* for contractors)
- 22. Toolbox talks
- 23. Records of site safety meetings
- 24. Other

Annexure 5 – Health and Safety Plan Index

- Cover Page
 - Index of the H&S Plan (*This Annexure 5*)
- A. Scope of work & activities, equipment, machinery, plant, hazardous articles, and selected contractors to be used in the project
- B. Project-specific baseline hazard identification and risk assessment & risk register
- C. Health and Safety Resources and Budget
- D. Competency of Principal Contractor
- 1) List of 5 Previous similar projects / construction activities
 - 2) OHS competency
- E. Organisational chart including list of employees
- F. Safety officer: duties, responsibility, authority, document control, communication
- G. Principal Contractor H&S management processes:
- 1) Risk Management: such as the issue-based risk-, risk review- and risk monitoring
 - 2) H&S Induction, training, and H&S competency management (including OHS Induction and applicable safe work instruction templates)
 - 3) General record keeping management
 - 4) Contractor and Sub-contractor management
 - 5) Site communication management
 - 6) Fatigue management
 - 7) First aid, accident & incident, and emergency management
 - 8) Fire prevention and equipment & hot work management
 - 9) Safety signage management
 - 10) Access & on-site traffic and public H&S management
 - 11) Fall Risk Work Management
 - 12) Temporary work management
 - 13) Scaffolding management
 - 14) Ladder safety
 - 15) Demolition management
 - 16) Electrical management
 - 17) Delivery, offloading, stacking, storage, and housekeeping management
 - 18) Hazardous chemical substances management
 - 19) Construction plant and machinery management
 - 20) Hired plant and machinery management
 - 21) Lifting and rigging management
 - 22) Employee facilities management
 - 23) PPE management
 - 24) Safety Inspections and Inspection Register management
 - 25) Internal Audit management
 - 26) Waste management
 - 27) Other

Annexure 6 – List of Appointments
CONSTRUCTION APPOINTMENTS

#	Designation	Legal reference	Name and proof of competence
1.	Assigned Responsibility Designation	OHSA S16(2)	
2.	Construction Manager	CR 8(1)	
3.	Construction Supervisor	CR 8(7)	
4.	Construction Supervisor Assistant	CR 8(8)	
5.	Traffic controller	S 8(2)(i)	
6.	Contractor of principal contractor	CR	
7.	Sub- Contractor of contractor of principal contractor	CR 7(1)(c)(v)	
8.	Emergency / Fire Co-Ordinator	OHSA S8	
9.	Fire Extinguisher Inspector	CR 29(h)– PER 19	
10	First Aider	GSR 3	
11	Safety Officer - CHSO	CR 8(5)	
12	Incident Investigator	GAR 9	
13	Risk Assessor	CR 9(1)	
14	Risk Assessor (on-site)	CR 9(1)	
15	Demolition Supervisor	CR 14	
16	Excavation Supervisor	CR 13	
17	Fall Protection Plan Developer	CR 10(1)(a)	
18	Temporary works designer	CR 12(1)	
19	Temporary works supervisor	CR 12(2)	
20	Construction Vehicle & Mobile Plant Inspector	CR 23(1)(k)	
21	Construction Vehicle & Mobile Plant Operators	CR 23(1)(d)	
22	Registered electrician	EIR 5(4,5)	
23	Electrical contractor	EIR 6	
24	Electrical Installation Controller	CR 24(c)	
25	Electrical Installation Inspector	CR 24(d)	
26	Ladder Inspector	GSR 13A	
27	Lifting Machine Operator	DMR 18	
28	Portable Electrical Equipment Inspector	EMR 9	
29	Scaffold designer	CR 12(1)	
30	Scaffold Erector / Inspector	SANS	
31	Scaffolding Supervisor	CR 16(1)	
32	Stacking & Storage Supervisor, including chemicals	CR 28	
33	Responsible for housekeeping	CR 27	
34	Person Responsible for HCS	HCS	

(Not limited)

Annexure 7 – Baseline Risk Table

BASELINE RISK ASSESSMENT

Scope of the works (as indicated on the drawings or by alternative instruction) and scope of work issued

Hazardous events

- (1) The Client identifies the following hazardous events specific for this construction project:
 - a) The Client employees, visitors, public or other services may possibly access the site and get injured.
 - b) Electrical works - may pose a risk of fire, electrocution and electrical shorting;
 - c) Demolition work may cause a fall and collapse risk
 - d) Brick / concrete works may pose dust-, fall-, drop-, and collapse risks.
 - e) Height work with a risk of falling.
 - f) Traffic Risk -transporting, delivery etc of material, persons, and equipment inclusive but not limited
 - g) Damage to client /public property or infrastructure

- (2) General construction activities from which hazards and risks emanate, which are universal for this type of construction work include:
 - a) Transport of persons, equipment, and articles to and from the site with associated transport and road-risks
 - b) Off-loading and loading of equipment and articles with associated rigging, lifting and mechanical risks (crushing of persons, crushing of limbs, hand injuries)
 - c) Use of small power (electrical and combustion) plant on site with associated health risks (diesel-, dust- inhalation, noise, whole body vibration, prolonged sitting work) and safety risks (mechanical risk of cutting, crushing, running out of control and operator fitness, training & competency)
 - d) Material handling with the ergonomic hazards of repeated bending, lifting, and carrying heavy objects.
 - e) Crush hazards during lifting, carrying, and placing of heavy objects
 - f) Manual handling with the ergonomic hazards of using hand tools, power tools (grinder, concrete cutter, jackhammer, drill etc), heavy objects lifting or torquing of the body
 - g) Hazards associated with a demolition-dust, cement-dust, and concrete dust exposure during, respectively, demolition, concrete- and dagga-mixing, concrete cutting or grinding, painting and glues
 - h) Lacerations from sharp objects such as metal objects
 - i) Work at a fall risk position
 - j) Exposure to HCS, and possibly HBA – posing some health and safety risks

- (3) Table C (following page) lists the tasks, machinery or installation exposure which may cause the health and safety hazards and associated risks during this project.

TABLE C

Hazard	Task-machinery-installation exposure	Safety risk	Health risk
Noise	Grinders / breakers	Acoustic trauma, Communication error leading to accidents	Noise induced hearing loss
Hand Arm Vibration	Grinders, jackhammer-operator		Work related upper limb disorders
Electricity	Existing or new services Electrical reticulation & portable machinery Unknown services	Electrocution Fire	
Construction dusts (demolition, cement, sanding paint)	Dust from works	Bronchospasm – skin-eye irritation	Asthma – dermatitis - conjunctivitis
Paints, glues, thinners	Painting		Irritation Neurological effects
Lifting/bending	All manual work	Acute muscular strain	Chronic muscular strain
Repetitive actions	Most laborer’s manual work		Chronic muscular synovial –skeletal
Prolonged standing	Most laborer’s manual work		Venous stasis, oedema, backache
Impact strain	Work with hammer, pick, spade		Headaches, muscular pain neck and shoulders
Working at heights	Access and egress at heights and work at fall risk position	Falls – serious injury / death	Muscular strain
Fitness for duty	Intoxication by employees-drugs/alcohol/medication	Accidents leading to injury	
Employee wellness	Personal – social –financial professional-health	Accident	Negative knock-on affecting work culture
Fatigue	Monotonous work, overtime, work rostering, personal issues	Lacerations, fractures, caught in machine or traffic	No-care mindset
Dangerous work	Fall Risk Handling sharp objects Excavations and work in excavations Scaffold erection Work with electrical installation Installation / commissioning of	Falling Lacerations, fractures, crush injuries and death Falling objects injuries Electrical shock Pinch crush and drop	
Dangerous equipment	Small plant, Mobile construction plant, Compactors	All sorts of accident-risks	
Dangerous Actions	Unauthorised work at heights or in drop zones Unauthorised demolitions, slips, trips, falls Live electrical connections	All sorts of accident-risks	All sorts of disease-risks
Lifting and rigging	Unsafe lifting and Using unsafe equipment	Various serious and possible fatal results.	

HEALTH AND SAFETY BASELINE RISK ASSESSMENT

Construction work	Hazardous Event	Health & Safety Risk
Access and transport on and to site	Transportation, traffic control	Motor vehicle accident and fatalities
Site establishment	Rigging – off loading- placement of containers and machinery	Falling objects - Sliding objects Cuts and lacerations – crush injuries
Off-loading equipment, machinery, materials	Manual rigging and possible crane operations- rigging- movement of equipment	Falling and moving objects or machinery Ergonomic strain, crush, death
Storage & stacking	Moving storage or stacks (bricks, sheets etc.)- picking off stacks	Falling objects or machinery- crush injuries
Chemicals and fuels	off-loading into bulk storage, decanting – refueling - spills	Fire, explosion, health, and safety of persons – chemical burns etc.
Members of the public in construction area	Public close to works in progress exposed to hazards	Injuries- death
Unidentified services	Electrocution, water leaks	Shock, burns, death, flooding, death
Electrical services and installation	Electrocution	Shock, burns, death, electrical explosion, death
Brick -and concrete works	Handling cement, concrete, heavy objects Falling structure- especially where retarding mortar is used	Skin, eye chemical insult, ergonomic strain
General construction work	Hand tools- small portable electrical tools- manual handling- sharp articles – electricity	Hand-, eye injuries, crush injuries, noise exposure, dust exposure – ergonomic strain –electrical shock - fire
Ladder –scaffold work	Collapsing –fall -drop	Severe injury- death
Chemical substances	Cement-dust- glues-paints- thinners, other HCS	HCS-specific illness
Lifting, rigging operations	Lifting articles	Falling articles- severe injury, death
Manual lifting and repeated movement	Ergonomic stress	Back and other muscular injury or disease
Manual work	Use of hands – strain on muscles and back	Lacerations, crush injury, back injury, muscle injury
Installation work at heights	Fall risk – drop risk, Ergonomic strain	Serious injury, death, musculoskeletal strain
Temporary works	Fall risk – drop risk Collapsing structure	Serious injury, death, musculoskeletal strain
Installation of fittings	Manual work- small power tool work- awkward positions – sharp objects	Lacerations – eye injury - musculoskeletal strain
Carpentry – shop fitting – flooring	Manual work- small power tool work- awkward positions – sharp objects	Lacerations – eye injury - musculoskeletal strain
Demolition	Structural collapse- impact tools- unidentified services-	Crush-, eye-, skin-, hand and shoulder injuries- severe to death

Annexure 8 – EMERGENCY NUMBERS

EMERGENCY NUMBERS			
FIRE, RESCUE & DISASTER MANAGEMENT SERVICES		MBM	<u>044 691 3722</u> 044 606 5107 / 5121
AMBULANCE		By Grace EMS	063 675 1936
		ER24	084 124
HOSPITAL		Life Bay View	044 691 3718 044 601 1956
		Provincial	044 691 2011
		Great Brak Clinic	044 620 2288
POLICE (SAPS)		Mossel Bay	044 606 2805
		Da Gamaskop	044 606 2200/2201
		Kwanonqaba	044 606 5600
		Great Brak	044 620 8300
TRAFFIC DEPT (GENERAL)		MBM	044 606 5201
ELECTRICAL		MBM	044 606 5114
WATER		MBM	044 606 5278
GENERAL		MBM	044 606 5000
MBM OHS		M Lindoor	044 606 5000 (Ext 6261)

SOUTH AFRICAN NATIONAL STANDARD

Water supply and drainage for buildings

Part 1: Water supply installations for buildings

WARNING

This document references other documents normatively.



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SANS 10252-1:2018
Edition 3.2

Table of changes

Change No.	Date	Scope
Amdt 1	2016	Amended to delete the introduction and to move the note to the introduction into the text, update the table on hot water demand, storage and heater power requirements (table 5), to delete the annexes on extract from Regulation R509 (8 June 2001) in terms of the Water Services Act, 1977 (Act No. 108 of 1977) and on extract from the Pressure Equipment Regulation in terms of the occupational Health and Safety Act, 1993 (Act No. 85 of 1993), and the references to the annexes, and to update the tables on climatic data for selected cities, mean daily hours of sunshine for selected cities for the month of January to December and mean daily total available solar irradiation on horizontal surfaces.
Amdt 2	2018	Amended to update referenced standards, to update and renumber the definitions, to update the clause on initial design considerations, the clause on materials, pipes, fittings, components and fixtures, the clause on layout, the table on minimum size of relief drain pipes, the clause on design, and the table on air gap at taps or similar terminal fittings, to delete the table on internal volume of pipes, to update the table on 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, the clause on installation, and the designation of the table on internal volume of dead legs in pipes.

Foreword

This South African standard was prepared by National Committee SABS/TC/ 138/SC 02, *Water and sanitation – Equipment and systems – Plumbing components*, in accordance with procedures of the South African Bureau of Standards, in compliance with annex 3 of the WTO/TBT agreement.

This document was approved for publication in December 2018.

This document supersedes SANS 10252-1:2016 (edition 3.1).

A vertical line in the margin shows where the text has been technically modified by amendment No. 2.

This document is referenced in the Regulations of the Water Services Act, 1997 (Act No. 108 of 1997), the National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977), the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), and the Legal Trade Metrology Act, 2014 (Act No. 9 of 2014).

Reference is made in 3.1, 3.1.5, 3.1.48, 4.2.1.1, the notes 1 and 2 to 4.2.1.1, 5.1.9, and 8.1 to the "relevant national legislation". In South Africa this means the National Building Regulations Act, 1977 (Act 103 of 1977). Amdt 1; amdt 2

Foreword *(concluded)*

Reference is made in 5.4.6.1.4, 8.4.6.6, A.1, A.2.1, and A.3.1 to the "relevant national legislation". In South Africa this means the Occupational Health and Safety Act, 1993 (Act No.85 of 1993).

Reference is made in 6.1.1.1 to the "relevant national legislation". In South Africa this means the Water Services Act, 1997 (Act No. 108 of 1997). **Amdt 1**

SANS 10252 consists of the following parts under the general title *Water supply and drainage for buildings*:

Part 1: Water supply installations for buildings.

Part 2: Drainage installations for buildings.

Annex D forms an integral part of this document. Annexes A, C and E to I (inclusive) are for information only.

Compliance with this document cannot confer immunity from legal obligations.

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Water supply and drainage for buildings

Part 1:

Water supply installations for buildings

1 Scope

1.1 This part of SANS 10252 establishes general principles for the design, installation and testing of water installations for buildings.

1.2 This part of SANS 10252 is not applicable to water installations related to:

- a) air-conditioning systems;
- b) industrial processes;
- c) specialized plants (including water softening plants);
- d) high temperature (exceeding 80 °C) water heating systems; and
- e) automatic sprinkler installations.

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 South African Bureau of Standards.

AS 2845.3, *Water supply – Backflow prevention devices – Part 3: Field testing and maintenance of testable devices.*

AS/NZS 2845.1, *Water supply – Backflow prevention devices – Part 1: Materials, design and performance requirements.*

AS/NZS 3500.1:2015, *Plumbing and drainage – Part 1: Water services.*

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ASTM A 240, *Standard specification for chromium and chromium-nickel stainless steel plate, sheet, and strip for pressure vessels and for general applications.*

ASTM A 312, *Standard specification for seamless, welded, and heavy cold worked austenitic stainless steel pipes.*

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ASTM A 403, *Standard specification for wrought austenitic stainless steel piping fittings.*

| ASTM E 96, *Standard test methods for water vapor transmission of materials.*

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EN 10250-4, *Open die forgings for general engineering purposes – Part 4: Stainless steels.*

PD 5500, *Specification for unfired fusion welded pressure vessels.*

SANS 14/ISO 49, *Malleable cast iron fittings threaded to ISO 7-1.*

SANS 32/ EN 10240, *Internal and/or external protective coatings for steel tubes – Specification for hot dip galvanized coatings applied in automatic plants.*

SANS 62-1, *Steel pipes – Part 1: Pipes suitable for threading and of nominal size not exceeding 150 mm.*

SANS 62-2, *Steel pipes – Part 2: Screwed pieces and pipe fittings of nominal size not exceeding 150 mm.*

SANS 151, *Fixed electric storage water heaters.*

SANS 181, *Thermostats for electric storage water heaters.*

SANS 198, *Functional-control valves and safety valves for domestic hot and cold water supply systems.*

SANS 204, *Energy efficiency in buildings.*

SANS 226, *Water taps (metallic bodies).*

SANS 241-1, *Drinking water – Part 1: Microbiological, physical, aesthetic and chemical determinands.*

SANS 241-2, *Drinking water – Part 2: Application of SANS 241-1.*

SANS 242, *Stainless steel sinks with draining boards (for domestic use).*

SANS 347, *Categorization and conformity assessment criteria for all pressure equipment.*

SANS 460, *Plain-ended solid drawn copper tubes for potable water.*

SANS 497, *Glazed ceramic sanitaryware.*

SANS 514, *Immersion heaters for electric storage water heaters.*

SANS 543, *Fire hose reels (with semi-rigid hose).*

SANS 664-1, *Wedge gate and resilient seal valves for waterworks – Part 1: General.*

SANS 664-2, *Wedge gate and resilient seal valves for waterworks – Part 2: Wedge gate valves.*

SANS 664-3, *Wedge gate and resilient seal valves for waterworks – Part 3: Resilient seal valves.*

SANS 665-1, *Wedge gate and resilient seal valves for general purposes – Part 1: General.*

SANS 665-2, *Wedge gate and resilient seal valves for general purposes – Part 2: Wedge gate valves.*

SANS 665-3, *Wedge gate and resilient seal valves for general purposes – Part 3: Resilient seal valves.*

SANS 719, *Electric welded low carbon steel pipes for aqueous fluids (large bore).*

SANS 752, *Float valves.*

SANS 776, *Copper alloy gate valves – Heavy duty.*

SANS 815-1, *Shoulder-ended and groove-ended piping systems – Part 1: Shoulder-ended steel pipes, fittings and couplings.*

SANS 815-2, *Shoulder-ended and groove-ended pipe systems – Part 2: Groove-ended steel pipes, fittings and couplings.*

SANS 821, *WC flushing cisterns.*

SANS 827, *The installation of pipes and appliances for use with natural gas.*

SANS 906, *Stainless steel wash-hand basins and wash troughs.*

SANS 924, *Stainless steel stall urinals.*

SANS 965, *Welded austenitic stainless steel tubes.*

SANS 966-1, *Components of pressure pipe systems – Part 1: Unplasticized poly(vinyl chloride) (PVC-U) pressure pipe systems.*

SANS 966-2, *Components of pressure pipe systems – Part 2: Modified poly(vinyl chloride)(PVC-M) pressure pipe systems.*

SANS 1006, *Plastic floats for ballvalves.*

SANS 1021, *Water taps (plastic bodies).*

SANS 1056-3, *Ball valves – Part 3: Light duty valves (not fire-safe).*

SANS 1062, *Pressure and vacuum gauges.*

SANS 1067-1, *Copper-based fittings for copper tubes – Part 1: Compression fittings.*

SANS 1067-2, *Copper-based fittings for copper tubes – Part 2: Capillary solder fittings.*

SANS 1109-1/ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads – Part 1: Dimensions, tolerances and designation.*

SANS 1123, *Pipe flanges.*

SANS 1156-1, *Hose for liquefied petroleum gas (LPG) – Part 1: Hose used in road and rail transport.*

SANS 1186-1, *Symbolic safety signs – Part 1: Standard signs and general requirements.*

SANS 1200 G (SABS 1200 G), *Standardized specification for civil engineering construction – Part G: Concrete (structural).*

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SANS 1200 L (SABS 1200 L), *Standardized specification for civil engineering construction – Part L: Medium-pressure pipelines.*

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

SANS 1200 LF (SABS 1200 LF), *Standardized specification for civil engineering construction – Part LF: Erf connections (water).*

SANS 1223, *Fibre-cement pressure pipes and couplings.*

SANS 1237, *Single-state regulators for liquefied petroleum gas (LPG).*

SANS 1240, *Automatic shut-off flush valves for water closets and urinals.*

SANS 1307, *Domestic solar water heaters.*

SANS 1356, *Fixed electric instantaneous water heaters.*

SANS 1480, *Single control mixer taps.*

SANS 1529-1, *Water meters for cold potable water – Part 1: Metrological characteristics of mechanical water meters of nominal bore not exceeding 100 mm.*

SANS 1529-3, *Water meters for cold potable water – Part 3: Physical dimensions.*

SANS 1529-4, *Water meters for cold potable water – Part 4: Mechanical meters of nominal bore exceeding 100 mm but not exceeding 800 mm.*

SANS 1529-9, *Water meters for cold potable water – Part 9: Requirements for electronic indicators used with mechanical water meters, electronic water meters and electronic prepayment water measuring systems.*

SANS 1539, *Appliances operating on liquefied petroleum gas – Safety aspects.*

SANS 1733, *WC flushing systems (low-flushing capacity) that operate with flushing cisterns.*

SANS 1808-5, *Water supply and distribution system components – Part 5: Flexible connectors.*

SANS 1808-9, *Water supply and distribution system components – Part 9: Metering taps and valves (metallic bodies).*

SANS 1808-10, *Water supply and distribution system components – Part 10: Copper alloy check valves (spring-loaded).*

SANS 1808-15, *Water supply and distribution system components – Part 15: Mechanical backflow-prevention devices.*

SANS 1808-16, *Water supply and distribution system components – Part 16: Drinking fountain taps.*

SANS 1808-24, *Water supply and distribution system components – Part 24: Gas-operated water heaters.*

SANS 1808-30, *Water supply and distribution system components – Part 30: Laboratory water taps.*

SANS 1808-35, *Water supply and distribution system components – Part 35: Electronically operated taps and valves.*

SANS 1808-37, *Water supply and distribution system components – Part 37: Single-control mixer taps (plastics).*

SANS 1808-44, *Water supply and distribution system components – Part 44: Pipe saddles.*

SANS 1808-53, *Water supply and distribution system components – Part 53: Drain cocks for hot-water storage containers.*

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SANS 1808-58, *Water supply and distribution system components – Part 58: In-line strainers.*

SANS 1808-66, *Water supply and distribution system components – Part 66: Demand type water taps.*

SANS 1835, *Ductile iron pipes, fittings, accessories and their joints, for use in high and low pressure systems for potable and foul water.*

SANS 1848, *Geyser drip trays.*

SANS 1849, *Butterfly valves for general purposes.*

SANS 1857, *Copper alloy gate valves – Light duty.*

SANS 2001-DP2, *Construction works – Part DP2: Medium pressure pipelines.*

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SANS 2001-DP6, *Construction works – Part DP6: Below-ground water installations.*

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SANS 4427-1/ISO 4427-1, *Plastics piping systems – Polyethylene (PE) pipes and fittings for water supply – Part 1: General.*

SANS 4427-2/ISO 4427-2, *Plastics piping systems – Polyethylene (PE) pipes and fittings for water supply – Part 2: Pipes.*

SANS 4427-3/ISO 4427-3, *Plastics piping systems – Polyethylene (PE) pipes and fittings for water supply – Part 3: Fittings.*

SANS 4427-5/ISO 4427-5, *Plastics piping systems – Polyethylene (PE) pipes and fittings for water supply – Part 5: Fitness for purpose of the system.*

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

SANS 6509/ISO 6509, *Corrosion of metals and alloys – Determination of dezincification of resistance of brass.*

SANS 10087-1, *The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations – Part 1: Liquefied petroleum gas installations involving gas storage containers of individual water capacity not exceeding 500 L and a combined water capacity not exceeding 3 000 L per installation.*

SANS 10100-1 (SABS 0100-1), *The structural use of concrete – Part 1: Design.*

SANS 10105-2, *The use and control of fire fighting-equipment – Part 2: Fire hose reels and above-ground hydrants.*

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SANS 10106, *The installation, maintenance, repair and replacement of domestic solar water heating systems.*

SANS 10140-3, *Identification colour markings – Part 3: Contents of pipelines.*

SANS 10140-4, *Identification colour marking – Part 4: Contents of taps and valves in laboratories.*

SANS 10142-1, *The wiring of premises – Part 1: Low-voltage installations.*

SANS 10177-2, *Fire testing of materials, components and elements used in buildings – Part 2: Fire resistance test for building elements.*

SANS 10254, *The installation, maintenance, replacement and repair of fixed electric storage water heating systems.*

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

SANS 10400-L, *The application of the National Building Regulations – Part L: Roofs.*

SANS 10400-S, *The application of the National Building Regulations – Part S: Facilities for persons with disabilities.*

SANS 10400-XA, *The application of the National Building Regulations – Part X: Environmental sustainability – Part XA: Energy usage in buildings.*

SANS 15874-1/ISO 15874-1, *Plastics piping systems for hot and cold water installations – Polypropylene (PP) – Part 1: General.*

SANS 15874-2/ISO 15874-2, *Plastics piping systems for hot and cold water installations – Polypropylene (PP) – Part 2: Pipes.*

SANS 15874-3/ISO 15874-3, *Plastics piping systems for hot and cold water installations – Polypropylene (PP) – Part 3: Fittings.*

SANS 15874-5/ISO 15874-5, *Plastics piping systems for hot and cold water installations – Polypropylene (PP) – Part 5: Fitness for purpose of the system.*

SANS 15875-1/ISO 15875-1, *Plastics piping systems for hot and cold water installations – Crosslinked polyethylene (PE-X) – Part 1: General.*

SANS 15875-2/ISO 15875-2, *Plastics piping systems for hot and cold water installations – Crosslinked polyethylene (PE-X) – Part 2: Pipes.*

SANS 15875-3/ISO 15875-3, *Plastics piping systems for hot and cold water installations – Crosslinked polyethylene (PE-X) – Part 3: Fittings.*

SANS 15875-5/ISO 15875-5, *Plastics piping systems for hot and cold water installations – Crosslinked polyethylene (PE-X) – Part 5: Fitness for purpose of the system.*

SANS 15876-1/ISO 15876-1, *Plastics piping systems for hot and cold water installations – Polybutylene (PB) – Part 1: General.*

SANS 15876-2/ISO 15876-2, *Plastics piping systems for hot and cold water installations – Polybutylene (PB) – Part 2: Pipes.*

SANS 15876-3/ISO 15876-3, *Plastics piping systems for hot and cold water installations – Polybutylene (PB) – Part 3: Fittings.*

SANS 15876-5/ISO 15876-5, *Plastics piping systems for hot and cold water installations – Polybutylene (PB) – Part 5: Fitness for purpose of the system.*

SANS 15877-1/ISO 15877-1, *Plastics piping systems for hot and cold water installations – Chlorinated poly(vinyl chloride) (PVC-C) – Part 1: General.*

SANS 15877-2/ISO 15877-2, *Plastics piping systems for hot and cold water installations – Chlorinated poly(vinyl chloride) (PVC-C) – Part 2: Pipes.*

SANS 15877-3/ISO 15877-3, *Plastics piping systems for hot and cold water installations – Chlorinated poly(vinyl chloride) (PVC-C) – Part 3: Fittings.*

SANS 15877-5/ISO 15877-5, *Plastics piping systems for hot and cold water installations – Chlorinated poly(vinyl chloride) (PVC-C) – Part 5: Fitness for purpose of the system.*

SANS 16422/ISO 16422, *Pipes and joints made of oriented unplasticized poly(vinyl chloride) (PVC-O) for the conveyance of water under pressure – Specifications.*

SANS 21003-1/ISO 21003-1, *Multilayer piping systems for hot and cold water installations inside buildings – Part 1: General.*

SANS 21003-2/ISO 21003-2, *Multilayer piping systems for hot and cold water installations inside buildings – Part 2: Pipes.*

SANS 21003-3/ISO 21003-3, *Multilayer piping systems for hot and cold water installations inside buildings – Part 3: Fittings.*

SANS 21003-5/ISO 21003-5, *Multilayer piping systems for hot and cold water installations inside buildings – Part 5: Fitness for purpose of the system.*

SANS 22391-1/ISO 22391-1, *Plastics piping systems for hot and cold water installations – Polyethylene of raised temperature resistance (PE-RT) – Part 1: General.*

SANS 22391-2/ISO 22391-2, *Plastics piping systems for hot and cold water installations – Polyethylene of raised temperature resistance (PE-RT) – Part 2: Pipes.*

SANS 22391-3/ISO 22391-3, *Plastics piping systems for hot and cold water installations – Polyethylene of raised temperature resistance (PE-RT) – Part 3: Fittings.*

SANS 22391-5/ISO 22391-5, *Plastics piping systems for hot and cold water installations – Polyethylene of raised temperature resistance (PE-RT) – Part 5: Fitness for purpose of the system.*

3 tions, symbols and abbreviations

3.1

For the purposes of this document, the definitions given in the relevant national legislation (see foreword), and the following apply.

3.1.1

acceptable

adequate

appropriate

satisfactory

suitable

acceptable to the authority administering this standard, or to the parties concluding this purchase contract, as relevant, or in the opinion of the water supply authority

3.1.2

aerator

device fitted to the outlet of a tap or mixing valve, to entrain air in the discharge

3.1.3

air vessel

air chamber

hydrosphere

expansion tank

closed chamber (with or without diaphragm) that utilizes the compressibility of contained air or gas, to

- a) promote a more uniform flow of water when the chamber is connected to the delivery pipe or suction pipe of a reciprocating pump,
- b) minimize shock due to water hammer when the chamber is connected to a high-pressure water system,
- c) augment the transient supply pressure in an installation, or
- d) to absorb volumetric thermal expansion of the fluid in the system.

3.1.4

appliance

any receptacle, apparatus or device that is permanently connected to the water supply, such as storage tanks, cisterns and sanitary fixtures

3.1.5

approved

approved by the local authority in whose area of jurisdiction the installation is carried out in the relevant national legislation (see foreword)

Amdt 2

3.1.6

automatic shut-off valve

flush valve

water fitting that is connected to a fixture and that when operated, supplies a pre-set quantity of water for flushing that cannot be held open and flush continuously

Amdt 2

3.1.7 backflow flow of water in a pipe in a direction opposite to the normal direction of flow	Amdt 2
3.1.8 backflow prevention device	Amdt 2
3.1.8.1 double check valve backflow preventer water fitting that incorporates at least two independently acting non-return valves, complete with facilities for testing the water tightness of each non-return valve independently	Amdt 2
3.1.8.2 reduced-pressure backflow preventer water fitting incorporating two or more return valves and an automatically operating pressure-differential relief valve located between two non-return valves, and including facilities for testing the water tightness of the control stages within the valve	Amdt 2
3.1.9 back-siphonage backflow of water resulting from negative pressure in a water installation or in the water supply system	Amdt 2
3.1.10 balanced pressure hot and cold water delivery pressure to mixing components that is balanced in such a manner that the residual dynamic pressure does not vary by more than 20 %	Amdt 2
3.1.11 balancing device device fitted in a reticulation pipe system and used to permanently balance the hot water reticulation system dynamically, or a pressure compensating flow control device which can control the maximum flow in hot and cold supply lines	Amdt 2
3.1.12 ball valve ball cock valve that can regulate flow by means of a ball with a hole through it that can be sealed by rotating the ball through 90°	Amdt 2
3.1.13 blanket insulation of a flexible type, which may be fibrous glass, mineral wool, polyester fibres or polyamic fibre	Amdt 2
3.1.14 branch pipe pipe that branches off from a service pipe, or a distribution pipe that serves only one terminal water fitting	Amdt 2
3.1.15 calorifier device for heating water by conductive heat transfer using an internal heat exchanger	Amdt 2

- 3.1.16** **capacity** **Amdt 2**
capability of a storage tank or water heater to contain
- a) in a storage tank: the volume of the tank between the operating level of the water contained in such a tank and the invert of the outlet from the tank, in litres,
- b) in an instantaneous water heater: the rated hot water delivery rate of the water heater, in litres per minute, at stipulated temperature,
- c) in a storage water heater: the nominal storage capacity of the heater, in litres, and
- d) in an heat exchange water heater: the storage volume of the heater, in litres.
- 3.1.17** **cistern** **Amdt 2**
small capacity storage tank to serve a toilet pan, urinal or a cistern type storage water heater
- 3.1.18** **cold insulation** **Amdt 2**
where the insulation is used to prevent heat gain to the process the term cold insulation will be used
- 3.1.19** **combined installation** **Amdt 2**
water installation used for fire-fighting, domestic, commercial or industrial purposes, or any combination thereof
- 3.1.20** **communication pipe** **Amdt 2**
pipe that is vested in the water supply authority and is installed by it for conveying water from a main to a water installation (see 3.1.39)
- 3.1.21** **control valve** **Amdt 2**
water fitting that is used to control the flow of water in a part of a water installation
- 3.1.22** **cross-connection** **Amdt 2**
link between two pipes
- 3.1.23** **dead leg** **Amdt 2**
that length of a hot water pipe between the terminal water fitting and the water heater or branch pipe forming part of a hot water circulation system
- 3.1.24** **disinfection** **Amdt 2**
sterilization of water or pipes and fittings, using chemicals such as chlorine or ozone
- 3.1.25** **distribution pipe** **Amdt 2**
pipe that branches off from a branch pipe that serves more than one terminal fitting

3.1.26	Amdt 2
expansion control devices	
3.1.26.1	Amdt 2
expansion control valve	
water fitting that is used to control the expansion pressure in a water heater consistently during normal operation of the water heater	
3.1.26.2	Amdt 2
expansion relief valve	
water fitting that is used to relieve the expansion pressure in a water heater consistently during normal operation of the water heater and that includes a vacuum relief function	
3.1.26.3	Amdt 2
expansion control vessel	
chamber	
vessel that is designed to absorb and store the water that has expanded as a result of the heating of a mass of water in a water heater	
3.1.27	Amdt 2
fire hydrant	
terminal water fitting that is connected to a pipeline and to which a fire hose may be attached	
3.1.28	Amdt 2
fire installation	
water installation that conveys water solely for fire-fighting	
3.1.29	Amdt 2
float valve	
terminal water fitting that is actuated by a lever attached to a float and that is used to control the water level in a cistern or storage tank	
3.1.30	Amdt 2
flood level rim	
lowest part of the top edge of any open receptacle over which water may overflow	
3.1.31	Amdt 2
gate valve	
full-bore isolating using a sluice or gate to slide on the valve across the stream, fully opening or shutting off the water flow	
NOTE It is not suitable for flow regulation in-between the setting of fully open or fully closed.	
3.1.32	Amdt 2
hazard	
3.1.32.1	Amdt 2
high hazard	
any condition, device or practice which in connection with the potable water supply system has the potential to cause death	
3.1.32.2	Amdt 2
medium hazard	
any condition, device or practice which in connection with the potable water supply system has the potential to endanger health	

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- | **3.1.32.3** **Amdt 2**
low hazard
any condition, device or practice which in connection with the potable water supply system would constitute a nuisance but not endanger health or cause injury
- | **3.1.33** **Amdt 2**
heat pump
electrical device using the refrigeration principle to heat water by extracting heat from ambient air
- | **3.1.34** **Amdt 2**
high temperature cut-out
temperature cut-out device
electrical control device that is used to permanently disconnect the input of electrical energy used for heating water when the temperature of the water reaches the maximum permissible limit at the monitoring point
- | **3.1.35** **Amdt 2**
installation work
work carried out in respect of the construction and connection of any part of a water installation
- | **3.1.36** **Amdt 2**
ion exchange
water softener
process in which water is passed through a suitably treated material that replaces "hard" ions (calcium and magnesium) with "soft" ions (sodium)
- | **3.1.37** **Amdt 2**
isolating valve
water fitting that is used to shut off and isolate a part of a water installation from the main installation (mains); the term includes ball valves, gate valves, sluice valves, stop cocks or any other type of shut-off valve arrangement
- | **3.1.38** **Amdt 2**
local authority
authority empowered by statute to exercise jurisdiction over the installation of water, plumbing, sewerage or stormwater works
- | **3.1.39** **Amdt 2**
main(s)
any pipe, other than a communication pipe, vested in the local authority and used by it to convey water to consumers
- | **3.1.40** **Amdt 2**
mixer
mixing valve
water fitting that is furnished with both a hot water and a cold water connection and in which hot and cold water are then mixed before the water is discharged through a common outlet with the flow of water being controlled by one or more control valves
- | **3.1.41** **Amdt 2**
nominal diameter
nominal size
nominal internal diameter of a pipe thread or fitting

NOTE The nominal size reference to inside diameter is from the practice of designing systems with steel pipes whereas in both copper and plastic pipes their nominal sizes refer to the outside diameters, from which the wall thickness (within prescribed tolerances) is deducted to determine their inside diameter.

3.1.42 non-return valve reflux valve check valve water fitting that automatically permits flow to occur in one direction only	Amdt 2
3.1.43 operating temperature temperature at which a system functions under normal operating conditions	Amdt 2
3.1.44 operating water level level of water reached in a storage tank when the valve controlling the inlet of water to such a tank closes under normal operating conditions	Amdt 2
3.1.45 orifice-plate control device fitting incorporating an orifice plate, which is installed in a pipeline and is intended to create a pressure drop, thereby reducing the flow rate	Amdt 2
3.1.46 pipe fitting any device incorporated in a water installation, including any tee, reducer, elbow, bend, valve, fire hydrant or fire-hose reel, but excluding any sanitary fixture or straight piping	Amdt 2
3.1.47 pollution introduction into any water supply system or installation, of any substance or thing that could cause the water conveyed in such system or installation to become harmful to health, or that could render such water unfit for its intended purpose	Amdt 2
3.1.48 population as defined in the relevant national legislation (see foreword)	Amdt 2
3.1.49 potable water water that does not contain any matter, pollution, contamination or minerals of an objectionable nature or in excessive quantity, or any infectious material, and that is considered by the water supply authority to be satisfactory for drinking, culinary and other domestic purposes (see SANS 241-1 and SANS 241-2)	Amdt 2
3.1.50 pressure rating nominal working pressure for which a water fitting is designed, before allowance is made for operational tolerances	Amdt 2
3.1.51 pressure reducing valves PRV	Amdt 2
pressure reducing valve (adjustable) water fitting that automatically reduces the pressure on its downstream side to a specific value that is adjustable by the installer, and does not vary due to any fluctuations on the inlet side	

pre-set pressure reducing valve

water fitting that automatically reduces the pressure on its downstream side to a pre-set upper limit, irrespective of any fluctuation in the inlet pressure

pressure control valve

PCV

pre-set pressure reducing valve (PRV) that incorporates an expansion control function (ERV) in one body

y amendment No. 2.

3.1.52

Amdt 2

pressure relief valve

water fitting that is pressure-actuated to automatically discharge water when a set pressure limit is exceeded

3.1.53

Amdt 2

probable flow demand

design flow demand

estimated flow rate through a pipe as a result of the simultaneous use of the maximum probable number of terminal water fittings connected to the pipe

3.1.54

Amdt 2

purpose of installation

3.1.54.1

Amdt 2

commercial purposes

drinking, ablution and culinary purposes on premises used for business or trade (for other than factories; see 3.1.49)

Amdt 2

3.1.54.2

Amdt 2

domestic purposes

drinking, ablution and culinary purposes on private or industrial premises

3.1.55

Amdt 2

required

by the local conditions (type of building), or local water supply system

3.1.56

Amdt 2

residual pressure (head)

pressure that remains after all hydraulic energy losses have been deducted

3.1.57

Amdt 2

return pipe

pipe that conveys hot water in a hot water circulation system, between the last terminal water fitting and the water heater

3.1.58

Amdt 2

riser

pipe used for fire-fighting and that is only charged with water when a fire occurs

3.1.59

Amdt 2

sanitary fixture

any receptacle, apparatus or device to which water can be permanently supplied, and from which waste water or soil water is discharged

3.1.60 service pipe pipe that is part of a water installation and that connects with the communication pipe	Amdt 2
3.1.61 static pressure pressure in an installation at zero flow	Amdt 2
3.1.62 stop cock valve that can regulate or prevent flow by means of either incorporating an orifice that can be sealed with a washer and plate, as in a tap	Amdt 2
3.1.63 storage tank any 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	Amdt 2
3.1.64 storage water heater water heater intended for the heating and storage of a fixed quantity of water	Amdt 2
3.1.65 temperature and pressure safety valve safety valve water fitting that combines the functions of over temperature and over pressure protection	Amdt 2
3.1.66 tempering valve thermostatically-controlled blending valve to be used near the hot water tank to temper the hot water with cold water to reduce the hot water to a lower temperature, for example 50 °C, in the upstream water system from the terminal fittings	Amdt 2
3.1.67 thermal conductivity <i>k</i> thermal transmission through a unit area of a material	Amdt 2
NOTE It is measured per unit temperature difference between the hot and cold faces, and the unit is W/(m·K).	
3.1.68 thermal resistance <i>R</i> -value resistance to heat transfer across a material, and is the mean temperature difference between two defined surfaces of a material or construction system under steady state conditions	Amdt 2
NOTE Thermal resistance is measured as an <i>R</i> -value. The higher the <i>R</i> -value the better the ability of the material to resist heat flow; it is measured in (m ² ·K/W).	
3.1.69 thermostatic mixer thermostatically-controlled mixing valve for blending two supplies of water of differing temperature, to achieve the desired temperature of the mixed flow to terminal fittings that is suitable for direct contact with the skin, including an anti-scalding feature	Amdt 2

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	3.1.70 type of installation	Amdt 2
	3.1.70.1 domestic installation water installation that conveys water solely for domestic purposes	Amdt 2
	3.1.70.2 general installation water installation on a site, which conveys water for domestic, commercial or industrial purposes	Amdt 2
	3.1.71 vacuum relief valve vacuum breaker water fitting that is used to prevent a condition of negative pressure in a pipe or appliance	Amdt 2
	3.1.72 valve water fitting for controlling the flow of water	Amdt 2
	3.1.73 water container vessel tank vessel that contains water and that is subjected to any pressure that could develop in, or be transmitted by the water	Amdt 2
	3.1.74 water fitting any component of a water installation, other than a pipe or pipe connection, through which water passes or in which water is stored	Amdt 2
	3.1.75 water heater appliance, usually self-contained, for heating water that is either stored in the appliance or passes through it	Amdt 2
	3.1.76 water heating appliances	Amdt 2
	3.1.76.1 electric storage water heater storage water heater in which water is heated by electrical energy	Amdt 2
	3.1.76.2 fixed water heater water heater that is installed in the operating position and is permanently connected to the electrical wiring of a building	Amdt 2
	3.1.76.3 heat exchange water heater water heater in which potable water is heated by a heat transfer system that maintains a physical separation between a primary heat transfer fluid and the potable water	Amdt 2

- 3.1.76.4** **gas water heater** Amdt 2 |
water heater which is heated by either natural or liquid petroleum gas and can be of the instantaneous and storage water heater types
- 3.1.76.5** **instantaneous water heater** Amdt 2 |
water heater in which the water is heated either by gas or electricity during the time of demand
- 3.1.76.6** **solar water heater** Amdt 2 |
water heater that is designed to be integrally connected to solar water heating panels and receives its heating energy from such a panel
- 3.1.76.7** **standard water heater** Amdt 2 |
fixed thermostatically controlled electric storage water heater that complies with the requirements of SANS 151
- 3.1.76.7.1** **cistern type** Amdt 2 |
standard water heater that has an integral cold water cistern
- 3.1.76.7.2** **closed type (unvented)** Amdt 2 |
standard water heater that is not naturally vented to atmosphere but allows the expanded water to escape through an expansion control valve set to open and discharge at the rated working pressure of the water heater
- 3.1.76.7.3** **closed type (vented)** Amdt 2 |
standard water heater that is vented to the atmosphere through a vent pipe on the outlet that discharges to the atmosphere
- NOTE The height of the vent pipe results in an increased static pressure in the hot water system.
- 3.1.76.7.4** **open outlet type** Amdt 2 |
standard water heater that is provided with a permanently open outlet from which hot water is discharged by displacement, the flow of water being controlled by means of a control valve in the supply pipe to the water heater
- 3.1.77** **water installation** Amdt 2 |
installation that is used or is intended to be used for the conveyance or storage of water in any building or on any site on which such building is situated, and that includes any pipe or water fitting but excludes any water meter vested in the water supply authority
- 3.1.78** **water level control valve** Amdt 2 |
water fitting, other than a float valve, that is used to regulate the inflow of water to a storage tank and to maintain the level of the water at a predetermined level

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3.1.79

working pressure of a fitting or appliance

maximum water pressure at which a fitting, system, installation or an appliance is designed to operate **Amdt 2**

3.1.80

working pressure of the installation

water pressure that occurs in an installation during normal operating conditions **Amdt 2**

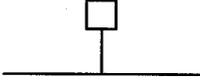
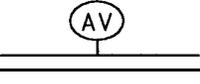
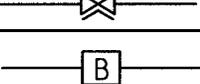
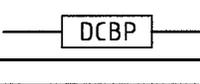
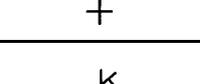
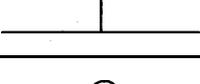
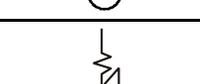
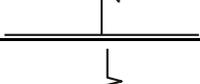
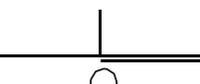
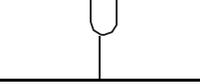
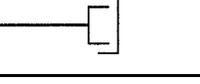
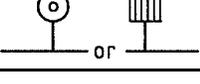
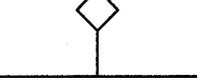
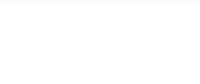
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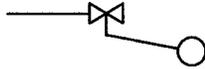
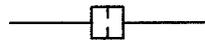
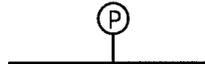
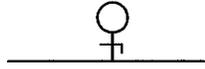
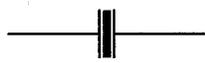
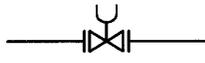
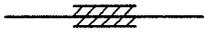
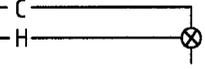
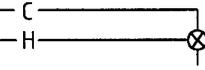
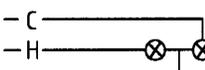
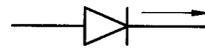
water supply system

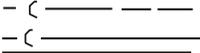
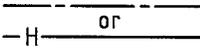
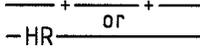
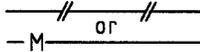
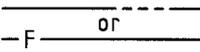
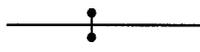
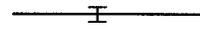
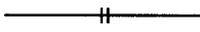
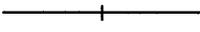
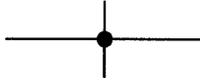
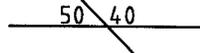
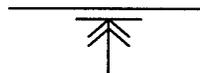
any system of structures, aqueducts, pipes, valves, pumps, meters or other associated equipment that is vested in the water supply authority and that is used or intended to be used by the authority in connection with the supply of water **Amdt 2**

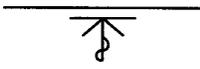
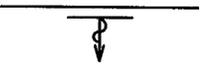
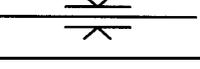
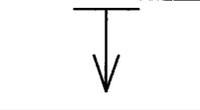
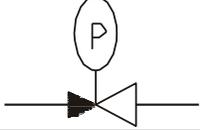
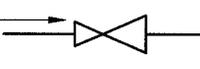
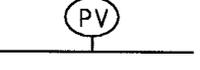
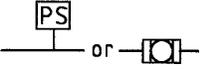
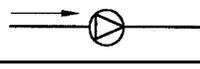
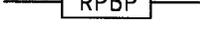
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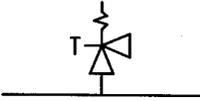
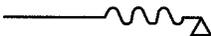
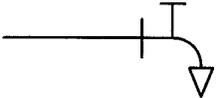
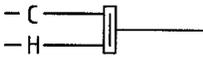
For the purposes of identification and explanation of details in the figures, the following symbols apply.

Air release valve	
Air vessel (air chamber)	
Automatic shut-off valve	
Balancing device (hot water control)	
Double check valve backflow preventer	
Draining tap	
Drinking fountain	
Dropper pipe (plan view, pipe cross-section)	
Expansion control valve	
Expansion control valve (incorporating vacuum relief)	
Expansion control vessel	
Fire brigade inlet/booster pump connection	
Fire-hose reel	
Fire hydrant	

Fire sprinkler	
Float valve	
Flow restrictor (controller)	
Flow switch	
Gauge (Pressure: P; Temperature: T; Level: L)	
Gauge with isolating valve	
Irrigation sprinkler	
Isolating coupling for dissimilar metals	
Isolating valve (flanged ends) (electrical control)	
Isolating valve (flanged ends) (manual control)	
Isolating valve (screwed ends) (electrical control)	
Isolating valve (screwed ends) (manual control)	
Lagged pipe	
Mixer (thermostatically controlled)	
Mixer (single manual control, single lever)	
Mixer (two manual controls)	
Non-return valve	

Normal direction of flow	
Orifice-plate control device	
Pipe carrying cold water	
Pipe carrying hot water	
Pipe carrying hot water (return)	
Pipe carrying mixed (temperature) water	
Pipe carrying water for fire-fighting	
Pipe crossing (not connected)	
Pipe joint (butt welded)	
Pipe joint (compression)	
Pipe joint (flanged and bolted)	
Pipe joint (screwed)	
Pipe joint (soldered or solvent welded)	
Pipe junction	
Pipe: nominal diameter (mm)	
Pipe support (adjustable)	
Pipe support (adjustable hanger)	

Pipe support (flexible)	
Pipe support (flexible hanger)	
Pipe support (guide)	
Pipe support (simple)	
Pipe support (simple hanger)	
Pressure control valve (PRV)	
Pressure control valve (adjustable)	
Pressure control valve combined with expansion control valve	
Pressure reducing valve (adjustable)	
Pressure reducing valve (preset)	
Pressure relief valve	
Pressure switch	
Pump	
Reduced pressure backflow prevention device	

Riser pipe (plan view)	
Temperature and pressure safety valve (safety valve)	
Shower (fixed)	
Shower (movable)	
Stopcock	
Storage water heater (domestic type)	
Strainer	
Tap (external)	
Tap (internal)	
Thermostatic controller	
Vacuum relief valve	
Vacuum relief valve combined with air release valve	
Water level control valve	
Water meter	

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3.3 deviations

For the purposes of identification and explanation of details on drawings and tables, the following abbreviations apply.

NOTE Drawings included in this part of SANS 10252 are of a schematic nature and should not be accepted as working drawings for installation purposes. **Amdt 1**

deviations for materials

HDPE	high density polyethylene	Amdt 2
PVC-U	unplasticized poly(vinyl chloride)	
PE-X	cross- linked poly-ethylene	
PE-RT	poly-ethylene raised temperature	
PVC-M	modified polyvinyl chloride	
PB	polybutylene	
PP	polypropylene	Amdt 2
PVC-C	chlorinated poly(vinyl chloride)	
PVC-O	oriented poly(vinyl chloride)	
SS	stainless steel	Amdt 2

deviations for fittings and fixtures

BA	bath
BT	tap (bath)
BTT	bidet (taps and spouts)
ET	external tap
FE	fire extinguisher
FH	fire hydrant
FM	fire main
FPC	fire pump connection
FS	flow switch
FV	float valve
HR	hose reel
HSTO	hot water storage tank

LCV	level control valve
NRV	non-return valve
PCV	pressure control valve
PRV	pressure reducing valve
PS	pressure switch
PU	pump
RBT	registered break tank
RM	rising main
RV	reflux valve
ST	tap (sink)
STO	cold water storage tank
SH	shower (taps and showerhead)
UA	urinals (automatically controlled flushing device)
UM	urinals (manually operated flushing device)
US	urinals (sensor-operated flushing device)
V	valve
WB	wash-hand basin
WBT	tap (wash-hand basin)
WC	toilet pan (water closet)
WH	water heater
WT	tap (wash trough)
WM	water meter

Amdt 2 |

4 | design considerations

4.1 | Information

Primary information required by the designer

The following information, as necessary, shall be obtained from the owner of the premises or from the water supply authority:

- a) a plan of the site, showing contours, proposed and existing floor or terrace levels (all related to geodetic datum) and the location and description of any existing services on the site;
- b) the intended function of the premises and the types of activities to be carried out on the premises;
- c) drawings of buildings, showing
 - 1) points that require water supply, and
 - 2) the proposed type of sanitary fixtures and apparatus;
- d) a schedule of sanitary fixtures and apparatus that require a water supply;
- e) the design population of the premises and the times that the premises will be occupied;
- f) the quantity of water and the water pressures required;
- g) the nature of the subsoil on the site;
- h) the quality of the water obtainable from the supply mains;
- i) the static and, where possible, residual pressures in the water supply mains;
- j) water quantities and flow rates obtainable from the water supply main for the various types of water demand;
- k) if applicable,
 - 1) a schedule of acceptable pipes and water fittings, and the size of the water meter,
 - 2) requirements for drawings, and other information that has to be submitted in order to obtain approval for the water installation,
 - 3) any special precautions to be taken for the crossing of any other services on the premises, and
 - 4) details of any existing connections and services;
- l) the location of the point of connection to the water supply main, or of the communication pipe;
- m) details on the metering of the water installation; and
- n) if the owner has to connect the water installation to the water supply, the following details:
 - 1) if the installation is to be connected either to the mains or to the communication pipe, details about the size and the type (material) of piping; and

- 2) if the installation is to be connected to a water meter, details about the size and type of outlet from the meter.

NOTE 1 Items 4.1.1(a) to (e) and (g) can usually be obtained from the owner. Item 4.1.1(f) should be determined by the design process given in 4.2. Items 4.1.1(h) to (n) should be obtained from the water supply authority.

NOTE 2 The information required for the approval of water installations may include the following:

- a) the title deed description of the premises;
- b) the name of every street on which the premises abuts;
- c) the scales of the drawings, and the north point;
- d) the position and size of the communication pipe(s) serving the premises;
- e) the location of every water fitting and its description;
- f) the location and capacity of every storage tank and water heater;
- g) details of the proposed accommodation for the water meter if it is to be installed within the premises;
- h) the pressure for which the installation has been designed; and
- i) the position of overflows.

NOTE 3 The potential aggressiveness of the water obtainable from the mains can provide guidance with regard to the types of pipes and materials to be used.

NOTE 4 The type or nature (or both) of the subsoil may restrict the choice of pipes and jointing methods to be used.

NOTE 5 SANS 10400-A classifies solar water heaters up to a limit of 6 m² on a roof and 12 m² not installed on a roof, as minor building works which may allow them not to require drawings or approvals by some local authorities. **Amdt 2**

NOTE 6 This preliminary information is for the overall planning and approval of the design. For more detail on design requirements, see clause 7.

al information

4.1.1 is any indication that contamination of the ground has occurred, an investigation shall be undertaken to determine whether there is any residual contamination that could adversely affect buried pipes or fittings.

4.1.2 ater supply installation is to be extended, the existing system shall be examined to ensure that it is suitable for extension, after which the entire design shall be re-assessed and modified, by the designer, as appropriate.

4.2 ment of water demand

al

4.2.1 gn population of a building shall be determined in accordance with of the relevant national legislation (see foreword). For the energy efficiency of buildings, SANS 204 and SANS 10400-XA shall be considered.

NOTE 1 The population calculated in terms of the relevant national legislation (see foreword) is the total population for a building of a particular class of occupancy and includes personnel, the public and visitors.

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NOTE 2 The total number of personnel will, in some cases, be the total population obtained from SANS 10400-A; 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, can be taken as 10 % of the total population for such complex or shop, calculated in terms of the relevant national legislation (see foreword).

NOTE 3 The scale of provision of facilities for different buildings, the selection of particular appliances most suited to their use, and the arrangement of such facilities within spaces in order to obtain optimum use of both space and appliances, are all matters requiring careful consideration if a high quality installation is to be obtained. It should be left to the owner of a building to decide what provision he wishes to make to satisfy the public and to safeguard his business interests.

4.2.2 ate shall be made

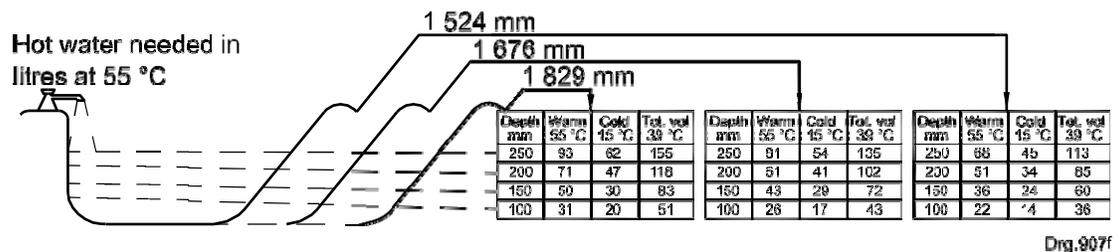
- a) of the total daily water demand, using table 1 and table 2, or using any other approved data,
- b) of the probable (or design) flow demand, in accordance with 4.2.2, and
- c) of the total hot water demand, in accordance with 4.2.3, and of the time of peak hot water demand in terms of 4.2.3.2.

NOTE 1 The probable flow demand will depend upon the type of appliance or fixture or fitting, the type of building in which it is installed, and the frequency and duration of usage. In most installations it rarely happens that the total number of appliances installed are ever in use simultaneously. In order to minimize costs, it is therefore usual to design a system that provides for a design usage that is less than the possible maximum.

NOTE 2 Using gross floor area as the parameter for determining water demands can result in excessive water demand figures, especially for superstores such as hypermarkets and warehouses.

NOTE 3 The size and shape of the bath should be considered (see figure 1).

Bath water (volume in litres and temperatures)



Drg.907f

Figure 1 — Bath detail

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.	

Probable (or design) flow demand

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

$$Q_p = (\Sigma Q)^n \quad (1)$$

where

Q_p is the probable flow demand, in litres per minute (L/min);

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 (L/min); and

n is a factor related to the probable simultaneous use of the fittings.

NOTE Values of n are given in table 4.

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

$$Q_p = (\Sigma Q)^n + 80 \quad (2)$$

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	Likely minimum flow rate per tap or fitting	Design flow rate per tap or fitting	Design flow pressure at tap or fitting for design flow rate ^b
	L/min	L/min	L/min	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
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
Sink				
15 mm taps (plain outlet)	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

Table 3 (concluded)

1	2	3	4	5
Sanitary fixture or fitting	Likely maximum flow rate per tap or fitting ^a	Likely minimum flow rate per tap or fitting	Design flow rate per tap or fitting	Design flow pressure at tap or fitting for design flow rate ^b
	L/min	L/min	L/min	kPa
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
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 are not available from the manufacturer. ^c Design flow rates for WC pans should preferably be approximately 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: first valve: 110 L/min, second valve: 85 L/min, third valve: 65 L/min, fourth valve: 45 L/min, fifth 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: first valve: 65 L/min, second valve: 55 L/min, third valve: 45 L/min, fourth valve: 35 L/min, fifth valve: 25 L/min, all valves thereafter: 5 L/min each. ^g Minimum flow pressure.				

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.	

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

$$Q_p = (\Sigma Q)^n + 45 \quad (3)$$

42.4 The available 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:

$$Q_p = \Sigma Q \quad (4)$$

42.5 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 Q_p shall be retained until it is replaced by a new value obtained from using equation (1), (2) or (3).

demand

42.1 In 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.

NOTE Often the pattern of hot water usage is largely a function of the population and of the type of activity that takes place in a building.

422 and 5 are a guide to be used to determine the hot water demand for the building. The usage shall be tabulated on an hourly basis over the operating period of the building, in order to establish a pattern of hot water usage for the building. In the absence of more detailed data for the premises listed in column 1 of table 6, the operating periods given in column 2 of table 6 shall be used.

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

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

Amdt 1

Table 6 — Operating periods for certain premises

1	2
Premises	Operating period h
Schools, kitchens, hostels, flats, offices, shops	12
Hotels, clinics	15
Factory ablutions	24

5 Materials, pipes, fittings, components and fixtures

5.1 Material

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

Where approval shall be obtained from the local authority regarding the use of specific materials or workmanship in the area concerned. Most local authority water bylaws require that all components for use in their areas of jurisdiction shall be listed on a schedule of approved products.

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

Where it is desired or deemed necessary to use materials, components, fittings or fixtures not covered by this part of SANS 10252, or by another appropriate standard, proof of quality and performance of the material or workmanship shall be established by tests or by reference to other appropriate standards. A single test report shall not sufficiently prove ongoing compliance.

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;
- j) dezincification resistance;
- k) serviceability; and
- l) water and energy efficiency.

Amdt 2 |

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rials, 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.

ed 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 (see 6.7.3).

ials 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 requirements given in the appropriate of 5.2 and 5.4. Galvanized storage containers shall not be used where the temperature of the hot water exceeds 60 °C.

NOTE 1 Non-standard or purpose-made water heaters can be constructed of, but not limited to galvanized steel, epoxy-coated steel, copper or stainless steel.

NOTE 2 Hot water storage containers can be constructed of protected steel, stainless steel, copper or aluminium or of non-ferrous alloys.

NOTE 3 The risk of corrosion in water heaters can be reduced by cathodic protection. This can be accomplished by the immersion of a sacrificial anode consisting of magnesium or any other anodic metal, in the tank. High temperatures promote rapid anode consumption and routine replacement of the anode is important to prolong the life of the heater. The anode should be appropriately earthed to the tank and system.

NOTE 4 Steel storage tanks can be protected, to varying degrees, by galvanizing, by a layer of aluminium zinc (sprayed on), or by lining them with copper, glass or other appropriate materials.

NOTE 5 Heating water above 60 °C substantially increases its corrosiveness, and this adversely affects the life of certain types of piping. A water temperature of between 60 °C and 70 °C can cause reversals in galvanized piping, or it can lead to pinhole pitting in copper tubing in closed circulating systems. High variable temperatures also result in increased expansion and contraction strains that can contribute to leaks at joints. The temperature of hot water should be controlled in the range of 55 °C to 60 °C.

NOTE 6 The circulation rate of hot water affects the risk of corrosion of piping. Extreme temperature fluctuations in the piping can be avoided if a suitable hot water circulation rate is selected. Resistance caused by

- a) air pockets at high points in the system,
 - b) sediment accumulation at low points,
 - c) long horizontal pipe runs,
 - d) defective balancing valves, and
 - e) rust or lime deposits in pipes,
- can result in inadequate circulation.

r 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 *Legionella 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.

pe and thickness of insulation material shall be suitable for the expected conditions of use.

NOTE 1 The most commonly used insulation materials are the flocculent or fibrous types, which depend on the existence of innumerable small air pockets within the material for their insulating properties. The thermal conductivity of these types of material increases with an increase in temperature.

NOTE 2 Materials for use on a cold or lukewarm surface are not always suitable for use on a hot surface.

NOTE 3 The surface temperature of insulation is greatly dependent on factors such as the water temperature, the location of the insulated component, sunlight and air movement.

Thermal insulation of hot water supply and circulating pipes shall be a minimum of $R-1$ (see 6.7.5) in accordance with the relevant national legislation (see foreword). **Amdt 2**

of dissimilar metals in the same below-ground installation should be avoided wherever practicable, or otherwise special measures shall be taken to prevent corrosion where pipes, pipe joints or connected fittings are of dissimilar metals.

r alloys which are predominantly zinc) is not a suitable material for body castings, pressings or machined bodies and operating mechanisms on plumbing fittings, and therefore, shall not be used in water installations.

5.2 es and pipe fittings

NOTE 1 Piping materials used for water installations in buildings include, but are not limited to galvanized mild steel, copper, stainless steel, polypropylene, polyethylene, cross-linked polyethylene, PVC-U, chlorinated PVC, Poly butylene, PVC-M and PVC-O.

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 prone 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, the copper pipe should be downstream of the galvanized steel pipe.

r and copper alloys

52.1 er 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 250 µm.

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52.2 anding 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 the manufacturer's instructions; and
- c) copper-based fittings for copper tubes that comply with the requirements of SANS 1067-1, or SANS 1067-2, as relevant.

52.3 he 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.

52.4 r 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 consists of of magnesium oxychloride (magnesite).

52.5 nd class 1 copper tubing shall not be bent or formed in any manner during installation or installed underground.

NOTE Copper tubing should be free from carbon residues in the bore where the supply water can support localized pitting corrosion.

-cement

52.1 ement pressure pipes that comply with the requirements in SANS 1223 shall be deemed to be acceptable.

52.2 ement products shall:

- a) be coated externally with bitumen where high acidity or sulfate-bearing soils are present, and
- b) preferably only be used in locations that are readily accessible for maintenance purposes.

NOTE Fibre-cement pressure pipes are suitable where freedom from tuberculation and a higher corrosion resistance (except in sulfate-bearing soils) are required.

ics

52.1 s materials, plastics pipes or plastics fittings shall be selected and used in accordance with the relevant standards (see 5.2.3.5, 5.2.3.6, 5.2.3.7 and 5.2.3.10), and the manufacturer's recommendations.

Plastics pipes and materials shall not be used in fire or combined installations above ground nor on the primary circulation loops between solar collectors and storage tanks. Special attention shall be paid to high temperatures and pressures, especially stagnation temperatures of solar water heating systems. Local authorities in some areas restrict the use of plastics pipes for direct connection into hot water heaters.

All SANS standards for plastic polymer piping systems 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. **Amdt 2**

52.2 on shall be given to the burning characteristics of plastics materials used in high fire risk areas or close to sources of heat that can impair their performance.

NOTE Characteristics that should be considered include whether the material supports combustion in air and whether, and to what degree, it is a flame retardant.

52.3 lastics pipes or fittings are suitably protected, they shall not be used in a position where permeation of gas or any other substance can cause (or is likely to cause) contamination of the water in them.

NOTE 1 For example, plastics pipes or fittings should not be laid beneath areas where spillage of oils, fuels, creosote or other hydrocarbons is likely to take place, unless such pipes or fittings are laid inside an impermeable sleeve or duct.

NOTE 2 Coefficients of expansion for plastics pipes exceed those for metal pipes, but this is normally not a problem where pipes are buried.

52.4 s manufactured from polyacetal shall not be used in closed-loop hot water or heating systems.

NOTE Closed-loop hot water or heating systems will cause degradation of the acetal, due to zinc chloride build-up in water.

52.5 ystems manufactured from polyethylene shall comply with the requirements of SANS 4427-1, SANS 4427-2, SANS 4427-3 and SANS 4427-5, and piping systems manufactured from polypropylene shall comply with the requirements in SANS 15874-1, SANS 15874-2, SANS 15874-3 and SANS 15874-5. The working pressure (for cold water temperatures exceeding 20 °C) of polyethylene pipes shall be rated in accordance with the requirements in SANS 4427-1, SANS 4427-2, SANS 4427-3 and SANS 4427-5. **Amdt 2**

52.6 pes and fittings that comply with the requirements of SANS 966-1; PVC-M pipes and fittings shall comply with the requirements in SANS 966-2 and PVC-O pipes shall comply with the requirements in SANS 16422.

52.7 s 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;

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- 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 polyethylene): 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.

52.8 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.

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

52.10 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 800 kPa (8 bar) at 70 °C.

Amdt 2

less steel

52.1 The following provisions shall be deemed to be acceptable:

- a) welded steel tubes manufactured from austenitic stainless steel and that comply with the requirements in SANS 965;
- b) pipes manufactured from stainless steel and that comply with the requirements in ASTM A 312, or EN 10250-4;
- c) fittings manufactured from stainless steel and that comply with the requirements in ASTM A 403;
- d) electric water heaters, or storage containers or pipes that are purpose-made from AISI type 316 L or SAF 2205 stainless steel for high pressure applications, and type 304 for low pressure applications; and
- e) stainless steel sinks that comply with SANS 242, stainless steel wash-hand basins and wash troughs that comply with SANS 906, and stainless steel stall urinals that comply with SANS 924.

52.2 Stainless steel supports in contact with

- a) stainless steel pipes or fittings shall be of the same grade as that of the pipes or fittings, and
- b) stainless steel water heaters or storage containers shall be manufactured from material at least equivalent to AISI type 304 L stainless steel in accordance with ASTM A 240.

NOTE Pitting corrosion in stainless steels is invariably related to the presence of halides (particularly chlorides) in the environment. As chlorides can be encountered in most environments, the likelihood of pitting of the stainless steel should always be considered.

52.3 Stainless steel material shall not be used

- a) below ground, unless approved, or
- b) where it might be in contact with materials such as ash, sodium chloride (salt), or any compound containing magnesium oxychloride (magnesite), unless the stainless steel material is suitably protected against external corrosion.

52.4 ng fluxes that can cause pitting corrosion of stainless steel, for example, fluxes containing chlorides or borites, shall not be used for soldering stainless steel.

nd steel

52.1 owing 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.

52.2 ried 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.

NOTE Galvanized pipes can be protected against corrosion either by wrapping them with special tape in accordance with the manufacturer's instructions, or by covering them with suitable protective coatings.

52.3 of the risk of corrosion, galvanized steel pipes shall not be used in the circulation legs of hot water installations unless such pipes have an adequate rate of circulation.

52.4 ple-loop hot water systems regular circulation of the water in all loops shall be ensured in order to prevent oxygen depletion of the hot water.

NOTE Galvanized steel piping carrying stagnant water could be attacked internally by anaerobic bacteria.

52.5 dles that are used for tapping off mains supply pipes of different materials shall comply with SANS 1808-44.

5.3 nal water fittings

al

53.1 l water fittings installed outside any building other than a residential dwelling shall

- a) incorporate a self-closing device,
- b) have a removable handle for operating purposes,
- c) be capable of being locked to prevent unauthorized use, or
- d) be of a demand type that limits the quantity of water discharged in each operation.

53.2 l fittings for hot water installations shall be compatible with the associated type of water heater.

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devices and WC flushing cisterns

53.1 le flush or dual flush WC flushing cistern shall comply with the requirements in SANS 821, and automatic shut-off flush valves for water closets and urinals shall comply with the requirements in SANS 1240.

NOTE For water conservation, it is recommended that the dual flush WC units be considered.

53.2 hing device that serves a water closet pan or urinal shall be activated

- a) manually, by the person using the pan or urinal, or
- b) automatically, by means of an approved apparatus that causes the flushing device to operate after each use of the pan or urinal, and
- c) shall be designed so that the valve cannot be held open to exceed the prescribed flushing volume.

53.3 gn of any automatically operated flushing device shall be such that no flush will take place when the device malfunctions.

53.4 hing device that serves a water closet pan shall comply with the requirements in SANS 821 and SANS 1240, as relevant, and shall be compatible with the water closet pan. During one flush action (full or part, as relevant) under normal operating conditions, the device shall

- a) clear the trap of the water closet, but
- b) not discharge more water than allowed by the local authority.

53.5 hing device that serves a urinal shall not be capable of discharging more than 2 L of water during one complete flush per stall or per wall-hung urinal or per 600 mm width of slab urinal. An automatic cistern or a tipping tank shall not be provided as a flushing device for a urinal. In the interest of water conservation, wall-hung urinals should be used in preference to stall urinals, wherever possible.

53.6 t pans and wall-hung urinals shall comply with the performance requirements in SANS 497. Low flushing capacity (4,5 L) WC flushing systems (including WC pan and cistern) shall comply with SANS 1733.

53.7 ws of flushing systems shall be either method 1, external warning primary overflow, or method 2 of SANS 821, internal overflow without external as required by the local authority.

mixers and showers

53.1 mixers

53.1.1 r 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.

53.1.2 ps shall operate effectively at the internal water pressure recommended by the manufacturer.

53.1.3 ps shall comply with SANS 1021, which is a standard that covers plastic taps for inside buildings only.

Amdt 2

53.2

Showers shall be of a type that can operate effectively at the internal water pressure recommended by the manufacturer. The maximum discharge flow rate shall be 10 L/min. **Amdt 2**

valves

The following provisions shall be deemed to be acceptable:

- a) float valves that comply with the relevant requirements in SANS 752; and
- b) plastics ball-floats (for float valves), that comply with the relevant requirements in SANS 1006.

5.4 -terminal fittings and components

low preventers

54.1 vacuum breakers

The capacity and performance of any vacuum breaker shall be such that no water previously discharged from any associated draw-off fitting can return through such vacuum breaker.

NOTE There are two basic types of in-line vacuum breaker, the atmospheric type and the pressure type. The pressure type has a spring loaded air inlet valve and a check element biased to the closed position. Both types are only effective against back siphonage.

54.2 check (non-return) valve and vacuum breaker

Only the type that admits air downstream of the check valve element for backflow prevention shall be used.

NOTE There are two types of combined check valve and vacuum breaker: one type operates to admit air to the pipework upstream of the check valve, and another type admits air downstream of the check valve.

54.3 check valve backflow preventer

Any double check valve assembly that complies with the appropriate requirements in SANS 1808-15 shall be acceptable.

54.4 pressure zone backflow preventer

Any reduced pressure zone backflow preventer that complies with the appropriate requirements of SANS 1808-15 is acceptable.

circulation pumps for hot water systems

54.1 Circulation pumps for boosting or secondary circulation shall be installed with the shaft in the horizontal plane and shall be adequately resistant to corrosion.

54.2 They shall not be audible above the background noise and the inlet and outlet connections to such pumps shall be fitted with full way valves and have union or flange type couplings to facilitate easy removal for maintenance or replacement.

se-made stainless steel water heaters and storage containers

54.1 by amendment No. 2.

54.2 made fixed electric water heaters and storage containers shall, be conformity assessed in terms of SANS 347 or fully compliant to SANS 151.

Amdt 2

NOTE Several of the design aspects referred to can apply to other materials.

54.3 type of stainless steel shall be used to manufacture all the parts of the water heater or storage container. The design of the water heater or storage container shall be such as to ensure that no water can reach the insulation material or the external container (or cladding) of the water heater or storage container. The surface of the underside of the external cladding of the water heater or storage container shall be ventilated to prevent condensation within the insulation. **Amdt 2**

trays

Safety trays shall comply with the requirements in SANS 1848.

NOTE See 8.4.4 for particulars regarding the installation of safety trays.

ners

Strainers shall comply with the requirements in SANS 1808-58.

NOTE The purpose of strainers is to prevent the passing through of solid material that could damage or block-up appropriate functional valves or terminal fittings.

tanks

54.1

5.4..1.1 nks shall be

- a) watertight and vermin proof,
- b) properly covered and ventilated,
- c) sized to comply with the requirements of the local authority, and
- d) sized to make provision for the usable capacity of a storage tank, which is the volume of water between the upper and lower operating water levels in the tank under normal operating conditions.

NOTE 1 Water for drinking purposes in buildings that exceed three storeys is usually supplied from a storage tank.

NOTE 2 The storage tank fulfils the purpose of attenuation of peaks in the water supply system and also provides an emergency supply during mains failure.

5.4..1.2 nks shall be provided with an adequate drainage system to ensure that the premises are not flooded in the event of leakage or accidental overflow. The capacity of such a drainage system shall be such that it is capable of discharging water at a rate at least equal to the rate of flow of the incoming water supply. The outlet of the drainage pipe shall be so situated that the discharge of water can be readily detected.

5.4..1.3 Pipe to any storage tank shall be provided with a float valve or any other approved level control device.

5.4..1.4 Welded storage tanks (metallic and non-metallic) shall be assessed for conformity in accordance with SANS 347, and the pressure equipment regulations in terms of the relevant national legislation (see foreword).

5.4.2 capacity exceeding 2 kL

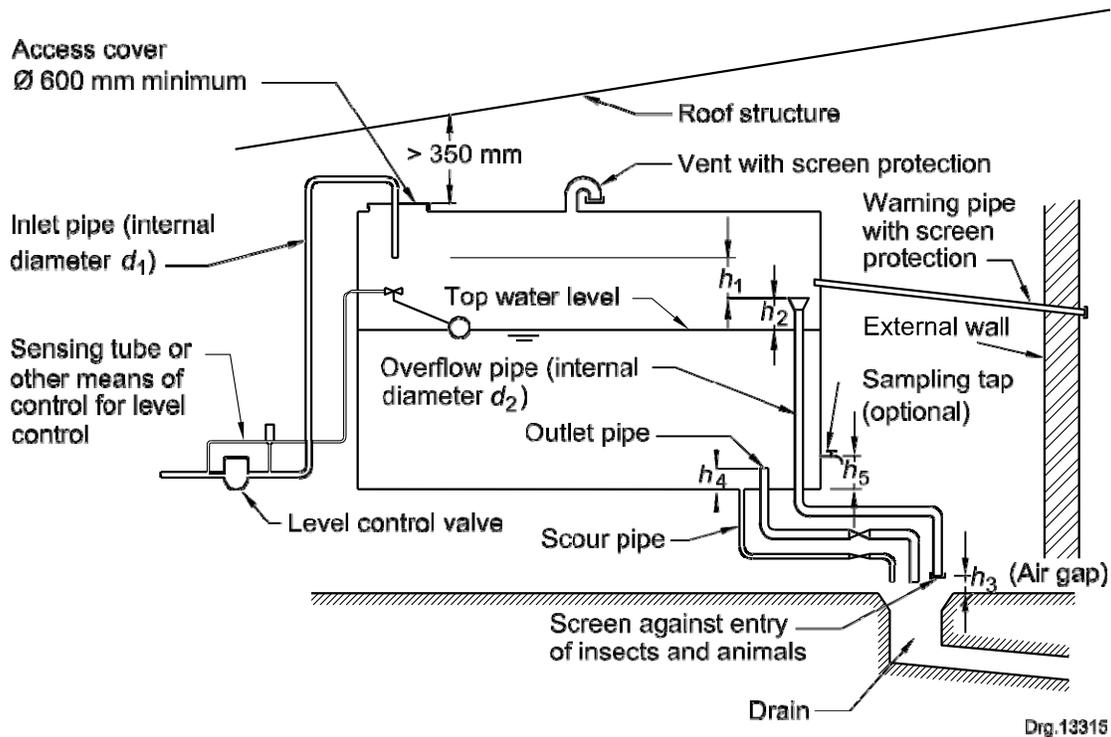
5.4..2.1 Inside the interior of the tank, the following shall apply:

- a) access shall be provided by an access opening that is of a size and shape into which a circle of diameter of at least 450 mm can be inscribed;
- b) the access opening shall be located either on the side, or on the top of the storage tank;
- c) the lid of the access opening shall be so designed that it cannot be left in the open position unattended;
- d) the access opening shall be covered by either a screwed-on cover or a tightly fitting lid that is hinged and has an overlapping rim of depth at least 40 mm; and
- e) the access opening shall be designed for easy access to the inside of the tank for inspection and maintenance purposes.

NOTE Disconnecting of the inlet pipe will ensure that the access opening is kept closed to avert water pollution.

5.4..2.2 Water shall be stored for drinking purposes and when so required, provision shall be made in the storage tank for the installation of a sampling tap situated at a point not less than 50 mm and not more than 150 mm above the internal floor of the tank.

5.4..2.3 Where a tank serves both a general installation and a fire installation, the design of the tank shall be such that the portion of its contents that is reserved for the fire installation cannot become stagnant. A storage tank of capacity exceeding 2 kL is shown in figure 2, and a typical arrangement of outlet pipes from a storage tank is shown in figure 3.



NOTE 1 Minimum diameter for an access opening is 600 mm diameter.

NOTE 2 Discharge capacity of overflow pipe at the head $\leq (h_1 + h_2) \geq$ discharge capacity of inlet pipe.

NOTE 3 $h_1 \geq 50$ mm or $h_1 \geq 2d_1$, whichever is the greater, subject to $h_1 \leq 150$ mm (the actual value of h_1 is based on hydraulic considerations).

NOTE 4 $h_2 \geq 50$ mm.

NOTE 5 $h_3 \geq 2d_2$.

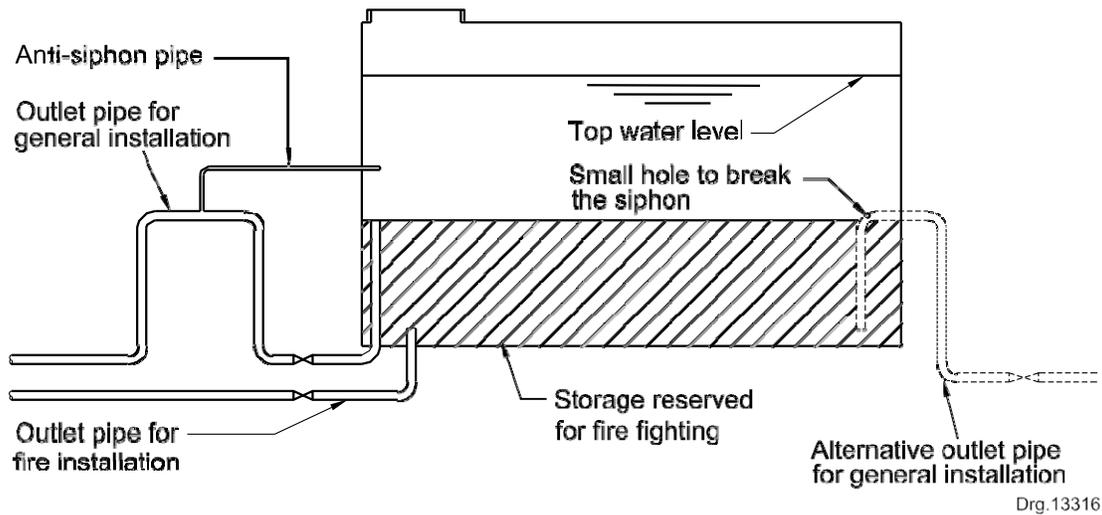
NOTE 6 $h_4 \geq 50$ mm.

NOTE 7 $50 \text{ mm} \leq h_5 \leq 150$ mm.

NOTE 8 Large tanks may have two access openings.

NOTE 9 Warning pipe is to have a minimum internal diameter of 19 mm and is to be of a rigid material. The invert of pipe is to be at least 25 mm above overflow level.

Figure 2 — Typical cold water storage tank of capacity exceeding 2 kL



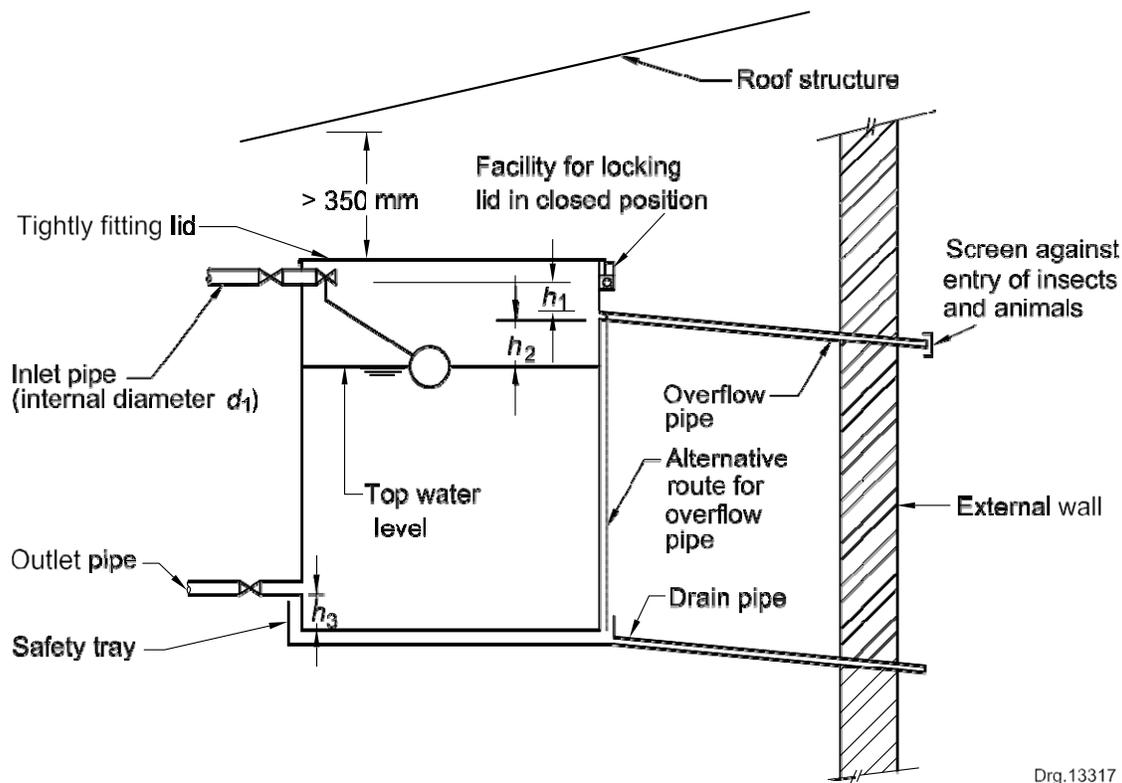
NOTE Only outlet pipes are shown.

Figure 3 — Typical arrangement of outlet pipes from a cold water storage tank

54.3 capacity 2 kL and less

Access to the interior of the storage tank shall be provided by an access opening (through the top of the tank) that

- a) has a tightly fitting lid that
 - 1) has an overlapping rim of depth at least 40 mm, and
 - 2) has a means of locking it in the closed position, and
- b) if it does not extend over the full area of the top of the tank, is provided with a raised rim of depth at least 40 mm around its circumference. A storage tank of capacity 2 kL and less is shown in figure 4.



NOTE 1 The discharge capacity of the overflow pipe \geq the discharge capacity of the inlet pipe capacity at the head $\leq h_1$.

NOTE 2 $h_1 \geq 50$ mm or $h_1 \geq 2d_1$, whichever is the greater, subject to $h_1 \leq 150$ mm.

NOTE 3 $h_2 \geq 50$ mm.

NOTE 4 $h_3 \geq 50$ mm.

NOTE 5 Overflow pipe to be of a rigid material.

Figure 4 — Typical cold water storage tank of capacity 2 kL and less

type water heaters

54.1 d water heaters and solar water heaters shall comply with the requirements in SANS 151, and any electric instantaneous water heater shall comply with the requirements in SANS 1356.

54.2 Ives for water heaters shall comply with SANS 1808-53.

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54.3 ed water heaters shall comply with SANS 1808-24 and SANS 1539. For information on the mandatory requirements of gas water heaters see annex A.

54.4 r storage tanks with external heating shall comply with all the relevant dimensional, mechanical strength, thermal and safety requirements in SANS 151.

heaters that use indirect electrical heating

Fluid for heat transfer shall be so selected as to convey the maximum amount of heat with a minimum amount of fluid and at the least possible cost.

NOTE 1 An indirect heating system uses a fluid in a separate circuit as a heating medium. The heated fluid transmits its heat through a heat exchanger to the water intended for distribution.

NOTE 2 The heat-carrying ability of a fluid is expressed as the "specific heat". The heat transfer efficiency is expressed in terms of the "volumetric specific heat". See I.1.2 for specific heat and volumetric specific heat values for fluids that can be used as heat transfer media.

NOTE 3 Water is a very efficient medium in terms of specific heat and is also one of the cheapest and most widely used.

heaters that use direct electrical heating

54.1 of water heaters of capacity exceeding 500 L shall be removable without loss of water from the heater.

54.2 heating elements of any water heater shall be positioned close to the bottom of the container.

54.3 e to be installed, the auxiliary elements of any water heater shall be positioned near the top of the container.

NOTE 1 In order to improve the efficiency of larger hot water supply systems, an auxiliary immersion or dry element can be installed in the storage container, to augment the main elements. With the main elements at the bottom of the container connected to a time control, set to heat the water mainly during a time of off-peak electricity use, the auxiliary elements will ensure that hot water in the top third of the container is available over a period of 24 h.

NOTE 2 The auxiliary element is usually rated at one-third to two-thirds of the rating of the main elements.

54.4 of heater elements used shall be compatible with the associated type of water heater.

54.5 on heating units for electric storage water heaters shall comply with the requirements in SANS 514.

NOTE Direct electrical water heating elements heat the water directly and can be one of the following types:

- a) Immersion elements (submerged or wet elements): in this type of system, electrical rod elements are installed in the hot water storage container, in direct contact with the water. This is a very common method of heating water by means of electricity. Scale formation on the elements is restricted as a result of their expansion and contraction. However, the storage container needs to be drained before the elements can be replaced; and
- b) Dry elements: Dry elements are so installed in a housing inside the storage container that they are not in direct contact with the water. Unfortunately, the outer surface of the housing, which is in contact with the water, is susceptible to the formation of scale, resulting in a decrease in heating efficiency over a period of time. The main advantage of this system is that the elements can be replaced without drainage of the storage container.

e type water heaters

54.1 ctric storage water heaters for domestic use shall comply with the requirements in SANS 151.

NOTE 1 Mixing of hot and cold water occurs more readily within a horizontal cylinder than within a vertical cylinder.

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NOTE 2 In urban areas, the most common method of heating water is by an immersion type electrical resistance element mounted in an insulated storage cylinder, commonly called a geyser. Geysers require little maintenance.

NOTE 3 Although it is common practice to increase the temperature setting of a geyser that is inadequate in size to supply the required volume of hot water, this practice has the effect of increasing energy loss and can shorten the life span of the geyser. The recommended temperature for storage of hot water is 60 °C.

54.2 et type storage water heaters as defined in SANS 151 shall incorporate a thermostat, shall not be pressurized or subjected to vacuum, and the flow of hot water shall be controlled on the inlet side.

54.3 ype storage (combination) water heaters as defined in SANS 151 shall not be pressurized or subjected to vacuum, and the flow of hot water shall be controlled on the outlet side.

54.4 pe storage (unvented and vented) water heaters as defined in SANS 151 shall be fitted with temperature and pressure safety valves apart from a thermostat, and the flow of hot water shall be controlled on the outlet side.

devices

54.1 ts for electric storage water heaters shall comply with the requirements of SANS 181 and shall include a high temperature cut-out device. Reliance for the protection of water heaters shall not be placed solely on thermostats. Further protection measures include the provision of temperature and pressure safety valves.

54.2 al control and safety valves for pressurized hot and cold water systems shall comply with the requirements of SANS 198.

NOTE 1 The thermostat is usually an adjustable device controlling the electrical energy input for heating the water to a selected operating temperature.

NOTE 2 A high temperature cut-out device that permanently disconnects the electrical energy supply at a preset high temperature limit often forms part of a thermostat.

NOTE 3 A temperature and pressure safety valve controls the temperature and pressure, as relevant in a water heater. It does not disconnect the electricity supply to the heater.

NOTE 4 The function of an expansion control valve is to prevent the hydraulic pressure within a water heater from exceeding the working pressure rating of the heater. The excess pressure can be due either to the expansion of the water under normal operating conditions or to failure of the pressure control valve upstream of the expansion control valve.

54.3 al control and safety valves for use in pressurized hot and cold water systems at static inlet water pressures of up to 2 000 kPa, and for working pressures of up to 600 kPa, shall be constructed and marked in accordance with SANS 198 and matched to the pressure rating of the system. The requirements for colour coding of functional control and safety valves are summarized in table 8.

Table 8 — Colour coding for working pressure ratings of functional control and safety valves

1	2
Rated working pressure p KPa	Colour
$p \leq 50$ $50 < p \leq 75$ $75 < p \leq 100$	Yellow Orange Blue
$100 < p \leq 200$ $200 < p \leq 300$ $300 < p \leq 400$ $p \leq 600$	Black Brown Red Green

ves, ball valves and butterfly valves

54.1 wing valves shall be deemed to be acceptable:

- a) copper alloy gate valves that comply with the requirements in SANS 776 and SANS 1857, as relevant for isolating purposes only, not for dispensing or flow control;
- b) ball valves that comply with the requirements in SANS 1056-3. Reduced bore valves shall not be used as in-line isolating valves, only as servicing valves for terminal fittings; **Amdt 2**
- c) butterfly valves that comply with the requirements in SANS 1849; and
- d) cast iron valves shall comply with SANS 664-1 SANS 664-2, SANS 664-3, and SANS 665-1, SANS 665-2 and SANS 665-3.

54.2 ves shall not be used to control the flow-rate of water as this could cause damage to the seats of the valves, which, in high pressure systems, could be of a serious nature.

54.3 ves shall not be used in installations that are prone to water hammer. In such cases, slow-acting valves (for example, stopcocks and diaphragm valves) are recommended.

re gauges

Pressure gauges that comply with the requirements in SANS 1062 shall be deemed to be acceptable.

le connectors

Flexible connectors shall comply with SANS 1808-5 and shall only be used for connecting to terminal fittings that have sufficient access for maintenance. They shall not be used in-line or for connecting to fixed water heating units.

on-return valves

Check valves shall comply with SANS 1808-10. Swing type check valves with metal-to-metal seats shall not be used on hot and cold water systems in buildings.

se reels

Fire hose reels shall comply with SANS 543.

ic solar water heaters

Domestic solar heaters shall comply with SANS 1307.

6 ayout

6.1 ral

ing of water supplies

6.1.1 r supplied from a main to an installation shall pass through an approved water meter that complies with the relevant national legislation (see foreword).

6.1.2 uired, the following shall apply:

- a) The water meter shall be installed in a suitable location where it is easily accessible and maintainable. The installation condition shall be in accordance with the manufacturer's specifications. Meter installations size DN 15 to DN 40 shall include an upstream isolating valve. If not included in the water meter, an upstream strainer and downstream non-return valve shall be fitted. An isolating valve accessible to the consumer shall be fitted downstream of the water meter. Where meters are exposed to the elements in boundary or yard installation, the meter shall be installed in a protective meter box or manifold assembly. An additional isolating valve shall be fitted down stream of the water meter, either incorporated in the meter box or in the service connection to the consumer.
- b) Plastic water meters shall not be exposed to direct sunlight and shall be fitted in a meter box or enclosure.
- c) Water meters from size DN 50 and larger shall be fitted with a straight length of pipe of the same diameter as the meter directly up- and downstream of the meter in accordance with the manufacturer's specification, in order to prevent flow disturbances affecting meter accuracy.

NOTE On mechanical water meter installation it is recommended that a strainer be installed upstream of the meter to prevent possible damage to the meter as a result of suspended solids.

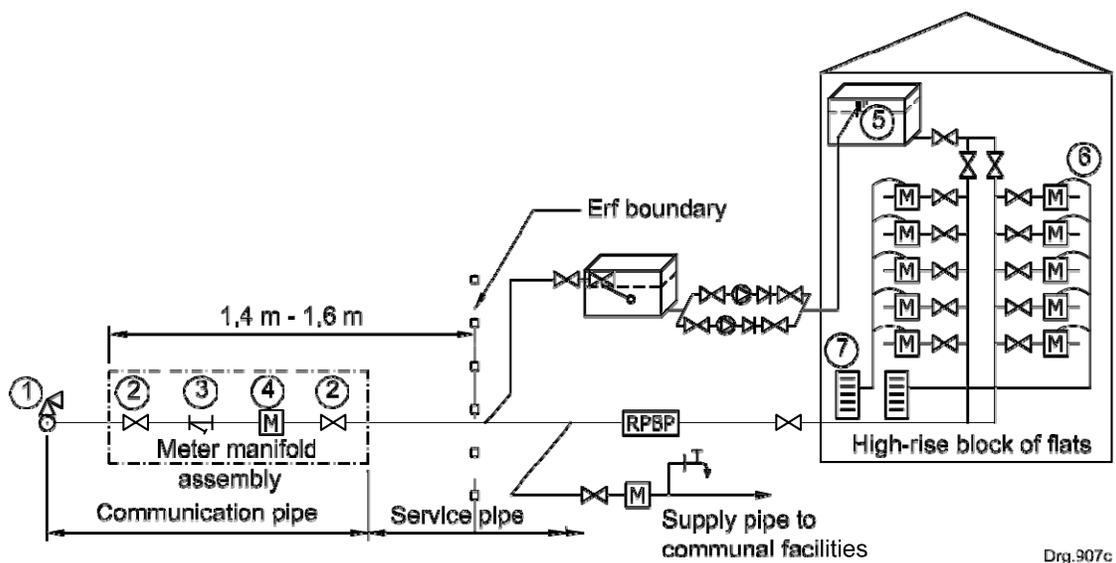
- d) Strainers shall have isolating valves fitted upstream and downstream of the strainer to allow for servicing of the meter and the strainer. Isolating valves shall not be used as flow restrictors. Pressure reducing valves shall only be fitted downstream of the meter after the prescribed length of straight pipe.
- e) Installations where the water flow has a very high differential between low and high flow, combination meters shall be used.
- f) Water meters shall not be installed in traffic areas. Water meters from DN 15 to DN 100, nominal size, shall comply with SANS 1529-1. Electronic water meters and prepaid meters shall comply with SANS 1529-9. The physical dimensions for water meters DN 15 to DN 100 are recommended in SANS 1529-3. The requirements for water meters exceeding DN 100, but not exceeding DN 800, are detailed in SANS 1529-4.
- g) Provision shall be made for the drainage of water that might discharge from the pipe on which the water meter is to be installed.

61.3 installations serving premises of separate occupancy shall facilitate individual metering.

NOTE 1 Individual metering promotes the economical use of water. This is best achieved via a single water connection. For high-rise buildings, meter reading can be facilitated by the use of meters fitted with remote reading systems using for example, radio, GSM, GPRS networks or wired counters. An installation serving individually metered flats in a high-rise block is shown in figure 5. The bulk meter shown can be used to check for example, un-metered leakage from the buried service pipes.

NOTE 2 The relation of boundary to meter should be in accordance with the local authorities.

NOTE 3 Deleted by amendment No. 1.



Key

- 1 Mains connection
- 2 Isolation valve
- 3 Strainer
- 4 Bulk meter
- 5 Automatic level control for pumps
- 6 Cable to connect meter with remote counter
- 7 Cabinet for remote counters/transmitters

Figure 5 — An installation serving a high-rise block of flats using remote counters

er pumps

61.1 is necessary to pump water to maintain a water supply, such booster pump installations on premises shall, unless otherwise approved, be so designed that the pumps do not draw water direct from the water mains, but from a storage tank that

a) is fed by gravity from the mains,

b) is fitted with an inlet control valve of the correct size, so set as to admit water to the tank from the mains at a rate at least equal to the average hourly peak water requirement of the premises, and

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- c) has a minimum capacity of the greater of at least 25 % of the average daily water demand or one hour's capacity of the pumping system.

NOTE 1 Booster pumps may be required where premises or buildings or parts thereof are situated above a level that cannot be served by the normal pressure in the water main or if the owner requires to have a secure water supply.

NOTE 2 For information on pumps, see annex C.

6.1.2 The pump shall be self-priming and float controlled or electrode controlled and shall be fitted with all electrical controls and safety devices for the protection of the pump or pump motors (or both), in the event of stoppage of the supply of water from the mains.

Isolating valves

6.1.1 Where required, or provided that 6.1.3.2 does not apply, a specific isolating valve shall be provided

- a) in the case of any water meter installed outside the boundary of the premises, in the service pipe at a point not exceeding 1,5 m inside the boundary of site,
- b) in the case of any water meter installed inside the boundary of the site, at a suitable point on the consumer's side of the water meter,
- c) where a pipe enters any building or any portion of a building in separate occupation,
- d) on any branch pipe that serves a flushing cistern, and next to the cistern,
- e) on any branch pipe that serves an automatic flush valve, or a flushing valve, unless such flush valves incorporate their own isolating valves,
- f) on each side of, and next to, any backflow preventer or any combination of the backflow preventer and pressure reducing valve,
- g) on each side of, and next to, any pressure reducing valve of nominal inlet diameter exceeding 25 mm,
- h) on the upstream side of any pressure reducing valve of nominal inlet diameter not exceeding 25 mm,
- i) in such positions that, should it become necessary to drain any pipe, the total length of the pipe that has to be drained between isolating valves does not exceed 30 m, and
- j) in the case of any storage tank,
 - 1) on the inlet pipe next to, and upstream of, the valve controlling the supply to the tank, and
 - 2) on the outlet pipe from the storage tank and next to the tank that supplies water to the water installation.

NOTE Any isolating valve used to shut off the supply to the storage tank should be of a type that cannot be suddenly closed (for example, a gate valve and not a butterfly valve).

6.1.2 In addition to the provisions of 6.1.3.1, an isolating valve shall not be provided between any pressure reducing valve and a water heater if such a pressure reducing valve incorporates an expansion relief device or vacuum relief device intended to protect such water heater.

6.1.3 ating valve in hot water installations shall be of the full-bore type in order to limit the effects of scale formation within the valve.

ontrollers

6.1.1

6.1.1.1 ry or if so required, flow controllers shall be incorporated in the water installation, to control the flow of water.

6.1.1.2 perated valves shall not be used as flow controllers because of the damage that can be caused to the seats.

NOTE 1 A flow controller or an automatic flow-control orifice, which is a simple self-cleaning device installed in-line, is sometimes useful for controlling the flow of water. The automatic controlling mechanism has a flexible orifice that varies inversely with the pressure in its cross-sectional area so that a constant flow rate is maintained. The flexible insert acts as a fixed orifice until the inlet pressure reaches the threshold pressure (80 kPa to 100 kPa). When the threshold pressure is exceeded, the orifice deforms, causing the pressure to drop to whatever pressure is necessary to overcome the system friction and sustain the rated flow. These are also called pressure compensating flow controllers.

NOTE 2 Flow controllers are obtainable for a wide range of rated flows, and are usually designed for connection to pipes or fittings of nominal internal diameter up to 50 mm.

NOTE 3 Some fittings have flow controllers installed integrally within the fitting itself.

6.1.2 **device**

Where appropriate, an acceptable balancing device should be introduced in the reticulation pipework to dynamically balance the system.

6.1.3 **flow controller**

Where the flow in a reticulation system needs to be controlled, an appropriate flow controller should be installed in the reticulation pipework or in the case of water reticulation systems with multiple loops the flow should be balanced to ensure equal distribution of flow throughout the reticulation.

NOTE This controller and its installation is normally of a permanent (non-replaceable) nature.

6.1.4 **I fitting flow controller**

This controller shall be replaceable and should be fitted to the terminal fitting for the purpose of water conservation. The flow rates for taps on wash-hand basins shall be a maximum of 6 L/min and on showers 10 L/min.

ners

6.1.1 le strainer shall be provided to prevent the entry of solid particles of size exceeding 710 µm into any fittings controlling water pressure or controlling the flow direction of water, unless such fittings incorporate their own strainers. Strainers for sizes 15 mm to 25 mm shall comply with SANS 1808-58.

6.1.2 er shall be located and installed in such a position that it is readily accessible for inspection and maintenance, without having to be disconnected from the supply pipe.

Amdt 2

trays

6.1.1 tray shall be provided under every storage water heater and every storage tank located in any roof space above a ceiling, and such a safety tray shall be used only for the purposes of collecting and draining away water that results from an accidental discharge from a specific component of a water installation.

6.1.2 ce shall be taken of the requirements of SANS 10254.

NOTE See 5.4.6.1.2 concerning the sizing and positioning of drain pipes.

fittings and components

6.1.1 uired, the following shall be provided:

- a) sediment traps in the form of clean-out tees with drain valves at the heels of all vertical lines;
- b) convenient flush-out points on horizontal lines; and
- c) the necessary connections for the backwashing of instantaneous non-storage water heaters, in order to remove sediment that might have accumulated.

6.1.2 f in-line fittings that could cause bottlenecks by providing a shoulder for deposit build-ups shall be minimized.

6.1.3 ble measures shall be taken to prevent the back-siphonage of hot water into the cold water supply.

6.2 nal water fittings and overflow pipes

al

6.2.1 nt water in unused pipework from becoming stagnant, a water supply pipe shall

- a) not be connected to any water fitting unless a terminal water fitting is also connected, or
- b) be disconnected from the installation when a terminal water fitting is disconnected, unless such a terminal fitting is disconnected for repair or replacement, and provided that the supply pipe is put into use within an acceptable time period to prevent stagnation of the water under local climatic conditions.

6.2.2 inal water fitting (other than a float valve) that serves a cistern or a storage tank shall be installed in such a position and in such a manner that the discharge of water from it is readily visible.

6.2.3 nal water fitting shall be attached to the outlet of an open-outlet type fixed storage water heater unless such a fitting has been designed to discharge hot and cold water while keeping the hot water outlet open to the atmosphere.

6.2.4 red by the local authority, the overflow pipe from any water closet cistern shall be carried either through an outside wall of the building concerned, or to another point where the discharge of water from it is readily visible.

6.2.5 rwise required, the hot tap shall always be situated on the left hand side and the handle of a single control mixer shall be positioned to the left for hot water discharge.

of urinals

Each wall-mounted urinal, stall urinal or each 1,8 m width of slab urinal shall be provided with a separate user activated flushing device. Waterless urinals shall be situated so that the drain is located on a branch line downstream of a wash-hand basin or a flushing urinal.

ing taps and showers

Unless otherwise required, ablution areas that have a battery of more than three wash-hand basins or showers shall be provided with metering or demand type taps or metering type showers.

6.3 flow prevention

Amdt 2 |

al

Any backflow prevention device shall be arranged at, or as near as practicable to, the point of delivery, draw-off or use of water in accordance with annex D.

Amdt 2 |

urn (check) valves

Where a non-return valve is connected in association with, and adjacent to, a vacuum breaker, the non-return valve shall be located upstream of the vacuum breaker.

NOTE In such cases, no minimum vertical distance between the non-return valve and the overflow level of the receiver or outlet of a draw-off fitting is required.

m breakers

63.1 breaker shall be positioned at a height of at least 150 mm above the overflow level of any receiving appliance such as a cistern or vessel when the latter is fixed, or 300 mm above the outlet of the fitting in all other cases.

63.2 valves such as taps shall not be installed downstream of an atmospheric in-line type vacuum breaker.

63.3 m breaker shall be suitably sized.

NOTE In general, a vacuum breaker should be of at least the same nominal size as the pipe on which it is installed.

6.4 in hot water systems

ation pumps

64.1 rwise required, a circulation pump shall be provided in all cases where the natural circulation in a hot water circulation system is insufficient.

64.2 d rotor (glandless) type circulation pumps shall be provided on primary circuits only.

NOTE 1 The function of the pump is only to induce circulation in order to maintain acceptable temperatures in the system, and not to supply hot water to any fitting.

NOTE 2 Continuous pump operation (controlled by a time switch) is more advantageous than stop-start operation (energy controlled).

64.3 The circulation pump shall be located in the return main where the temperature of the water is low and the pumps are more accessible.

pumps

64.1 Pumps shall be so selected as to provide the total hot water demand.

NOTE 1 The heat pump extracts heat from one medium and transfers it to another. All refrigeration equipment, air conditioners and chillers with refrigeration cycles are in essence heat pumps, although the term "heat pump" is reserved for equipment that provides heat rather than that which removes heat for cooling purposes.

NOTE 2 Heat pumps are capable of heating water to more than 60 °C. They utilize ambient or waste heat, and can therefore be operated with greater energy efficiency than can conventional heating systems. In larger hot water installations, energy savings offset the higher capital costs of such pumps and therefore their use to supply or to augment existing systems is growing as an energy conservation method.

NOTE 3 A typical hot water installation that incorporates a heat pump is shown in figure 6.

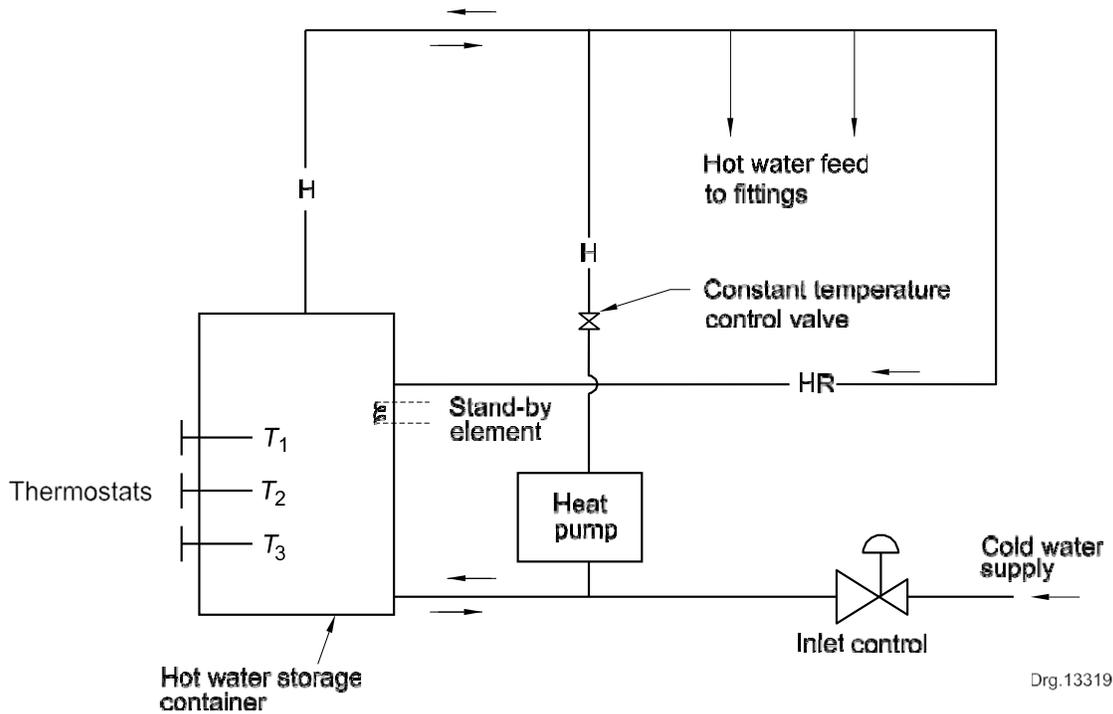


Figure 6 — Schematic layout of a typical hot water system incorporating a heat pump

64.2 A circulation pump is provided, and unless otherwise required, a stand-by heating system shall be provided as a backup in the event of failure of the heat pump.

6.5 rage tanks

al

Any storage tank shall be so placed or special measures so taken that the tank can be readily drained, and then inspected and cleaned on the inside.

ater storage tanks

65.1 tanks are buried, or are partly sunk into the ground, special measures shall be taken to detect leakage from the tank.

NOTE 1 The measures necessary can include an underfloor drainage system, or an impervious membrane, draining to a readily visible outlet point.

NOTE 2 Where separate outlet pipes from any storage tank are provided for supplying hot water apparatus and for feeding cold water outlets, the former type of outlet should be set at a level at least 25 mm above the level of the latter type of outlet; this measure will minimize the risk of scalding should the water supply fail.

NOTE 3 Where possible, water for drinking purposes should not be supplied from a cistern or tank. Taps supplying water for drinking purposes (other than those discharging from a hot water system that supplies water for domestic purposes in dwelling houses or residential buildings) should preferably be connected to the water installation pipe at a point before such pipe supplies any cistern or tank.

65.2 tank, under operating conditions, shall not have any opening to the atmosphere other than the overflow pipe and a suitably protected vent.

65.3 e tank shall be so situated that entry of surface water or ground water into the tank is prevented. This requirement shall be deemed to be satisfied if a storage tank is

- a) located entirely above ground level on a well-drained site not liable to flooding, or when its base is at least 600 mm above the highest known flood level, or
- b) a concrete reservoir that is buried or partly sunk into the ground and has been designed in accordance with SANS 10100-1, and constructed and tested in accordance with SANS 1200 G, or
- c) situated in a watertight basement below ground level.

65.4 nlet pipes to, and outlet pipes from, storage tanks are positioned as far apart as possible to limit the short-circuiting of flow, suitable measures shall be adopted to limit such possibility.

65.5 is anticipated that, because of initial under-utilization of the installation, water entering any storage tank will remain there for longer than two weeks, temporary provision shall be made for disinfecting the water.

NOTE 1 One method of disinfecting water is to fit a chlorinator (using calcium hypochlorite tablets in a special holder) in a bypass on the supply pipe to the tank (see SANS 460).

NOTE 2 Dosing of the water in the tank by adding granules or tablets containing chlorine direct to the water in the tank without first dissolving them, and taking steps to disperse the chlorine solution in the tank can result in a localized concentration of chlorine and resultant corrosion.

storage tanks (see annex E)

65.1 r storage tanks shall be thermally insulated in an acceptable manner to prevent heat loss.

65.2 cause of its design, it is necessary for a non-mechanical safety device, such as a fusible plug to be fitted to a hot water storage tank, such tank shall also be fitted with a temperature and pressure safety valve designed to open at a temperature of at least 5 °C below that at which the non-mechanical safety device operates, or is designed to operate.

65.3 If a hot water storage tank is to stand on a floor, it shall be of a type provided with internal supports.

6.6 Water heaters and associated fittings or components

Devices

66.1 All safety devices installed shall be compatible with the associated type of water heater, and such devices shall have corresponding pressure ratings that are not higher than the working pressure of a fitting or appliance, e.g. rating of the water heater, or of the fixed storage water heater. **Amdt 2**

NOTE 1 Problems and dangers can arise from defective fittings, faulty designs and incorrect installation. Examples of "incorrect" installation are

- a) the placing of a non-return valve or isolating valve between the water heater and the expansion control valve,
- b) restricting the outlet of a safety valve,
- c) the location of a vacuum relief valve at a level below the top of the water heater, and
- d) a system that permits water to be heated to a temperature exceeding boiling point.

NOTE 2 If water confined in a container is subjected to an increase in temperature above that at which it would normally boil, a potentially dangerous situation arises. If the pressure is suddenly reduced either by yielding of the walls of the container or by a sudden large draw-off of hot water, the water in the container could flash into steam, resulting in an explosion. If both the energy input control device and safety valve fail, then an explosion will occur.

NOTE 3 Bursting of the water container takes place when the container is subjected to a higher internal hydraulic pressure than it was designed for. This condition can develop due to an excessive inlet pressure, unrelieved expansion pressure (due to heating of the water) or an occurrence of both simultaneously.

NOTE 4 The water container can collapse when a condition of negative pressure which it is not capable of resisting is created within the container. This condition can be induced when

- a) water is drawn off without the admission of air or water,
- b) when the rate of water outflow from the container exceeds the combined rates of inflow of water and air, or
- c) the water within the container cools without the admission of water or air.

NOTE 5 The heating element can burn out if it is not continuously immersed in water while electrical energy is supplied to the element. Such a condition is brought about by such conditions as the unintentional drainage of the water container by back-siphonage.

NOTE 6 Hot water systems require particular attention in terms of safety. The continuing safe operation of a hot water system depends on having the right equipment correctly installed in a well designed system, which is properly maintained and not exposed to misguided interference. The use of appliances that have all the necessary safety devices factory-fitted is recommended in order to prevent the omission of certain items during installation.

NOTE 7 Several devices are available to protect hot water systems against damage. These devices can either prevent the build-up of unsafe water temperatures in the storage tank, or relieve pressure within the system when an unsafe condition occurs, or both.

NOTE 8 A temperature and pressure safety valve is intended to protect a water heater against excessively high pressures and a water temperature above boiling point. It consists of a combination of

- a) a pressure relief valve that opens when the pressure in the water heater reaches a pre-set maximum pressure which is related to the pressure rating of the water heater, and
- b) a thermal probe that also opens the pressure relief valve when the temperature of the water in the heater reaches a pre-set value usually not exceeding 95 °C.

NOTE 9 A pressure reducing valve is intended to reduce the incoming water supply pressure either to the working pressure rating of a water heater incorporated in the installation, or to the maximum permissible pressure allowable in an installation. The pressure control valve is usually situated at a convenient position in the incoming cold water supply pipeline.

NOTE 10 An expansion control valve is intended to prevent the hydraulic pressure within a water heater from exceeding the working pressure rating of the heater. The excess pressure could be caused either by the expansion of the water under normal operating conditions or by failure of the pressure control valve upstream of the expansion relief valve.

NOTE 11 A vacuum relief valve is intended to prevent a state of negative pressure from occurring in a hot and cold water system. It therefore acts as a safeguard against the collapse or unintentional draining of the container.

NOTE 12 Figure 7 shows the relationship between the various protective devices associated with water heaters (arrows signify direction of water flow), and examples of installations for dwelling houses showing the location of protective valves are given in SANS 10254 (see annex F for a general guide).

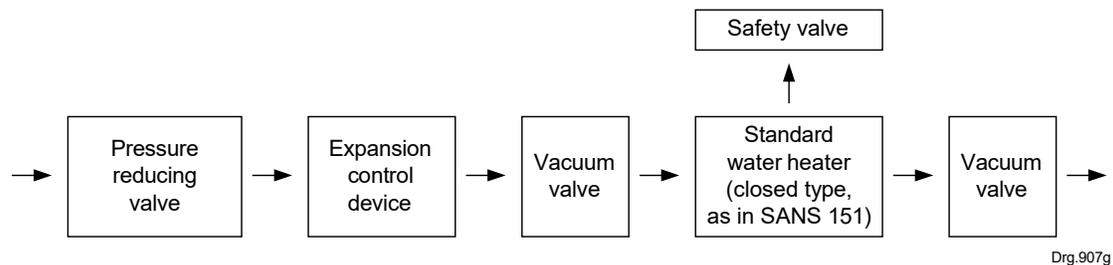


Figure 7 — Relationship between the various protective devices associated with water heaters

66.2 sary, a pressure control valve shall be installed to reduce the incoming water pressure either to the working pressure of a water heater incorporated in the installation or to the maximum permissible pressure allowed in the installation. The pressure control valve shall be situated at a convenient position in the incoming cold water supply pipeline.

66.3 r water is heated,

- a) the energy supply to each heater shall be under effective thermostatic control,
- b) the energy supply to each heater shall be fitted with a temperature-operated manually reset energy cut-out that is independent of the thermostatic control, and

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- c) a means of dissipating the heat input shall be provided in the form of either adequate venting or a temperature and pressure safety valve, except where water is only heated indirectly by a primary circuit which itself is protected in accordance with the requirements given in 6.6.1.3(a) or (b), or when it is heated from a source of heat that is incapable of raising the temperature above 90 °C.

66.4 r contained in any water heater or cylinder is not at all times open to the atmosphere, or if the water heater is not vented, the following shall apply:

- a) an expansion control valve shall be installed in the cold water supply pipe to the water heater in a position such that there is no valve between the water heater and the expansion control valve;
- b) vacuum relief valves shall be installed on the inlet and outlet side (see SANS 10254) in the following positions, so as to prevent drainage of the water heater and in the case of copper water heaters, also to prevent collapse of the heater:
- 1) as close as practicable to the water heater that is to be protected; and
 - 2) on upstands that are provided in both the cold water feed pipe to, and the hot water feed pipe from, the water heater, and such upstands shall extend at least 300 mm above the top of the water heater, if required by the local authorities and manufacturer's installation instructions, otherwise the height shall comply with the requirements in SANS 10254;
- c) the discharge pipe connected to a safety valve shall be of metal and shall be at least the same size as the valve and able to withstand any continuous discharge of hot water or steam at a temperature of up to 125 °C without becoming deformed in any manner; and
- d) if any temperature and pressure or temperature-pressure safety valves are installed, they shall be
- 1) installed at, or as near to, the top of the water heater as is practicable,
 - 2) so fitted as to permit ready replacement, and
 - 3) protected from freezing.

66.5 Large pipes from the safety valve and the expansion relief valve shall not be interconnected.

66.6 Temperature and pressure safety valve shall be installed within the top 20 % of water in the container, and not lower than 150 mm from the top of the container. The thermal probe shall be situated in the zone of highest temperature. **Amdt 2**

66.7 Tempering medium cannot safely control the maximum temperature in a water heater to 60 °C, a tempering valve shall be installed near the water heater in accordance with the manufacturer's instructions and should the maximum temperature need to be thermostatically controlled at terminal fittings (i.e. for frail care, people with disabilities and infants) thermostatic mixers shall be installed. **Amdt 2**

water heaters

66.1 A fixed water heater is so designed and installed that the water contained in it is at all times open to the atmosphere, provision shall be made

- a) for the safe discharge of water arising from the expansion of the water under normal operation, and
- b) for the dissipation of pressure resulting from abnormal operation of the heater.

66.2 Control fitting of any sort other than a draining valve shall be installed direct in the pipeline between any fixed water heater and its associated expansion control valve or vacuum breaker.

Amdt 2

66.3 Pipes shall remain unobstructed and always be open to the atmosphere.

66.4 Design of indirect water heating systems,

a) special additives shall, if necessary, be added to the heat transfer medium, to control corrosion, and

b) where pipes are subject to freezing temperatures, an anti-freeze substance shall be added to the heat transfer medium.

66.5 To avoid water delivery pressure, the various components of the system shall be so installed that the hot and cold water delivery pressure to water mixing components is balanced. The residual dynamic pressure at the fittings shall not vary by more than 20 %. This requires that the layout and the pipe sizes shall be correctly calculated in terms of SANS 10252-1 to ensure the correct flow pressures taking into account simultaneous uses of other draw off points on those lines.

Amdt 2

heaters that use electricity

66.1 Heaters that use direct electrical heating shall be so controlled as to endeavour to limit the maximum simultaneous electricity demand for large consumers.

NOTE The electricity consumption of the water heater can be scheduled in such a way that the maximum electricity demand assessment before the water heater's contribution is not increased by the heater's demand. The water heater will thus consume electricity only during the individual consumer's off-peak electricity demand periods.

66.2 Electric water heater shall be provided, as needed, with

a) safety devices in accordance with SANS 151,

b) thermostats in accordance with SANS 181, including a temperature cut-out device.

heaters that do not use electricity

66.1 Rated instantaneous water heaters of the tube type that have an output rating not exceeding 28 kW shall be provided with

a) an automatic gas flow valve controlled by the flow of water to the heater, and

b) a thermostatic water temperature control device, or a temperature-operated energy cut-out device.

NOTE For more information concerning gas water heaters, see annex A.

66.2 Rated instantaneous water heater that has an output rating exceeding 8 kW shall be provided with a pressure relief safety valve.

66.3 Pressurized hot and cold water installations shall be provided with functional control and safety valves in accordance with SANS 198, as appropriate.

f valve drain pipes

66.1 Large pipes from expansion control and safety valves shall

a) be of a size not less than the size of the connection to which it is fitted with due consideration to the fact that the maximum length run is 4 m and for runs exceeding 4 m, the size shall be increased over the whole length to a maximum of 9 m, **Amdt 2**

b) that has three or fewer bends, and for each additional bend, and the maximum drain pipe length shall be reduced by 600 mm; all bends shall be formed with a centre-line radius at least five times the diameter of the drain pipe, **Amdt 2**

c) shall be so installed that

- 1) it inclines downwards continuously to its outlet,
- 2) drainage of both valve and piping is ensured,
- 3) blockage due to freezing or foreign objects is prevented, and
- 4) when flow occurs from it, the flow can be readily observed with the minimum risk of injury or damage due to steam or hot water, and

d) that is used for conveyance of water resulting from the normal expansion of heated water shall discharge to the atmosphere in a position where the discharge is readily discernable but shall not inconvenience the building's occupants or cause damage to the building.

66.2 Pipes from individual pressure, temperature or combined pressure-temperature safety valves shall not be combined.

66.3 Vent or exhaust pipe from a fixed water heater shall

a) extend on a rising grade from the highest point of the container, without restriction or sharp change in direction between the heater and the outlet, and shall be as short as is practicable,

b) where a cold water feed tank is installed, extend on a rising main to a height of the greater of 300 mm and at least 80 mm above the water level in the cold water feed tank for every 1 m between the overflow water level in the cold water feed tank and the base of the heater. The pipe shall be

- 1) turned downwards to pass through the cover of the cold water storage tank, terminating above the level of the water supply inlet and discharge, clear of the level control valve, or
- 2) taken outside the building and suitably bent and properly supported or stayed where it projects more than 1 m above the roof,

c) where a pressure reducing valve is installed with a vent pipe relief, extend to a height above the valve equal to the pressure rating of the valve in metres of water plus a minimum of 1 m and a maximum of 2 m; the pipe shall extend on a rising grade to a height above the bottom of the water heater that does not exceed the maximum head of the water heater, and

d) be of sufficient size to relieve the energy input, but in no case be less than the size recommended by the water heater manufacturer, and shall not be less than the size given in column 2 of table 9 for the nominal thread size of the valve outlet connection given in column 1 of table 9, with the provision that, on secondary circuits, the vent pipe required at the highest point of the hot water piping shall also be accepted as providing the pressure relief for the container if it meets the condition set out in 6.6.5.3(a), (b) and (c).

Table 9 — Minimum size of relief drain pipes

Dimensions in millimetres

1	2
Nominal (thread) size of valve outlet connection	Nominal size of drain pipes
15	15
20	20
25	25
32	32
40	40

Amdt 2

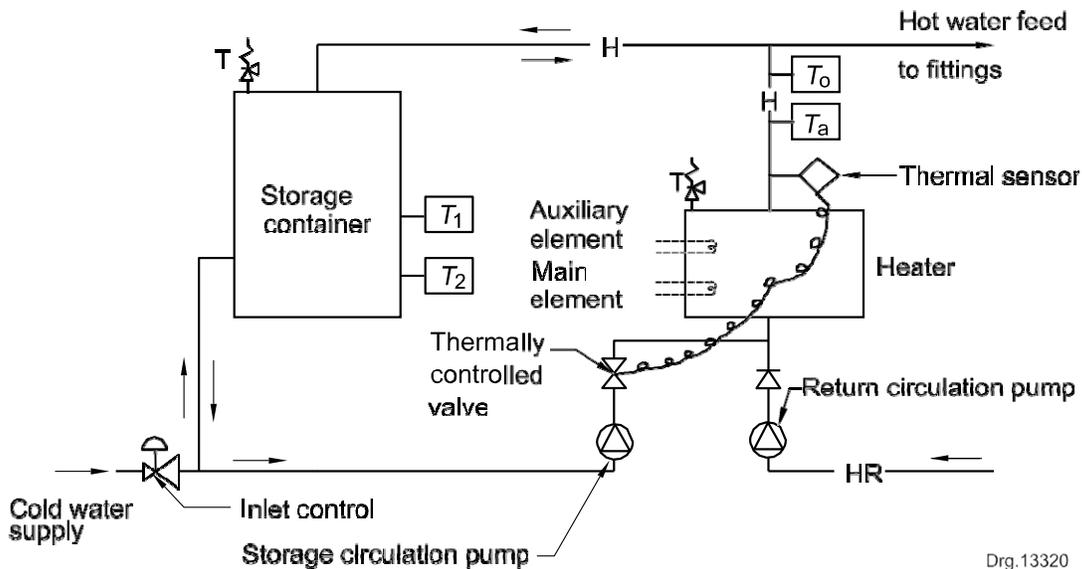
r elements

66.1 of heater elements used shall be compatible with the associated type of water heater, and immersion heaters for electric storage water heaters shall comply with the requirements in SANS 514. (See also 5.4.9.)

66.2 ired, a system where the heater elements are housed in a separate vessel and not in the hot water storage container shall be provided. A hot water system with a separate heater is shown in figure 8.

NOTE 1 The installation allows hot water to be delivered either direct into the storage container or direct into the hot water supply pipework.

NOTE 2 The separate element system has the advantages of both the wet element and the dry element systems since scale formation on the elements is restricted (their being wet elements), while replacement of the elements is possible without drainage of the storage container.



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Key

<i>H</i>	Hot water
<i>HR</i>	Circulated hot water return
<i>T</i>	Temperature and pressure safety relief valve
<i>T₁</i> and <i>T₂</i>	Thermal sensors that control the operation of the storage circulation pump
<i>T₀</i> and <i>T_a</i>	Thermal sensors that control the operation of the heater elements

NOTE Thermal sensors *T₁* and *T₂* control the operation of the storage circulation pump. *T₀* and *T_a* control the operation of the heater elements.

Figure 8 — Schematic layout of a hot water system with a separate heater

6.7 es

al

6.7.1 network layout for both hot and cold water systems shall be such that length and directional changes are minimized.

6.7.2 sary, thermosiphonic action that can take place within the pipes shall be controlled by means of a "thermal lock" formed by an in-line U-configuration of the feed pipes.

NOTE 1 Deleted by amendment No. 2.

NOTE 2 In the case of larger size horizontal cold water feed pipes connected to water heaters, thermosiphonic action can take place within the pipe, resulting in hot water moving in an upstream direction on top of the cold water flow. This normally occurs during periods of no hot water or very little hot water demand and this reverse movement cannot be stopped by means of a non-return valve because of the extremely slow flow rates involved. However, it can be controlled by means of a "thermal lock", because cold water, owing to its higher density, fills the bottom of the "U" and cuts off the backflow of hot water.

vention of airlocks in gravitational systems

Amdt 2

6.7.1 For suitable measures have been taken to prevent the formation of airlocks in pipes, the following shall apply:

- a) pipes of length not exceeding 1 m shall be installed horizontally, or with an upward slope in the direction of flow;
- b) pipes of length exceeding 1 m shall be installed with an upward slope of at least 1:100 in the direction of flow; and
- c) where pipework cannot be installed in accordance with the requirements of (a) and (b) above, pipes shall be suitably vented at their highest positions.

6.7.2 Necessary, appropriate steps shall be taken

- a) to avoid the trapping of air during filling,
- b) against the formation of airlocks during operation, and
- c) to ensure that the pipework layout facilitates the removal of air during filling.

NOTE Trapping of air can be avoided if automatic vent valves are suitably installed in the pipeline. These valves may discharge some water and adequate drainage should be provided.

Amdt 2

vention of noise and water hammer

The layout of any pipework shall be such that noise and water hammer that occur in such pipework are limited to an acceptable minimum.

NOTE 1 Apart from poor design, poor pipe layout and poor installation can also cause unacceptable noise and water hammer.

NOTE 2 Sound is transmitted along metal pipes with very little loss of energy, so noise caused by outlet fittings is often mistakenly diagnosed as pipe flow noise. Plastics pipes appreciably attenuate noise, while rubber-hose-type vibration isolators attenuate noise transmission in metal pipelines.

NOTE 3 Bellows-type vibration isolators or rubber-hose-type vibration isolators can be used to reduce the sound pressure peaks as they travel along pipes. Air vessels should be used to absorb sound pressure peaks at a point close to their formation. (See also 8.6.4.1.)

NOTE 4 Noise caused by thermal movement of pipes consists of creaks, squeaks or one or more impulsive sounds and can be very disturbing. Such sounds can occur a considerable time after the water that causes the movement has been used. Significant thermal movement can occur in hot water pipes as a result of temperature changes. If movements take place smoothly, they do not create noise and the use of resilient pipe clips or brackets, or resilient pads between pipes and fittings, will often introduce sufficient flexibility to take up such movements. Where very long straight runs of pipe are involved, expansion loops or joints might be required.

NOTE 5 Taps can generate noise by the impact of the emergent water stream on the surfaces of an appliance or of a fixture, or on the water already in it. Most disturbance from this type of noise is likely to occur with metal sinks and similar appliances. The use of flow aerators helps to reduce such noise. The undersides of appliances can be treated to minimize vibration and noise transmission and it is good practice to isolate lightweight appliances from lightweight structural elements that could transmit and amplify noise of this kind.

NOTE 6 Cavitation at the seat of terminal fittings and in-line fittings such as pressure reducing valves is also a major cause of noise, and a reduction in the water pressure and in the flow velocity is necessary to control such cavitation (for example, a float-operated valve will operate less noisily at a reduced flow pressure, while its rate of delivery can be maintained if a seat of larger diameter is fitted).

Amdt 2

NOTE 7 Prevention and alleviation of water hammer can be achieved by preventing the sudden closure of valves and by absorbing pressure peaks and increasing the attenuation of sound pressure waves when transmitted through the pipework. A pipe layout that avoids long straight pipe runs to taps and valves should be selected. Solenoid-operated valves that usually incorporate a servo-action to ensure tight closure, and self-closing taps are frequently the cause of noise and water hammer. When fittings of this kind are specified, non-concussive types should be used and they should be properly maintained to ensure continuance of their non-concussive qualities.

NOTE 8 Oscillation of float-operated valves can also cause noise in water installations. Prevention of oscillation is usually simple if the float valve is suitable for the supply pressure and is properly installed and maintained. Oscillation can be prevented by means of a damping plate so fitted to the float or arm that it is immersed in the water in the tank and is oriented to present the greatest resistance to oscillary motion. An alternative procedure is to fit baffle vanes in the tank, to prevent any surface waves from affecting the float.

NOTE 9 A well-designed pump used under the correct conditions should not generate excessive noise. If the static pressure at the pump inlet is insufficient, there is a risk of cavitation and turbulence, which can cause noise and vibration. Noise transmission from pumps and also vibration of the pipes themselves can be reduced by means of rubber-hose-type vibration isolators fitted between the pump and such pipework.

NOTE 10 Lightweight structures are relatively easily set into vibration and readily transmit structure-borne sound. Where pipes have to be fixed to lightweight elements, flexible, vibration-isolating clips or brackets should be used. Where a choice of pipe material exists, the use of relatively flexible pipes of small diameter helps to reduce the transfer of sound energy from the pipework to the structure. Pipework can also be isolated from the building structure by means of resilient inserts in the pipe brackets. In severe cases of transmission of specific tones, a hydraulic-acoustic filter tuned to the unwanted frequency can be used, but specialist advice should be obtained in such circumstances.

NOTE 11 Airborne transmission of flow noise originating in outlet fittings should be reduced by means of sealing off the direct air path wherever possible. Whenever sound radiation from the pipework is a potential problem, pipes should be installed in closed ducts.

different materials

Unless galvanic action is unlikely to occur, or unless effective measures are taken to prevent such deterioration, metal pipes of different materials shall as far as possible not be connected to one another.

NOTE 1 Galvanic action will be reduced when the sequence of metals in relation to the normal direction of flow is galvanized steel (zinc) to uncoated iron to copper.

NOTE 2 A copper supply pipe connected to a galvanized steel storage tank or coated steel storage water heater will result in galvanic action occurring in the tank or heater. The installation of a sacrificial anode in the tank or heater is commonly used to protect it against such galvanic action.

al insulation

6.7.1 fittings and components shall, when necessary, be protected against freezing. The insulation provided shall be appropriate to the minimum temperatures that can be expected in that geographical area.

NOTE For more information on thermal pipe insulation, see annex G.

6.7.2 cold pipes to and from the hot water cylinders and central heating systems shall be insulated with pipe insulation material with a thermal resistance (*R*-value) measuring unit ($\text{m}^2 \cdot \text{K/W}$) in accordance with table 10.

6.7.3 insulation shall

a) be protected against the effects of weather and sunlight,

- b) be able to withstand the temperatures within the piping, and
- c) achieve the minimum *R*-value given in table 10.

Amdt 2 |

Table 10 — Minimum *R*-value of pipe insulation

1	2
Internal diameter of pipe mm	Minimum <i>R</i>-value^a m ² ·K/W
≤ 80	1,00
> 80	1,50
^a Determined with a hot surface temperature of 60 °C and an ambient temperature of 15 °C.	

67.4 For vessels and tanks shall be insulated with a material that achieves a minimum *R*-value of 2.

NOTE To achieve this value, insulation in addition to the manufacturers' installed insulation might be required.

67.5 Insulation on vessels, tanks and piping containing cooling water shall be protected by a vapour barrier on the outside of the insulation.

67.6 Heating insulation requirements do not apply to space heating water piping

- a) located within the space being heated where the piping is to provide the heating to that space, or
- b) encased within a concrete floor slab or in masonry.

Such piping shall comply with this part of SANS 10252.

67.7 Insulation to be insulated includes all flow and return piping, cold water supply piping within 1 m of the connection to the heating or cooling system and pressure relief piping within 1 m of the connection to the heating or cooling system. Where possible lengths of pipe runs shall be minimized.

67.8 Where thermal insulation material has been installed, the outer surface of any insulation material shall be made as smooth as possible, to minimize the exposed surface area. The ingress of moisture into such material shall be prevented.

NOTE Roughness increases the effective surface area of insulation material and consequently, heat losses and moisture increase the thermal conductivity of the material.

6.8 Installations and combined installations

6.8.1 General

68.1 Firework shall not be enclosed in the same duct as a pipe containing fuel or gas.

NOTE 1 A fire installation can be either a dedicated fire installation, or combined with a general installation (i.e. combined installation).

NOTE 2 A fire installation in a building is essentially an extension of the reticulation in the street reserve, and is normally necessary to augment the fire brigade's special equipment.

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NOTE 3 Water should be used only to extinguish class A fires, i.e. fire loads of wood, textiles and paper and all goods manufactured there from.

NOTE 4 Hose reels in a building are mainly intended for use by the occupants of a building, as a "first-aid" measure at the time of the outbreak of a fire and until such time as the fire brigade arrives.

NOTE 5 Water meters and other fittings in the service pipe can cause considerable pressure loss. Where there is a wide divergence between normal consumption flow rates and the required minimum fire flow rates, combination meters should be fitted.

NOTE 6 Combined installations should only be provided in buildings without booster pumps, unless the domestic draw-off connections are protected with pressure reducing valves since the automatic starting of such pumps is initiated by flow or pressure fluctuations in the fire installation.

68.2 Installation shall be connected to a communication pipe provided by the local authority and located at a position and depth to be determined by such local authority. Such fire installation shall either connect

- a) direct to such communication pipe where the local authority's water supply is capable of providing the pressure and rate of flow as given in 7.2.2, or
- b) where so required by the local authority or where the local authority's water supply is not capable of providing sufficient pressure and rate of flow, to a storage tank as given in 7.3.2.

NOTE The municipal water is supplied without guarantee of flow pressure, quality or continuance of supply. This needs to be taken into account when deciding on storage capacity.

68.3 Communication pipe and the water from that pipe are intended only for use in the case of fire and shall be used only for fire-fighting purposes; no connection of any kind shall be made from such communication pipe other than to hydrants, hose reels, or associated storage or pressure tanks.

68.4 As required by the local fire service, a fire installation or combined installation shall at all times be kept charged with water.

68.5 A check valve in any installation shall be so positioned as to prevent or hinder the flow of water from any fire-pumping connection to any hose reel or hydrant connected to such installation.

68.6 Written consent is given by the local authority, no extension shall be made to any existing installation after such installation has been connected to the mains.

68.7 As required by the local authority, a pump system, including a tank, shall be installed in a ventilated compartment constructed in such a manner that it has a fire-resistance rating of at least 120 min when tested in accordance with SANS 10177-2. Where such a compartment is so located that access to it does not abut on a street or on a public place or on an open area on the premises,

- a) the means of access shall be enclosed by walls that have a fire-resistance rating of at least 120 min, and
- b) the access contemplated in (a) above shall not be used as a means of access to any other part of the building.

68.1 This shall comply with the requirements in SANS 543.

68.2 r and distribution of hose reels and hoses shall be such that the whole of each floor is protected. Allowance shall be made for obstructions due to the design and layout of the building and due to goods being stored on the floor (see also SANS 10105-2).

68.3 reel shall be furnished, in close proximity to the inlet of the hose reel, with a shut-off control valve being a stop tap in accordance with SANS 226.

7 gn

7.1 ary considerations

al

7.1.1 ved competent person shall accept the responsibility for the design of

- a) a structure that supports a water heater or storage tank of which the nominal capacity exceeds 250 L, or **Amdt 2**
- b) a slab or a roof structure where a water heater or storage tank of any capacity is suspended from the underside of such slab or roof structure.

NOTE The local council water supply conditions may determine the design of the water system.

7.1.2 nsive operation and maintenance manual shall be readily available for any installation that incorporates storage tanks and reticulation systems. As-built drawings reflecting the pipe work and equipment installation shall be required. A schematic of the pipe work shall be displayed in the plant room.

For plant room design, cognizance shall be taken of the following requirements:

- a) maintenance requirements;
- b) repairs to the equipment;
- c) installation of the equipment;
- d) removal of the equipment;
- e) general access to the equipment; and
- f) ventilation requirements.

7.1.3 pply pressure could exceed 600 kPa in any general or combined installation, a pressure reducing or control valve shall be incorporated in the service pipe upstream of the first terminal water fitting, to limit such pressure to a static pressure of a maximum of 600 kPa.

supply quality — Human consumption

Conditions unfavourable for the development of the bacterium *Legionella 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,

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- 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 50 °C, **Amdt 2**
- f) the stored hot water shall be maintained at a temperature of at least 55 °C, but shall reach 60 °C for at least 1 h a day, and **Amdt 2**
- g) the quality of the water shall be such as to comply with SANS 241-1 and SANS 241-2.

NOTE 1 The bacterium *Legionella pneumophila*, which is now known to cause Legionnaires' disease (legionellosis), has been found in hot water supply and air-conditioning cooling water systems in public buildings and hospitals. When present in a water system, the bacterium causes infection through human inhalation of fine droplets (aerosols) of water containing the bacterium. Aerosols can be generated at showers, sprays and whirlpool baths and spas.

NOTE 2 The possibility of the presence of the bacterium in a supply of water that has been heated to a temperature exceeding 55 °C is greatly reduced.

supply quality — Plumbing considerations

7.1.1 The quality of the water shall be considered if the quality of the water supplied is such that it could adversely affect the water installation. Protection against scale formation and against corrosion shall be provided for hot water systems if considered essential.

7.1.2 In case of doubt, a complete water quality analysis shall be undertaken. The more common problems in hot water systems are scale formation, corrosion, biological growth, suspended solid matter or any combination of these. These problems can seriously reduce the heating efficiency of the system or can lead to premature failure of equipment or create a health hazard to the user. While soft water can cause corrosion, hard water (which is less aggressive) can cause scale formation. Corrosion problems increase with an increase in temperature because corrosive gases such as oxygen and carbon dioxide are released while the electron conductivity of the water is increased. The tendency of hard water to deposit scale usually also increases with an increase in temperature. The scale can act as a protective shield against corrosion, but reduces the rate of heat transfer. The hardness and alkalinity of the water will therefore give a rough indication of the scaling or corroding properties of the water.

7.1.3 If water treatment chemicals for correcting naturally hard water shall be properly used according to the manufacturer's instructions, as the improper use can cause more serious problems than might have occurred without treatment.

NOTE 1 Fungi, algae, slime or bacterial growth are not usually encountered in a hot water system if the water is heated to above 55 °C.

NOTE 2 Treatment methods to control scale formation are aimed at minimizing calcium carbonate precipitation, this mineral being the least soluble common constituent of water.

NOTE 3 A common method of preventing scale formation is to soften the water by means of an ion exchange process. In the process, calcium and magnesium ions are absorbed from the water in exchange for a chemically equivalent amount of sodium ions that are not scale forming.

NOTE 4 In cases where removal of the hardness from water is particularly difficult, the alkalinity can be removed in an ion exchange process that yields equivalent amounts of chloride.

7.2 Ign pressures and flows

al

72.1 rwise required,

- a) the design static pressure at any terminal fitting other than a fire hose reel or fire hydrant shall not exceed 600 kPa, and
- b) the design static pressure at any fire hose reel valve or fire hydrant valve shall not exceed 600kPa.

72.2 rwise required (for example fire services), the velocity of the flow of water in any pipe shall not exceed

- a) 3,0 m/s for buried pipelines and for pipelines installed above ground where noise is not a critical factor, or
- b) 1,5 m/s to 2,5 m/s depending on the nature of the installation and the noise levels allowed.

NOTE Noise that occurs in pipework is caused when pipes vibrate due to the action of water flowing through them. Noise does not usually become significant at a flow velocity of less than 2 m/s and both noise and water hammer can be prevented and alleviated by the restriction of water velocities. A design flow velocity that does not exceed 2 m/s should be used for domestic and institutional installations (see 7.2.1.2(b)).

Installations and combined installations

72.1 uge pressure of at least 300 kPa at the level of the highest protected point shall be maintained when one hose reel is in full operation in any combined installation.

72.2 stallation or combined installation shall

- a) be so constructed as to provide
 - 1) a supply of water sufficient for the effective operation of the number of hose reels and hydrants that can be operated or come into operation simultaneously in any division, and
 - 2) a flow pressure, at any hose reel or hydrant, of at least 300 kPa and a flow rate of at least
 - i) 30 L/min per hose reel, and
 - ii) 1 200 L/min per hydrant, and
- b) incorporate devices that limit the gauge pressure at any hydrant valve to 600 kPa under full flow conditions.

72.3 ined installation where a fire boosting system is installed (see 7.3.4), all branches to non-fire-related pipework (installations) shall be protected by a pressure control valve.

7.3 gency supplies

ity of water storage tanks for purposes other than fire-fighting

For the category of premises given in column 1 of table 11, provision shall be made for the storage of water for purposes other than fire-fighting and the volume of water to be stored shall be at least that given in column 2 of table 11.

NOTE 1 In the determination of the storage capacity, account should be taken of the pattern of water usage on the premises, and the likely frequency and duration of breakdown in water supply from the supplying authority.

NOTE 2 The design storage capacity can be derived from the values given in table 1.

Table 11 — Minimum water storage capacity required for premises

1	2
Category of premises	Minimum storage required
Boarding schools, children's homes or residential nurseries	4 h to 8 h demand ^a
Commercial premises, including offices and shops	4 h to 8 h demand based on gross floor area ^a
Educational institutions	4 h to 8 h demand for the design population of the building ^a
Hotels, boarding houses, motels and nurses' homes	4 h to 8 h demand per bed space ^a
Hospitals, clinics, nursing homes	24 h demand for every bed the building is designed to accommodate
All other buildings where continuous water supply is required, i.e. hairdressers	4 h demand per day
Multiple storeys that exceed 25 m in height above the lowest ground level abutting on such building	8 h demand per dwelling unit
Old-age homes	8 h demand per capita
^a Recommended amounts are shown.	

ity of water storage tanks for fire-fighting purposes

7.3.1 of at least 25 m³ of water with a pumping system shall be immediately available at all times from a public supply or private reservoir where the building is more than 25 m in height.

7.3.2 bined installation where provision is made for the storage of water as given in column 1 of table 11, the following shall apply:

- a) the storage tank serving the building shall be divided into two self-contained compartments or into two separate tanks;
- b) both such compartments shall comply with the requirements of 5.4.6 and 6.5; and
- c) the compartments shall be so arranged that each compartment can be shut down for maintenance and cleaning purposes, without causing an interruption in the supply of water to terminal fittings or appliances.

7.3.3 otherwise required, a storage tank shall be provided for any building (see figure 9 to figure 13)

- a) where a hose reel is installed at a height (or at a height exceeding that) at which the local authority is incapable of maintaining a water supply, from its water supply system, adequate for the effective operation of the hose reel, or
- b) incorporating a dedicated fire installation.

7.3.4 tank referred to in 7.3.2.3 shall be situated at a level above the highest hose reel or hydrant connected to the installation and shall contain a usable volume of water of

- a) at least 4,5 m³ but not exceeding 9 m³, reserved for fire-fighting purposes (see figure 13), and
- b) in addition to that required in (a), at least 1 m³ to supply at least one and not more than five water closets in the building (to keep the water from becoming stagnant).

7.3.5 otherwise required, a building where a hose reel or hydrant is installed at a height exceeding 25 m above the lowest ground level abutting on the building, or at a height exceeding that at which the local authority is capable of maintaining an adequate water supply from its water supply system and through the equipment of its fire brigade, shall be provided with

- a) a high level storage tank in accordance with 7.3.2.3, and
- b) a low level storage tank at or below ground level, that shall
 - 1) have a capacity of at least 25 m³ that is reserved for fire-fighting purposes,
 - 2) be supplied by a service pipe that is
 - i) of internal diameter at least 20 mm,
 - ii) connected to a communication pipe,
 - iii) provided with a pressure gauge reading of up to 2 500 kPa,
 - iv) controlled at its outlet by a high pressure automatic shut-off valve, and
 - v) fitted with a manually operated isolating valve,
 - 3) be connected to a supplementary service pipe that
 - i) is of internal diameter at least 100 mm,
 - ii) has a twin fire-pumping connection fitted at its inlet, and
 - iii) has an outlet so positioned as to discharge into the top of the tank, and
 - 4) be provided with an approved gauge, of a type that does not become unreadable with time, to indicate the level of water contained in the tank.

NOTE 1 A sight glass should not be used to indicate the level of water in a tank is not recommended, since it is likely to become obscured by algae.

NOTE 2 A combined installation in a building, that incorporates only hose reels installed at a height not exceeding that at which the local authority is capable of maintaining an adequate water supply from its water supply system (booster pump not required) is shown in figure 9.

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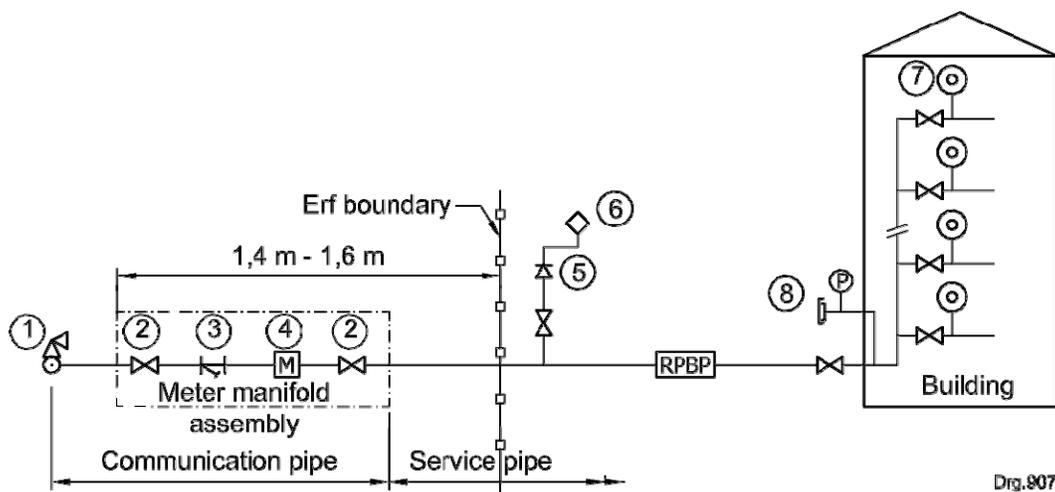
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NOTE 3 A combined installation in a building, that incorporates both hose reels and hydrants installed at a height not exceeding that at which the local authority is capable of maintaining an adequate water supply from its water supply system (booster pump not required) is shown in figure 10.

NOTE 4 A fire installation in a building, that incorporates both hose reels and hydrants installed at a height not exceeding that at which the local authority is capable of maintaining an adequate water supply from its water supply system (booster pump not required) is shown in figure 11.

NOTE 5 A combined installation in a building, that incorporates both hose reels and hydrants installed at a height not exceeding that at which the local authority is capable of maintaining an adequate water supply from its water supply system (booster pump and storage for hose reels required) is shown in figure 12.

NOTE 6 A typical combined installation that incorporates both hose reels and hydrants in a building that exceeds 25 m in height is shown in figure 13.

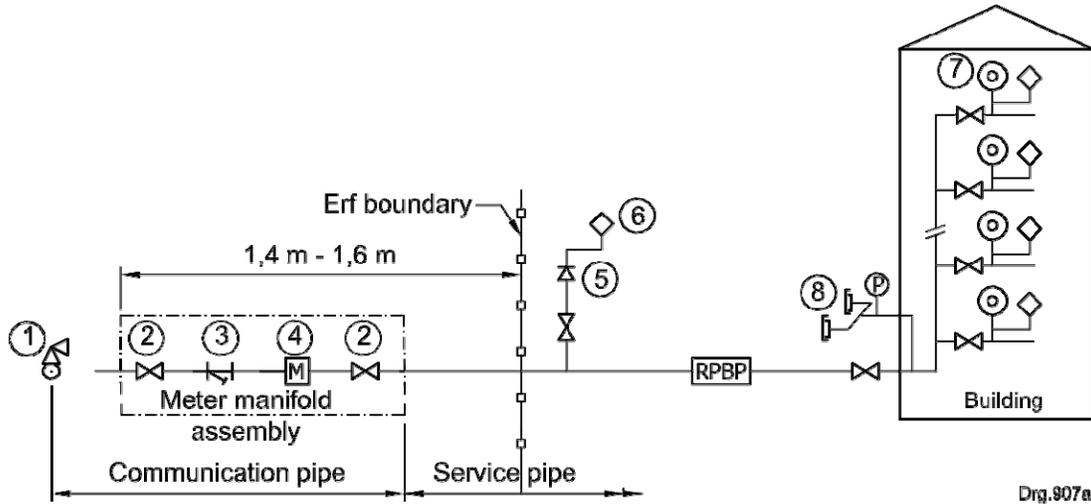


NOTE The relation of the boundary to the meter is in accordance with the local authority.

Key

- 1 Mains connection
- 2 Isolation valve
- 3 Strainer
- 4 Meter
- 5 Non-return valve
- 6 Fire hydrant
- 7 Fire hose reel
- 8 Booster connection
- P Pressure gauge
- RPBP Reduced pressure backflow preventer

Figure 9 — A typical combined installation that incorporates only hose reels in a building less than 25 m high where a booster pump is not required

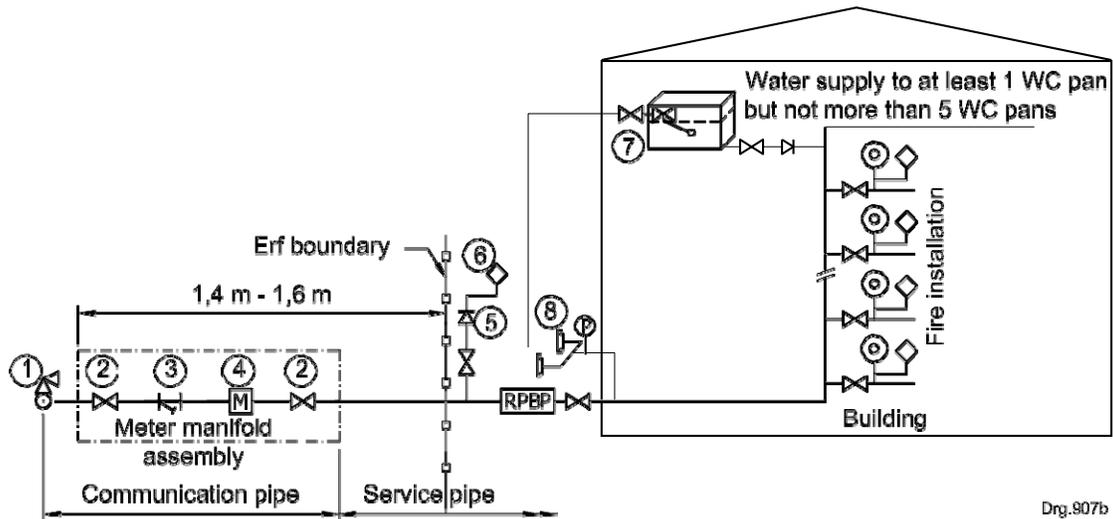


NOTE The relation of the boundary to the meter is in accordance with the local authority.

Key

- 1 Mains connection
- 2 Isolation valve
- 3 Strainer
- 4 Meter
- 5 Non-return valve
- 6 Fire hydrant
- 7 Fire hose reel
- 8 Booster connection
- P Pressure gauge
- RPBP Reduced pressure backflow preventer

Figure 10 — A typical combined installation that incorporates both hose reels and hydrants in a building less than 25 m high where a booster pump is not required



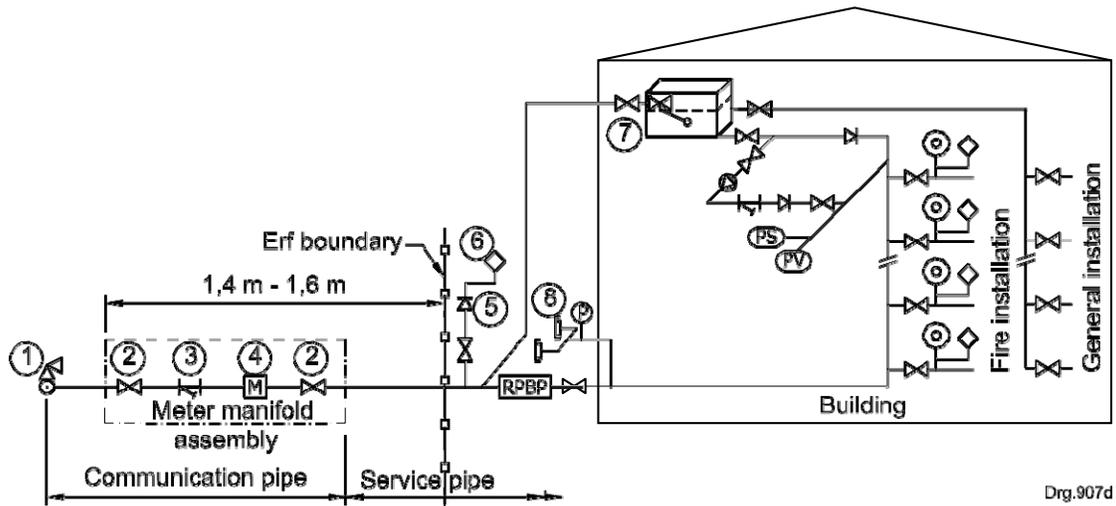
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NOTE The relation of the boundary to the meter is in accordance with the local authority.

Key

- 1 Mains connection
- 2 Isolation valve
- 3 Strainer
- 4 Meter
- 5 Non-return valve
- 6 Fire hydrant
- 7 4,5 m³ min. storage to be reserved for fire-fighting purposes, plus 1 m³ min. for general purposes
- 8 Booster connection
- P Pressure gauge
- RPBP Reduced pressure backflow preventer

Figure 11 — A typical fire installation that incorporates both hose reels and hydrants in a building less than 25 m high where a booster pump is not required



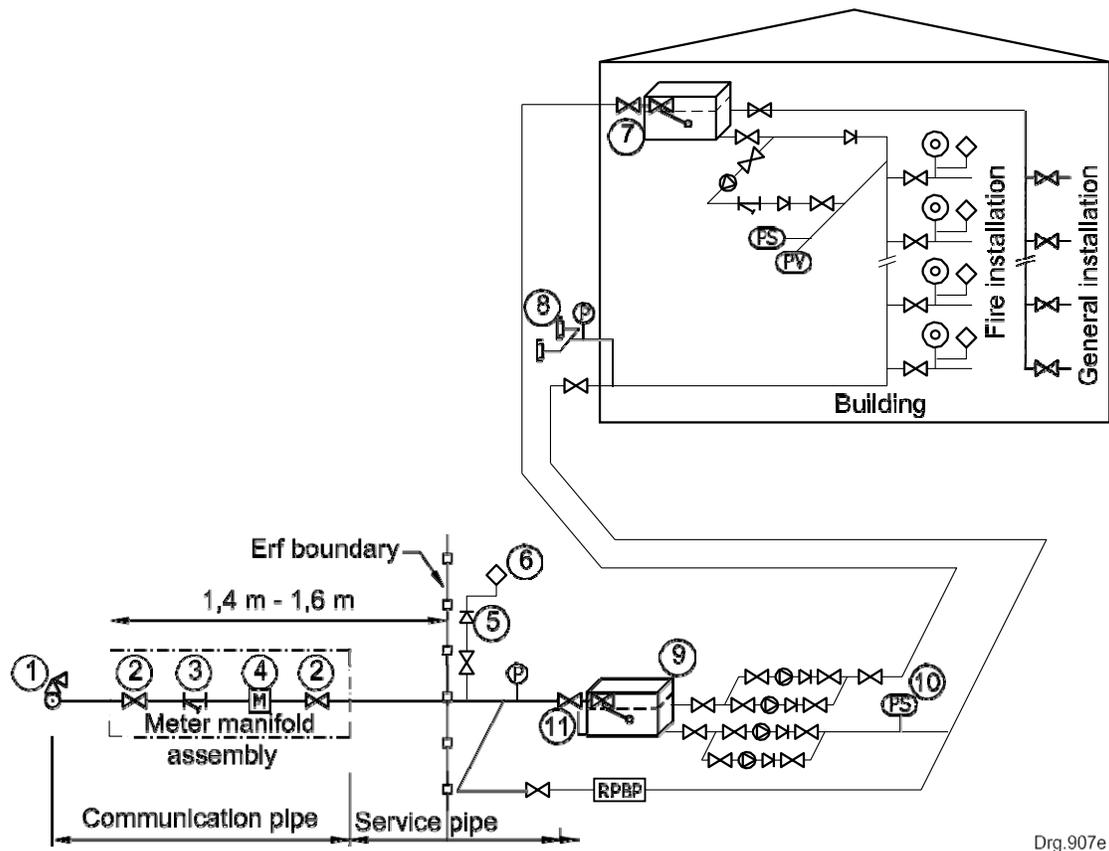
NOTE 1 A booster pump is required to provide a flow of 90 L/min at a flow pressure of 300 kPa at any hose reel when not more than 3 hose reels operate together (and no hydrants are operating).

NOTE 2 The relation of the boundary to the meter is in accordance with the local authority.

Key

- 1 Mains connection
- 2 Isolation valve
- 3 Strainer
- 4 Meter
- 5 Non-return valve
- 6 Fire hydrant
- 7 4,5 m³ min. storage to be used reserved for fire-fighting purposes, plus 1 m³ min. for general purposes
- 8 Booster connection
- P Pressure gauge
- RPBP Reduced pressure backflow preventor
- PS Pressure switch
- PV Pressure relief valve
- M Meter

Figure 12 — A typical combined installation that incorporates both hose reels and hydrants in a building less than 25 m high where a single booster pump and storage for hose reels are required



NOTE 1 A high level booster pump is required to provide a flow of 90 L/min at a flow pressure of 300 kPa at any hose reel when not more than 3 hose reels operate together (and no hydrants are operating).

NOTE 2 Each of the two interconnected power-driven booster pumps should be capable of providing a flow of at least 1 200 L/min at a pressure of 300 kPa at any hydrant valve operating alone.

NOTE 3 The relation of the boundary to the meter is in accordance with the local authority.

Key

- 1 Mains connection
- 2 Isolation valve
- 3 Strainer
- 4 Meter
- 5 Non-return valve
- 6 Fire hydrant
- 7 4,5 m³ min. storage to be reserved for fire-fighting purposes, plus 1 m³ min. for general purposes
- 8 Booster connection
- 9 25 m³ storage to be reserved for fire-fighting purposes
- 10 Automatic pressure sensor control for fire pumps and alarm systems
- 11 Water level indicator

Figure 13 — A typical combined installation that incorporates both hose reels and hydrants in a building that exceeds 25 m in height

connections

7.3.1 ing connection shall be situated in a readily accessible position outside the building at ground level, and shall be mounted on the face of the building in an accessible position.

The position and purpose of any pumping connection shall be suitably indicated.

NOTE The position and purpose of the pumping connection can be indicated by a notice reading as follows:

FIRE BRIGADE INLET
PRESSURE LIMIT 1 015 kPa

7.3.2 apply pumping connection fitted with a coupling of an approved size and type shall be provided in the pipe serving any storage tank of any hospital, clinic, nursing home, old-age home, or any other building from which the occupants cannot readily be removed in the event of an interruption in the water supply. An approved, non-return valve shall be installed immediately upstream of such pumping connection.

7.3.3 rwise required, the requirements in 7.3.3.4 shall apply to a fire installation or a combined installation in a building of height that exceeds 6 m above the lowest ground level abutting on such building.

7.3.4 that serves both hose reels and hydrants shall be provided with a twin fire- pumping connection as follows:

- a) one pumping connection shall connect direct to the water installation; and
- b) the other pumping connection shall connect direct to either
 - 1) the only storage tank, if there is only one, or
 - 2) the storage tank situated at ground level, if there is more than one storage tank.

NOTE 1 These pumping connections are intended for the use of the fire brigade, either for the filling of the storage tanks or for fire-fighting purposes, when necessary.

NOTE 2 Any fire installation or combined installation that is provided with a storage tank and booster pump should incorporate a drain-cock between the pump and the reflux valve.

NOTE 3 Because non-return valves cannot be checked for positive water seals once they have been commissioned, they frequently cause low level storage tanks to overfill, and this overfilling is then incorrectly diagnosed as being the result of leaking float valves.

7.3.5 pumping connection discharges direct into a storage tank, any pipe fitted with one or more pumping connections shall be fitted with

- a) a pressure gauge reading up to 2 500 kPa installed in the connecting pipe immediately upstream of, and next to, the pumping connection,
- b) a reflux valve so located as to shut off the direct supply of water from the local authority's system to such installation automatically, whenever and for so long as any such pumping connection is in use, and
- c) a test valve installed immediately upstream of, and next to, the pressure gauge as given in (a) above.

7.3.6 wise required, an above-ground hydrant shall be provided at a point not more than 60 m from a pumping connection, where the distance between any pumping connection and any fire hydrant connected to the mains exceeds 60 m. In such cases, the following shall apply:

- a) the hydrant shall be installed at a point upstream of any backflow prevention device installed in accordance with 6.3; and
- b) a non-return valve shall be installed in the branch pipe that serves the fire hydrant, immediately downstream of its point of connection to the mains.

er pumps for fire-fighting purposes

7.3.1 ter pump installation shall be

- a) so designed that where stand-by pumps are provided, any pump can be selected for duty at any time,
- b) fitted with a suitable pressure gauge on the delivery side of the pump, and
- c) at the entrance to the non-fire pipework (installation), fitted with an appropriate pressure reducing valve (see also 7.2.2.3).

NOTE 1 A mimic board or other suitable means of indication should be provided to show the status of pumps, water levels and alarms.

NOTE 2 It might not be necessary to provide booster pumps or storage tanks in buildings that incorporate hose reels at a height not exceeding 25 m above the lowest ground level abutting on the building if the water supply system is of such a standard that adequate flow rate and pressure that complies with 7.2.2 can be obtained at all times.

NOTE 3 For information on pumps, see annex C.

7.3.2 y installation is provided with a storage tank in accordance with 7.3.2.3, the installation shall be provided with a single power-driven booster pump capable of maintaining a flow rate of at least 90 L/min at a flow pressure of at least 300 kPa at any hose reel, where not more than three hose reels operate together (and no hydrant valves are operating).

7.3.3 y installation is provided with a storage tank in accordance with 7.3.2.5, such installation shall be provided with at least two interconnected power-driven booster pumps (see 7.3.4.4(c)), individually capable of producing and maintaining the flow rate and pressure as given in 7.2.2, and drawing water from the low level storage tank as given in 7.3.2.5. Each pump shall be connected to a delivery pipe of nominal internal diameter of at least 100 mm, or at least 150 mm in the case of any delivery pipe the height of which exceeds 50 m above such pump.

7.3.4 pumps shall be fitted with either an automatic or a manual control starting mechanism that shall comply with the following:

- a) an automatic starting mechanism shall be fitted with an automatic override control;
- b) an automatic starting mechanism shall start a booster pump automatically as soon as any single fire hydrant or any two hose reels are brought into operation, causing a lowering of the static pressure in the fire installation; and
- c) the two interconnected power-driven booster pumps as given in 7.3.4.3 shall be fitted with automatic starting mechanisms. One of the two booster pumps shall be powered by an electric motor and the other by a compression-ignition engine that starts automatically and immediately in the event of failure of the normal electricity supply.

7.3.5 If provided, a booster pump unit that is powered by an electric motor shall be connected to a stand-by motor-driven generator that starts automatically in the event of failure of the normal electricity supply to the motor.

7.3.6 Pumps provided with automatic pump starting mechanisms shall comply with the requirements of the local authority.

7.4 Conservation of water and water quality

General

7.4.1 The measures shall be taken to prevent deterioration of the quality of the water in any water installation. Water from an installation shall not be used in any manner that could affect its potability unless adequate measures are taken to prevent deterioration of the quality of the water, such as preventing the entry of a substance into such an installation that could affect the potability of the water or is likely to endanger health, or both.

7.4.2 Water shall be stored under conditions that will not adversely affect the quality of the water (for example, storage tanks should be manufactured from material that is fully opaque to light transmission if located where light falls upon it).

Connections

7.4.1 A connection shall be made between

- a) a general installation conveying water from the supply main and an installation conveying water from any other source of supply,
- b) any water installation conveying potable water and any drain or sewer,
- c) any water installation pipe and any service pipe upstream from any backflow preventer installed in terms of 7.4.3, and
- d) a general installation and any fire installation when they are supplied through separate communication pipes.

7.4.2 A connection shall be made to a communication pipe upstream of any water meter.

7.4.3 A pumping connection is provided,

- a) a reduced pressure backflow preventer shall be installed between any such pumping connection and the communication pipe serving the installation, and
- b) a non-return valve shall be installed in the outlet pipe between a storage tank and the pumping connection where such pumping connection connects direct to the outlet pipe from such tank.

Prevention of backflow

7.4.1 The measures shall be taken to prevent the back-siphonage of water into the following:

- a) a communication pipe from any of the following water installations:
 - 1) a fire installation or combined installation;
 - 2) a general installation serving any of the following activities:

- i) medical treatment of people or animals;
 - ii) medical, pharmaceutical or chemical research and manufacturing;
 - iii) agriculture, including dairies and nurseries;
 - iv) laundering and dry-cleaning;
 - v) photographic processing;
 - vi) metal plating; or
 - vii) treatment of hides and skins;
- 3) a general installation serving any of the following locations:
- i) mortuaries;
 - ii) abattoirs;
 - iii) sewage purification plants;
 - iv) refuse pulverizing works;
 - v) harbours;
 - vi) oil processing and storage facilities;
 - vii) wineries, distilleries, breweries, yeast and soft drink factories;
 - viii) sports fields; or
 - ix) any other premises on which an activity is carried out that can affect the potability of water; and
- b) an installation, in all cases where
- 1) the design of terminal fittings installed (including any hose bibcocks, laboratory taps or movable shower units) is such that a hose or any other flexible pipe can be attached to the fittings,
 - 2) fire hose reels are installed in a combined installation,
 - 3) an underground irrigation system can provide contact between polluted water and water within the installation, or
 - 4) any other fittings can provide contact between polluted water and water within the installation.

NOTE Backflow can be caused by the following:

- a) the development of negative pressure or the lack of pressure in a water supply system (i.e. when a main is drained for maintenance operations, or when fire-fighting is in progress nearby, or because of a burst water main); or
- b) the downstream pressure exceeding that of the supply. (This is for example possible in an installation such as a heating system, an elevated tank, and a pressure producing system such as a boiler. In the case of a fire installation, non-potable water carried in a fire tender can be introduced into the installation via a pumping connection.)

7.4.2 nt the possibility of backflow of water in any of the water installations as given in 7.4.3.1, or in any other case where such a possibility exists, and unless other approved measures have been taken,

- a) a storage tank shall be installed such that
 - 1) the entry of water into the storage tank is solely from a pipe that discharges at a height, above the flood level rim of the tank, of the greater of at least 75 mm and twice the nominal diameter of such pipe, and
 - 2) water required for any activity that can pollute the water supply is withdrawn only from the outlet of such storage tank, or
- b) appropriate backflow prevention measures shall be selected from those listed in column 1 of table 12, for the degree of the potential hazard contemplated in column 2 of table 12.

Table 12 — Backflow prevention measures

1	2
Type of measure	Application
Reduced pressure backflow preventer	Where the possibility exists of contamination of the water supply by a substance that is hazardous to health.
Double check backflow preventer	Where potential pollutants are not toxic but could affect the taste or appearance of the potable water.

7.4.3 r approved measures are taken to prevent the backflow of water from terminal water fittings that discharge water into a sink, wash-hand basin, bath or other similar appliance,

- a) such terminal water fittings shall be so installed that the vertical distance between the point of discharge of the fitting and the spill-over level of the receiving appliance is at least equal to the distance given in table 13 for the size of the fitting concerned,
- b) a double check valve shall be incorporated as close as is practicable to the point of discharge, or
- c) a combined check valve and vacuum breaker shall be so installed that the vacuum breaker is at least 300 mm above the spill-over level of the receiving appliance.

Table 13 — Air gap at taps or similar terminal fittings

Dimensions in millimetres	
1	2
Nominal size of tap or terminal water fitting	Vertical distance between tap outlet and spill-over level of receiving appliance
< 15	20
> 15 and < 20	25
> 20	The greater of 70 or twice the nominal size of the tap or fitting

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7.4.4 For approved measures are taken to prevent the backflow of water from any terminal water fitting (other than those given in 6.3.3.1) that can provide contact between polluted water and water within the installation,

- a) a vacuum breaker shall be installed at the highest point of an upstand, at least 300 mm above the point of discharge of the highest terminal water fitting concerned,
- b) a terminal vacuum breaker shall be so installed that it is situated at least 300 mm above the highest point of connection of any pipe to a riser serving the terminal water fitting concerned, or
- c) a single check valve or vacuum breaker shall be installed next to any terminal water fitting unless such a terminal fitting incorporates a single check valve or vacuum breaker.

7.5 water generation and distribution

NOTE 1 An appropriate method for a cost-benefit analysis would be to consider the net present value determined from a discounted cash flow analysis. Benefits that occur over the estimated lifetime of the equipment are thus related back to the first capital investment.

NOTE 2 Apart from other considerations, a detailed cost-benefit analysis should be carried out, when appropriate, in order to select the most suitable hot water generating plant and distribution system. All relevant factors should be considered, including the following:

- a) the hot water demand, usage patterns and usage requirements;
- b) the layout of the hot water installation;
- c) available heat sources, and energy operating costs; and
- d) capital expenditure, maintenance and long-term running costs.

storage type systems

7.5.1

The total hot water storage capacity in storage type systems shall allow for the effective "loss" of hot water storage capacity within the container as a result of the mixing of hot water with the incoming cold water. In the absence of reliable data, an allowance of 10 % to 25 % shall be made for the mixing of hot and incoming cold water.

Figure 14 shows the piping that contains hot water that can be considered part of the bulk storage.

NOTE In pumped hot water circulation installations, or those in which the water is kept hot by means of trace heating, a portion of the hot water in the piping can be considered to be in storage, thereby reducing the required bulk storage capacity and the recovery rate of the water heater.

7.5.2 storage capacity

The required hot water storage capacity shall be determined from the relationship that exists between hot water demand and the rate of heat recovery of the stored water.

7.5.3 heater power

In the absence of other suitable information, the net heater power required to heat a volume of water shall be determined using the following equation:

$$P = R \cdot C \cdot \Delta T \quad (5)$$

where

- P is the net heater power rating, in kilowatts (kW);
- R is the replenishment rate at which water has to be heated, in litres per second (L/s);
- C is the specific heat of the water (4,2 kJ/L·°C); and
- ΔT is the difference between the temperatures of the incoming cold water and the hot water to be delivered, in degrees Celsius (°C).

NOTE The efficiency of a properly insulated electric water heater usually exceeds 90 %.

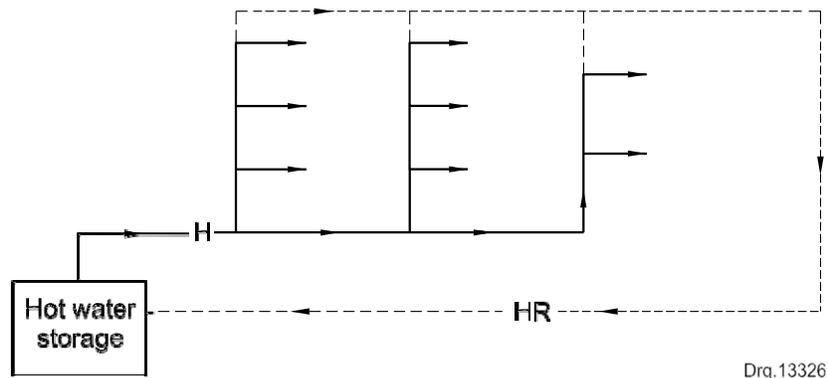


Figure 14 — Hot water piping (shown solid) that contains hot water considered to be part of the hot water bulk storage

7.5.4 temperatures

7.5.4.1 supply temperature

Unless otherwise required, the temperature of hot water available

- at domestic fixtures such as baths, basins and showers shall be at least 38 °C, and
- at sinks, shall be at least 45 °C (in order to melt fats).

7.5.4.2 supply temperature

Unless otherwise required, the temperature of water that discharges from any terminal water fitting supplied from a hot water installation shall not exceed 60 °C, however thermostatic mixers may be required to achieve a lower supply temperature.

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Instantaneous hot water generation plant

7.5.1 Unless otherwise approved, the net heater power rating for an instantaneous water heater shall be determined using the following equation:

$$P = \frac{F \times C \times \Delta T}{\eta} \quad (6)$$

where

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- P is the net heater power rating, in kilowatts (kW);
- F is the flow rate, in litres per second (L/s);
- C is the specific heat of the water (4,2 kJ/L °C);
- ΔT is the difference between the temperatures of the incoming cold water and the hot water to be delivered, in degrees Celsius (°C); and
- η is the percentage of heater efficiency.

NOTE 1 The net heater power rating is dependent on the flow rate through the heater.

NOTE 2 The value of the heater efficiency should be obtained from the manufacturer. It is generally 0,75 for gas-fired instantaneous water heaters.

7.5.2 ases, the instantaneous water heating process is triggered by a differential pressure switch and an orifice restrictor. This causes higher down stream hot water flow pressure drops than storage water heaters. Therefore, pipe design, pipe sizing and simultaneous use of terminal fittings shall be carefully considered and calculated to ensure sufficient hot water and balanced hot and cold water pressure at terminal fittings.

heated hot water storage type systems

7.5.1 rwise required, the energy input required for a solar water heater shall be calculated using the following equation:

$$H = \frac{V \times C \times \Delta T}{\eta} \quad (7)$$

where

- H is the solar energy required, in kilojoules per day (kJ/d);
- V is the hot water demand, in litres per day (L/d);
- C is the specific heat of the water (4,2 kJ/L °C);
- ΔT is the required temperature rise of the water, in degrees Celsius (°C); and
- η is the percentage efficiency of the absorber as tested to SANS 1307 or as declared by the manufacturer. **Amdt 2**

7.5.2 to get the energy input as given in 7.5.3.1, the solar absorber shall, unless otherwise required, be of size at least equal to the area calculated using the following equation:

$$A = H/S \quad (8)$$

where

- A is the absorber area, in square metres (m²);
- H is the solar energy required, in kilojoules per day (kJ/d); and
- S is the mean available solar irradiance, in kilojoules per square metre per day (kJ/m²/d).

7.5.3 minimum storage capacity of a container in any solar hot water system shall, unless otherwise required, be as follows:

- a) if no supplementary energy source is provided, a storage capacity of 20 % in excess of the daily hot water demand under winter conditions; and
- b) if a supplementary energy source is provided,
 - 1) for a solar heater system, a storage capacity of at least 100 % of the daily hot water demand under summer conditions, and **Amdt 2**
 - 2) for a solar heater and supplementary storage container system, a storage capacity of **Amdt 2**
 - i) in the case of the solar container, at least 25 % of the daily hot water demand under summer conditions, and
 - ii) in the case of the supplementary container, at least 75 % of the daily hot water demand under summer conditions.

7.6 sizing

al

7.6.1 shall be so sized that the noise and water hammer that occur in such pipework are limited to a reasonable minimum. (See 6.7.3 and 7.2.1.2.)

NOTE There is more than one correct method for sizing pipework.

7.6.2 pipe sizes are specified by reference to another similar installation, or unless otherwise approved, the general approach given in 7.6.1.3 to 7.6.1.12 shall be followed in order to size installation pipework.

7.6.3 the pipework diagram, and identify

- a) the type of piping (pipe materials) to be used, and
- b) the types and positions of terminal fittings.

NOTE 1 Since the internal diameter of pipes and fittings manufactured from different materials can differ from each other, the substitution of one pipe material of a particular nominal diameter for another pipe material of a similar nominal diameter can result in greatly differing flow rates in the installation.

NOTE 2 Using the term "nominal diameter" without stating the particular material can be misleading, since the nominal size of galvanized steel pipes refers to the inside diameter while that of plastics and copper pipes refers to the outside diameter. The bore sizes of copper, stainless steel and plastics pipes that have the same nominal diameter can also differ substantially because of greatly differing wall thicknesses. It is, therefore, essential not only to state the pipe diameters (nominal or actual), but also the pipe materials and pressure classes of pipes and fittings to be used.

7.6.4 each junction in the pipework diagram consecutively, starting from the main or cistern, in order to identify junctions and pipes.

7.6.5 determine the design static pressure available at each pipe junction and terminal water fitting by adding or deducting the drop or rise respectively, from a point where the available residual head is known.

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7.6.6 Determine the minimum flow rate and residual head required at all terminal fittings or appliances, and for every pipe at the point of supply to any such fittings or appliances.

NOTE 1 Because of the widely divergent rates of flow obtainable with different types and makes of fittings, a particular fitting (which is to be flow-controlled) should be specified to ensure that all points will receive a sufficient flow of water without parts of the installation being starved of water.

NOTE 2 The choice of terminal water fittings can also have an influence on required storage volumes (for example, water economy taps and showerheads can produce a total saving in water consumption of up to one-third).

NOTE 3 See annex H for examples of calculations concerning pipe sizing.

7.6.7 Determine the loss of head through fittings and appliances in accordance with 7.6.2.4, or express such losses as an equivalent length of pipe by making reference to

- a) the manufacturers' literature, or
- b) tables 14 and 15, or
- c) other suitable literature (such as design codes and plumbing reference material).

7.6.8 Determine equivalent lengths to the actual pipe length, keeping in mind that the losses given in table 14 through tees shall be assumed to occur at changes of direction only. Losses through fully open gate valves may be ignored. Where galvanized steel pipes are used for small installations such as those in dwelling houses, the calculations for pipe sizing shall be based on the data given in table 14. For larger installations, data relating specifically to galvanized steel shall be used.

7.6.9 Determine the pipe sizes.

NOTE Final pipe sizes will be selected on the basis of an informed final rational estimation.

7.6.10 Take loss of head through draw-off or delivery valves into account when the diameter of a pipe to supply such individual fittings is determined.

Table 14 — Loss of head through elbows, bends and tees, expressed as equivalent pipe length

1	2	3	4
Nominal bore of fitting mm	Equivalent pipe length m		
	Copper ^a , stainless steel and plastics		
	Elbow	Bend	Tee
15	0,5	0,4	1,2
20	0,8	0,5	1,4
25	1,0	0,6	1,8
32	1,4	0,75	2,3
40	1,7	1,0	2,7
50	2,3	1,2	3,5
65	3,0	1,5	4,5
75	3,4	1,9	5,8
100	4,5	2,7	8,0
150	7,2	4,0	15,0

^a Smooth bore.

**Table 15 — Loss of head through draw-off taps^a,
expressed as equivalent pipe length**

1	2	3
Nominal size of bib tap or pillar tap	Typical maximum discharge rate with tap fully open	Equivalent pipe length ^b
mm	L/s	m
15	0,20	4
20	0,30	12
25	0,60	22

^a Head losses can vary with taps of different manufacture.
^b For copper, plastics and stainless steel pipes.

7.6.11 f head through draw-off taps is given in table 16.

NOTE 1 Some draw-off taps have a loss of head much higher than the losses given in the table (for example, a single tap hole mixer with a 2 mm × 8 mm connection).

NOTE 2 Where it is impracticable to forecast in detail the numbers and types of pipe fittings to be used, an approximation can be made by adding an equivalent length of pipe, as a percentage of the actual length, to cover all head losses in pipe fittings. The percentage added can vary between 10 % and 40 %, depending on the complexity of the pipe layout.

NOTE 3 In major hot water distribution systems, special fittings with significant head losses are often used. For information on these, reference should be made to the manufacturers' literature.

Table 16 — Loss of head through draw-off taps

1	2	3	4	5	6
Discharge rate	Loss of head				
	m				
	Size of bib tap			Size of pillar tap	
L/s	15 mm	20 mm	25 mm	15 mm	20 mm
0,075	0,2			0,24	
0,12	0,4			0,4	
0,15	0,5	0,2		0,5	0,24
0,20	0,8	0,35		0,7	0,3
0,22	1,1	0,45		0,8	0,4
0,30	1,8	0,8	0,45		0,5
0,35		1,1	0,70		0,7
0,47		1,4	0,9		
0,55			1,2		
0,60			1,5		

7.6.12 initial pipe sizes which would be finally established by rational estimation by making reference to 7.6.2, or any other suitable method, calculate the residual pressure at every terminal water fitting or appliance, starting with the point of supply or alternatively, the point where it is anticipated that the residual pressure will be critical.

7.6.13 calculated residual pressures against those required to obtain the desired flow rate. If the calculated residual head is less than the head required for a particular fitting, or if the head is negative, select a larger pipe and recalculate the residual pressure.

NOTE 1 The rate of flow through a pipe depends upon the length and bore diameter of the pipe, the roughness of the internal surface of the pipe, and the pressure drop (loss of head) along the pipe.

NOTE 2 The use of in-line flow restrictors or flow controllers should be considered where the available residual pressure can result in an excessive draw-off at a fitting that could starve other areas where the available (residual) pressure is critical.

loss formulae

7.6.1 appropriate roughness factor, *K*, for pipes shall be determined by making reference to either

a) table 17, or

b) any other suitable literature (such as the manufacturer’s literature, design codes and plumbing reference material).

NOTE Exponential formulae are often used in assessing the friction and transmission losses in a pipe network however, the best of them are only reasonably accurate, and then only in certain flow regimes. Of the various formulae, the D’Arcy-Weissbach and Colebrook-White formulae are fundamentally more accurate, since they are applicable over the whole range of conditions normally found within water distribution networks.

Table 17 — Roughness values for factor *K*

1	2	3
Material classification	factor <i>K</i>	
	mm	
	New	Deteriorated
Drawn non-ferrous metallic and non-metallic smooth-walled pipes	0,003	0,060
Fibre cement	0,030	1,000
Galvanized mild steel	0,060	0,300

7.6.2 appropriate, a growth factor shall be determined and the roughness factor *K*, adjusted, using the following equation:

$$K = K_0 + \alpha \cdot t \tag{9}$$

where

*K*₀ is the original roughness factor, in millimetres (mm);

α is the growth factor, in millimetres per year (mm/year);

t is the expected deterioration period of the component, in years.

Wherever possible, the growth rate shall be derived from the records of existing mains carrying the same type of water. In the absence of other suitable data, the following values shall be used for design purposes:

- a) for fibre-cement pipes: $\alpha = 0,015$ mm/year;
- b) for plastics pipes: $\alpha = 0,001$ mm/year; and
- c) for galvanized steel: $\alpha = 0,002$ mm/year.

NOTE 1 The carrying capacity of pipes usually diminishes with time because of the formation of tubercles, scale or slime on the inside walls. Furthermore, the interaction between the water and the pipe wall can result in corrosion of steel pipes and the development of tubercles that could partially block the pipe. Scale and slime formation are due to the precipitation (onto the wall of the pipe) of chemicals dissolved in the water where anaerobic bacteria can be active and help to promote corrosion. The type of phenomenon causing reduction in the carrying capacity of a pipe can thus be affected by the material of the pipe, its manufacturing process, the efficiency of protective coatings (for example, bitumen, epoxies, glass fibres and concrete), the chemical and biochemical characteristics of the water and the velocity of flow in the pipe.

NOTE 2 The precipitation potential of water can be derived from indices such as the Langelier Saturation Index and the Ryzner Stability Index. In the absence of other evidence, these indices could be used to estimate the growth rate α .

NOTE 3 Colebrook and White reported that the growth rate of scale formation or tuberculation under a given set of conditions is constant and although the growth rate formula suggests an unlimited increase in roughness, a practical upper limit occurs after 20 years to 30 years.

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7.6.3 loss for steady-state turbulent flow along a rough pipe shall be calculated using the following equations:

$$h_f = \frac{\lambda \cdot L \cdot V^2}{2g \cdot \Delta} \quad (10)$$

$$\frac{1}{\sqrt{\lambda}} = -2 \log \left[\frac{K}{3,75D} + \frac{2,51}{Re \sqrt{\lambda}} \right] \quad (11)$$

which at 25 °C becomes

$$\frac{1}{\sqrt{\lambda}} = -2 \log \left[\frac{K}{3,75D} + \frac{2,247 \cdot 10^6 D}{Q \sqrt{\lambda}} \right] \quad (12)$$

where

- h_f is the head loss, in metres (m);
- λ is the D'Arcy-Weissbach friction factor;
- L is the pipe length, in metres (m);
- V is the mean flow velocity, in metres per second (m/s);
- g is the acceleration due to gravity (taken as 9,8 m/s²);
- D is the diameter of the pipe, in metres (m);
- K is the roughness, in metres (m);
- Re is the Reynolds number which is = $\frac{VD}{\gamma}$;
- Q is the volume flow, in cubic metres per second (m³/s);
- γ is the kinematic viscosity, in square metres per second (m²/s).

NOTE 1 The friction factor, λ , varies with the viscosity of the fluid, the roughness of pipe walls, the diameter of the pipe and the velocity of flow.

NOTE 2 Equation (11), known as the Colebrook-White formula, is used to calculate the D'Arcy-Weissbach friction factor, λ , for the entire turbulent flow range (Reynolds number > 4 000).

NOTE 3 The kinematic viscosity, γ , for water depends on the temperature as follows: at 0 °C, $\gamma = 1,79 \cdot 10^{-6}$ m²/s; at 20 °C, $\gamma = 1,01 \cdot 10^{-6}$ m²/s; at 40 °C, $\gamma = 0,66 \cdot 10^{-6}$ m²/s.

NOTE 4 Friction loss and flow rate velocity curves for pipes of different materials are given in annex I. While the curves show the range of diameters listed in the standards, it should be ascertained which diameters are obtainable from manufacturers.

NOTE 5 Friction loss factors for Laminar flow are of no practical importance and have been omitted in the equations given in 7.6.2.3.

7.6.2.4 When necessary (see 7.6.2.5), the secondary energy losses shall be calculated using the following equation:

$$h_1 = k \cdot \frac{V^2}{2g}$$

where

- h_1 is the secondary loss, in metres (m);
- k is an empirical pressure loss coefficient;
- V is the mean flow velocity, in metres per second (m/s);
- g is the acceleration due to gravity (taken as 9,8 m/s²).

Values of k shall be obtained by making reference to the manufacturers' literature, or to table 18, keeping in mind that since the values of k , for reflux valves, can vary considerably depending on the type of valve and whether the valve is installed horizontally or vertically, such values shall be obtained from the manufacturers.

NOTE 1 Secondary (or transition) losses occur with changes in direction, or with changes in the magnitude of the flow (when energy is expended to maintain the resultant eddy flow), or both. While friction losses in long pipelines are usually far greater than secondary losses, the situation is often reversed in short, smaller diameter pipelines with several fittings. Secondary losses should therefore always be considered in water installations in buildings.

NOTE 2 Friction losses are usually expressed as a function of kinetic energy head.

7.6.2.5 If necessary, determine the total head loss for a pipe by adding the secondary losses and the friction losses.

Table 18 — Pressure loss coefficient *k*

1	2
Type of fitting	<i>k</i>
Entry losses (tanks):	
Sharp-edged entrance	0,50
Re-entrant entrance	0,80
Slightly rounded entrance	2,25
Bell-mouthed entrance	0,05
Foot valve and strainer	2,50
Exit losses (tanks):	
Sudden enlargement	1,00
Bell-mouthed outlet	0,20
Intermediate losses (pipe fittings):	
Elbows (R/D = 0,5 approx.)	
22,5°	0,20
44°	0,40
90°	1,00
Close radius bends (R/D = 1 approx.)	
22,5°	0,15
44°	0,30
90°	0,75
Long radius bends (R/D = 2 to 7)	
22,5°	0,10
44°	0,20
90°	0,40
Sweeps (R/D = 8 to 50)	
22,5°	0,05
44°	0,10
90°	0,20
Mitre elbows	
22,5° – 2 piece	0,15
30° – 2 piece	0,20
45° – 2 or 3 piece	0,30
60° – 2 piece	0,65
60° – 3 piece	0,25
90° – 2 piece	1,25
90° – 3 piece	0,50
90° – 4 piece	0,30
Tees:	
Flows in line	0,35
Line to branch or branch to line:	
Sharp-edged	1,20
Radiused	0,80
R/D = radius/diameter	

Table 18 (concluded)

1	2
Type of fitting	<i>k</i>
Angle branches: Flow in line	0,35
Line to branch or branch to line: 30°	0,40
45°	0,60
90°	0,80
Sudden enlargements ^a : Ratio of inlet diameter to outlet diameter: 4:5	0,15
3:4	0,20
2:3	0,35
1:2	0,60
1:3	0,80
1:5 and over	1,00
Sudden contractions ^a : Ratio of inlet diameter to outlet diameter: 5:4	0,15
4:3	0,20
3:2	0,30
2:1	0,35
3:1	0,45
5:1 and over	0,50
Tapers ^a Flow to large end negligible Ratio of inlet diameter to outlet diameter: 4:5	0,30
3:4	0,40
1:2	0,12
Valves Gate valves: Fully open	0,12
Quarter closed	1,00
Half closed	6,00
Three-quarters closed	24,00
Ball valve	10,00
Globe valve	10,00
Right angle valve	5,00
Reflux valve	1,00
Butterfly valve	0,30
Stopcock	10,00
R/D = radius/diameter	
^a Values for enlargements, contractions and tapers apply to smaller diameter.	

7.7 water piping

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7.7.1 Water demand for the building shall be determined in accordance with 4.2.3.

7.7.2 In addition to the hot water supply pipe, the following shall be determined:

a) the lengths; and

b) the sizes in accordance with the demand from the fixtures to be served, and in accordance with 7.6.

| 7.7.3 Design limits are given in table 20.

Amdt 2

| NOTE Deleted by amendment No. 2.

Table 19

Deleted by amendment No. 2.

Table 20 — 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

Amdt 2

1	2
Internal diameter of pipe	Maximum length of pipe
mm	m
≤ 15	12
> 15 and ≤ 25	8
> 25	3

Amdt 2

7.7.4 Where required, the temperature drop from the storage water heater or other heating equipment to the branch serving the furthest terminal fitting shall be restricted to not more than 8 °C.

7.7.5 Insulation material of an appropriate type and thickness shall be selected in accordance with 5.1.9 and the rate of heat loss in the system shall be determined in accordance with 7.7.2, or by reference to any other suitable method.

7.7.6 Where the temperature of the hot water discharged at any terminal fitting is not adequate, one or any combination of the following steps shall be carried out:

- a) adjust pipe sizes in accordance with 7.6;
- b) re-select insulation materials; and
- c) take other appropriate measures (for example, trace heating, recirculation flow and return systems).

NOTE When appropriate, such as in the case of larger hot water installations, undertake a cost/benefit analysis to identify the most appropriate steps to take.

7.7.7 For circulation systems

- a) the piping that begins at the heating equipment and ends at the branch serving the last fixture shall be regarded as the supply piping, and the piping from this branch back to the heating equipment shall be regarded as the return piping,
- b) insulation material of an appropriate type and thickness shall be selected in accordance with 6.7.5, and the rate of heat loss on the supply and return side of the system shall be determined in accordance with 7.7.2, or by reference to any other suitable method,
- c) the piping shall be sized in accordance with 7.7.3, or by reference to any other suitable method, and
- d) the heating equipment shall be sized, taking into account all the heat losses in the supply piping, the heating equipment and the return piping.

NOTE 1 Water is only drawn from the supply piping and the only purpose of the return piping is to complete the loop to allow for circulation.

NOTE 2 The supply side of a hot water circulation system will be maintained at an acceptable temperature as long as a sufficient amount of hot water is circulated.

NOTE 3 Heating equipment can include elements such as, secondary elements, heat pumps and trace heating.

NOTE 4 Extensive heat losses can occur in a thermosiphonic circulation system and designs using this type of principle often require return piping of large diameter, resulting in high and costly thermal losses, especially with long pipe runs. A disadvantage of this system is that it cannot be shut off when circulation is not required.

NOTE 5 In the forced-flow hot water circulation system, a centrifugal pump is used to create circulation, using smaller diameter piping to avoid large thermal losses on the return piping. The pressure induced by the pump is comparatively high so that the pressure loss due to the decrease of water temperature can be ignored.

Calculation of heat losses

Heat loss shall be calculated using the following equations:

a) For heat losses from flat, or nearly flat, surfaces:

$$q = \frac{T_1 - T_m}{h/k + 1/f} \tag{14}$$

b) For heat losses from cylindrical surfaces (pipes):

$$q = \frac{T_1 - T_m}{\left[\frac{d_o}{2k} \right] \left[\text{Log}_e \left[\frac{d_1}{d_o} \right] + \frac{d_o}{f d_1} \right]} \tag{15}$$

$$q_1 = \pi \cdot d_o \cdot q \tag{16}$$

where

- q is the rate of heat loss per unit area of hot surface, in watts per square metre (W/m²);
- T_1 is the temperature inside the container or pipe, in degrees Celsius (°C);
- T_m is the ambient temperature, in degrees Celsius (°C);
- h is the thickness of the insulation material, in metres (m);
- k is the thermal conductivity of the insulation material, in watts per metre per degree Celsius (W/m/°C);
- f is the heat transfer coefficient per unit area of external insulation surface, in watts per square metre per degree Celsius (W/m²/°C);
- d_o is the external diameter of the pipe, in metres (m);
- d_1 is the external diameter of the insulation, in metres (m); and
- q_1 is the rate of heat loss through the insulation per unit length of pipe, in watts per metre (W/m).

ation systems

7.7.1 Circulation head shall be determined using the following equation:

$$CH = F_1 + NSH \quad (17)$$

where

CH is the circulation head, in metres (m);

F_1 is the friction loss in the circulation system, in metres (m);

NSH is the net static head ($NSH = 9,81 (\rho_{rp} - \rho_{sp}) H_c$), in metres (m);

ρ_{rp} is the density of water in return piping, in kilograms per cubic metre (kg/m^3);

ρ_{sp} is the density of water in supply piping, in kilograms per cubic metre (kg/m^3);

H_c is the circulation height, in metres (m).

NOTE The circulation pressure consists of the net static head plus the total friction loss in the circulation pipe system.

7.7.2 In a closed-loop pumped hot water circulation system, the required rating of the circulation pump shall be such as to provide the necessary circulation pressure and flow in the system.

7.7.3 Pipes shall be such that a sufficient rate of flow is maintained in order to control the drop in the temperature of hot water conveyed through the pipes. The return piping shall be so designed that the temperature drop on a circuit is not less than 5 °C and not more than 22 °C. In the absence of other suitable data, the relation between water flow and temperature shall be derived using the following heat balance equations:

$$\Phi = \Delta\Phi \cdot L \quad (18)$$

$$\Delta\Phi = (Q \cdot \rho \cdot C \cdot \Delta T) L \quad (19)$$

where

Φ is the heat loss from the pipe, in kilowatts (kW);

$\Delta\Phi$ is the heat loss from the pipe per metre run, in kilowatts per metre (kW/m);

L is the total length of pipe, in metres (m);

Q is the water flow, in litres per second (L/s);

ρ is the density of water, in kilograms per litre (kg/L);

C is the specific heat of water, in kilojoules per kilogram degree Celsius (= 4,2 kJ/(kg·°C);
and

ΔT is the temperature drop, in degrees Celsius (°C).

7.8 installations and combined installations

al

7.8.1 installation or combined installation shall be the subject of a rational design.

7.8.2 gn shall make provision for the number of hose reels and hydrants that can be operated or can come into operation simultaneously in any division.

7.8.3 rwise required, fire hydrants in any building that exceed 12 m in height, or when the total floor area of the building exceeds 1 000 m², shall be provided on the basis of one hydrant per 1 000 m² of floor area for each floor or part thereof.

7.8.4 s, although intended for use by the fire brigade, shall be situated in suitable positions subject to direction by the local authority.

izes

7.8.1 any fire installation or combined installation shall be sized according to a rational design and in accordance with 7.6, where appropriate.

7.8.2 re installation,

a) the nominal diameter of

- 1) a communication pipe serving such installation shall be at least 75 mm,
- 2) a pipe supplying water to a fire hydrant shall be at least 75 mm, except that where the length of such pipe exceeds 50 m, the nominal diameter of such pipe shall be at least 100 mm, and
- 3) a service pipe supplying water to a hose reel on any one storey of a building shall be at least
 - i) 25 mm, if it serves one or two hose reels,
 - ii) 32 mm, if it serves three hose reels,
 - iii) 40 mm, if it serves four or five hose reels, and
 - iv) 50 mm, if it serves more than five hose reels.

7.9 ilities for people with disabilities

Facilities for people with disabilities shall be designed to comply with SANS 10400-S.

8 llation

8.1 ral

The relevant national legislation (see foreword) and local authorities require that installation work shall be done by or under the adequate control of a plumber as defined in SANS 10400-A.

8.2 and storage of materials, fittings and components

, fittings and components shall be handled carefully to obviate damage.

facturers' instructions shall be followed as to how their products shall be loaded, transported, unloaded and stored.

manufacturer's documentation accompanying the product and components with regard to warranties, guarantees, operating instructions, safety instructions and required maintenance shall be passed on to the owner of the property.

NOTE Deleted by amendment No. 2.

8.3 ntification

pes and fittings shall bear acceptable markings for the purpose of identification as required, except for pipes and fittings for domestic dwellings. In installations where services are grouped together (such as in access shafts or ducts), all pipes shall be suitably marked in accordance with SANS 10140-3.

ipment on which the safety of a hot water system depends shall be clearly marked in order to prevent faulty adjustments being made on site, or to prevent such equipment from being replaced with incorrect items.

tents of taps and valves in laboratories shall be marked in accordance with SANS 10140-4.

8.4 lation of fittings and components

al

84.1 ulation pumps, valves and water meters shall be installed in readily accessible positions.

NOTE Deleted by amendment No. 1

84.2 ches from horizontal hot water mains shall, as far as possible, be taken from the top half of the pipe, to avoid the formation of sediment traps and air pockets.

84.3 oint unions shall not be used in galvanized piping that conveys hot water because the brass seat could result in abnormal localized corrosion within the union, giving rise to restrictions.

84.4 umer is responsible for the construction of the connection between the water main and the installation, such connection shall be made in accordance with SANS 1200 LF.

low prevention devices

84.1 flow prevention device shall be installed in such a position that

- a) it can be readily inspected,
- b) a condition of backflow in the pipe in which the device is installed can be readily detected,
- c) it is readily accessible for removal for the purposes of servicing, repair or replacement, without alteration to the water installation or to the structure within which the device is situated,
- d) it cannot be flooded by water or any other liquid, and
- e) in the case of a vacuum breaker, it is installed in an appropriate anti-syphon loop.

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84.2 Additional installation instructions issued by the manufacturer or supplier of non-return valves shall be complied with.

circulation pumps

Circulation pumps shall be installed in accordance with the manufacturer's instructions and space shall be allowed for maintenance and removal without disturbing the piping.

NOTE See also annex C for more information.

drainage trays

84.1 Where a storage tank or water heater is installed and a galvanized steel safety tray is provided, hardwood spacers shall be used to separate the storage tank or water heater from the tray. The surface of the tray shall be painted with at least two coats of bitumen paint.

84.2 Drainage from a safety tray shall

- a) be adequately supported to maintain a continuous fall to its point of discharge,
- b) discharge to the atmosphere in a position where the discharge is readily visible, but will not cause any damage to the building or its contents, and
- c) not be used to drain away periodic overflows such as those due to the normal expansion of hot water.

NOTE Suitable alternatives to galvanized steel safety trays should be provided for areas that have highly corrosive atmospheres (see also 5.4.4).

water heaters and storage tanks

84.1 Cold water pipe connections to any water storage container shall be carefully positioned to limit the degree of mixing of hot and cold water within the container. The cold water feed shall

- a) if applicable, be connected at the bottom of a horizontal cylinder to a long perforated pipe within the cylinder, or to a bend or tee, with the tee's outlet or two branches (as the case might be) discharging horizontally into the bottom of the cylinder, and
- b) not be allowed to discharge upwards in a storage container.

84.2 A storage tank shall be installed in such a position that its exterior and interior can readily be inspected, cleaned and maintained.

84.3 A minimum clear working space of 600 mm shall be provided on all the sides of a storage tank constructed of bolted sections, in order to allow for access to the bolts.

NOTE For information on the installation of gas water heaters, see annex A.

84.4 Venting devices associated with water heaters shall be so installed that

- a) they are protected from freezing, and
- b) any discharges to the atmosphere are readily visible.

84.5 y storage tank or water heater is installed in a roof space above a ceiling, or in a confined space, an access opening shall be provided in the ceiling, or in the confined space, for the removal of the storage tank or water heater from such space. Any dimension of the access opening shall be

- a) at least a diameter of 600 mm, and
- b) large enough to allow for removal of the water heater or storage tank.

84.6 ater heater with an internal sacrificial anode is installed, sufficient space shall be provided for the removal and replacement of such anode.

rts for storage tanks and water heaters

84.1 r heater or storage tank is supported by any platform, such platform shall

- a) be capable of safely sustaining any loads to which it is likely to be subjected,
- b) support the water heater or storage tank in accordance with the instructions of the manufacturers of such water heaters or storage tanks, and
- c) shall comply with the requirements in SANS 10400-L.

84.2 oden platform is used to support a water heater or storage tank of capacity not exceeding 2 kL, such wooden platform shall, unless otherwise required, be constructed as follows:

- a) the dimensions of the platform shall not be less than those of the water heater, storage tank or any associated safety tray, plus an additional working space of at least 500 mm in width that extends over the full length of one side of the platform;
- b) the supports shall be constructed from structural timber that is
 - 1) at least 114 mm × 38 mm in cross-section,
 - 2) placed on edge, and
 - 3) spaced not further apart than 350 mm; and
- c) the platform decking shall be constructed of timber planks that are at least 75 mm wide and 25 mm deep, and such decking shall be placed at right angles to the supports,
 - 1) with a space that does not exceed 25 mm between them if the decking is to support a lightweight metal tank, or
 - 2) abutting on one another if the decking is to support a storage tank or water heater made from plastics material, fibre cement or fibreglass.

84.3 m that supports a water heater or storage tank shall, if applicable, be supported by at least two load-bearing walls or two suitably designed roof trusses.

84.4 e tank made of bolted steel panels shall be supported on rigid beams that are spaced not more than 350 mm apart and that are located under the jointed flanges of the bolted panels in one direction only.

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84.5 heaters or storage tanks of capacity ≤ 200 L shall be attached by means of brackets or hangers to a load-bearing masonry or concrete wall or to any other vertical structural element. Tanks and water heaters larger than 200 L shall not be wall mounted. **Amdt 2**

84.6 Installation of gas operated water heaters shall comply with SANS 10087-1 for LP gas and with SANS 827 for natural gas. All gas installations shall be installed by a registered gas practitioner as required by the relevant national legislation (see foreword). After commissioning, a certificate of compliance shall be issued.

84.7 For heater installations for domestic use shall comply with SANS 10106. After commissioning, a certificate of compliance shall be used. **Amdt 2**

8.5

al

85.1 Joints are made,

- a) all proprietary joints shall be made in accordance with the manufacturer's instructions,
- b) such joints shall be made watertight and shall remain so during use,
- c) all pipes, fittings and components to be jointed shall be internally clean,
- d) care shall be taken to ensure that no jointing material projects inside the bore of the pipe,
- e) all burrs shall be removed from the ends of pipes, and
- f) care shall be taken to prevent jointing materials from entering the waterways.

85.2 Where flexibility is desirable where there is a possibility of movement in the pipeline or between pipes and fittings, provision shall, where necessary, be made in the assembly of the pipework to accommodate and control thermal movement.

85.3 Pipework connected to, and all protective valves associated with, water heaters shall be connected by means of flush unions or similar connectors (such as caps and linings), to facilitate the replacement of such fittings. If compression fittings are used for this connection, sufficient provision shall be made for the pipework to be sprung, it shall not be between rigid fixed points. It shall not be required to cut the pipe to affect repair or removal or replacement of the component. **Amdt 2**

85.4 Pipes shall be so joined to one another as to maintain the continuity of the bore.

85.5 Soldering materials shall comply with the following:

- a) bronze welding filler rods shall contain at least 57 % copper;
- b) silver brazing alloys shall contain at least 1,8 % silver;
- c) soft solder shall contain no lead and be predominantly tin with a small percentage of copper; and
- d) rubber rings used for jointing shall be of the dimensions, composition and hardness suitable for the particular application.

85.6 Threaded joints shall be formed on metal threads by the use of polytetrafluoroethylene (PTFE) tape, hemp, or an acceptable pipe jointing compound, and on PVC-U threads by the use of PTFE tape only.

Iron or copper alloy pipes

85.1 Iron pipes shall be jointed

Amdt 2 |

- a) with suitable compression fittings (manipulative or non-manipulative),
- b) with suitable capillary-soldered fittings,
- c) by forming the tube ends into capillary-type soldered joints,
- d) by either bronze welding or silver brazing, or
- e) as otherwise approved.

85.2 The manufacturer's instructions shall be strictly followed when copper pipes are being jointed, particularly with regard to the grade of solder and flux to be used for capillary-soldered fittings.

NOTE 1 Copper pipes can sometimes contain a carbonaceous film from the lubricant used in the drawing process, and this film can promote corrosion. The film develops when (during the manufacturing process) the tubing is heated to a high temperature for the drawing process.

NOTE 2 Soft solder of copper-tin or silver-tin has an adequate shear strength in all normal water temperature conditions.

85.3 Flanges shall be secured to the flanges of fittings and appliances by means of gunmetal or extruded-brass bolts and nuts, and the joint shall be made watertight with a gasket.

Fibre-cement pipes

85.1 Connections between fibre-cement pipes shall be of the spigot and socket type, with a rubber sealing ring or bolted gland, or as approved.

85.2 Connections between fibre-cement pipes and metal pipes shall be bolted gland or, when fibre-cement spigots are being jointed to metal sockets, lead caulked, or as approved.

85.3 All connections shall be made by tees (branches) and crosses, tapping bands or ferrule main taps.

NOTE Fibre-cement products should be protected from impact when used in exposed positions, and care should be exercised when connections are made to fibre-cement storage tanks, since the joints tend to become brittle when cold.

Ductile iron pipes

85.1 Connections between ductile iron pipes and fittings shall be

- a) spigot and socket pipes with push-fit joints with elastomer gaskets, or
- b) flanged pipes (weld-on type and integrally casted flanges)

85.2 For ductile iron pipes to be jointed with push fit joints, the following procedure shall be carried out:

- a) Clean socket chamber and pipe spigot as well as gasket.
- b) Check if the spigot is chamfered and in good condition. If it is a cup pipe, remake the chamfer.

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- c) Insert the gasket into the socket chamfer after the condition is inspected, looping it into a heart shape, with the lip seal nose directed towards the back of the socket. Check that the gasket fits snugly around the circumference.
- d) Apply lubricating paste to the exposed surface of the gasket, the spigot end and the chamfer. Ensure that the lubricating paste is brushed-applied in reasonable amounts.
- e) Centre the spigot in the socket and maintain it in this position by resting it in mounds of tamped soil, or preferably gravel.
- f) Push the spigot into the socket, checking that everything is correctly aligned.
- g) Deflect the joints, if necessary, within the permissible limits.
- h) Allow 1 cm from the end of the spigot to the end of the socket chamber when inserted.

85.3 tile iron pipes are to be jointed with flanges, the following procedure shall be carried out:

- a) Check the appearance and cleanliness of the flange faces and the gasket.
- b) Align the parts being assembled.
- c) Leave a small gap between the flanges being joined for the gasket to be inserted.
- d) Centre the gasket between the raised faces on both flanges using the located lugs as indicated.
- e) Fit the bolts and nuts.
- f) Tighten the bolts and nuts in opposing sides first. Observe the torques for the bolts as prescribed.

nized steel pipes

85.1 etween galvanized steel pipes and between galvanized steel pipes and fittings shall be

- a) screwed joints that have pipe threads that comply with SANS 1109-1, where pressure-tight joints are to be made on the threads,
- b) flanged joints using steel pipe flanges that comply with SANS 1123, or
- c) as otherwise approved.

85.2 le thread filler shall be used to obtain watertight joints where necessary, and exposed threads after jointing shall be suitably protected against corrosion.

NOTE Exposed threads can be painted, or where the pipes are to be installed underground, thickly coated with bituminous or other suitable paint to prevent corrosion.

85.3 nts are made by either screwed or cast-on flanges, the nuts shall be tightened in opposite pairs.

85.4 all not be welded or brazed unless galvanizing is done afterwards.

ics pipes**85.1 pipes**

Amdt 2 |

8.5.1.1 Mechanical jointing fittings or other approved methods shall be used for jointing polyethylene pipes, and any such mechanical jointing fitting shall be suitable for the class of pipes being used.

8.5.1.2 Used to join high density polyethylene pipes shall be as given in 8.5.6.1.1, or shall be compression-type jointing fittings suitable for the class of pipes being used.

NOTE Polyolefin pipes include polyethylene, polypropylene, polybutylene, crosslinked polyethylene, multilayer crosslinked polyethylene and raised temperature polyethylene etc.

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85.2 Uncoated polyvinyl chloride (PVC-U) pipes

8.5.2.1 Manufacturer's instructions shall be scrupulously followed when PVC-U pipes are being jointed, particularly in the case of solvent welding.

8.5.2.2 Pipes of size 50 mm and greater shall be jointed by means of push-fit integral elastomeric sealing rings that are compressed when the plain-ended pipes are inserted into the adjoining sockets.

8.5.2.3 Pipe ends shall be chamfered, cleaned and lubricated before they are inserted into the adjoining socket.

8.5.2.4 Pipes shall, unless provision is made for expansion, be inserted either fully into the adjoining socket or as far as any locating mark put on the spigot end by the manufacturer.

8.5.2.5 Flange joints shall only be used on PVC-U piping of size up to and including 50 mm. Such joints shall be of the non-manipulative type and care shall be taken not to over-tighten them.

8.5.2.6 Where solvent cement welded joints are made, pipes and fitting shall be cleaned at the joint and the type of solvent cement shall be appropriate for the composition of the plastics material.

8.5.2.7 Where signs of ring seal are available according to each manufacturer's system. Joint rings from different manufacturers are not generally interchangeable and the rings used shall be those designed for the system concerned.

NOTE 1 A solvent weld system is one in which most of the joints have been made by means of the solvent cement weld technique. A solvent weld system normally comprises socketed fittings in conjunction with double spigot lengths of pipe. Most ranges of fittings also include some components with spigot ends for close coupling to sockets on other items. In the case of a solvent weld system, it might, in some situations be necessary to introduce expansion joints into the pipework.

NOTE 2 It is difficult to make satisfactory solvent welded joints in the field, and such joints tend to be brittle. Some local authorities do not permit solvent weld joints, particularly in trench conditions.

less steel pipes

85.1 Non-stainless steel pipework of size up to 25 mm shall be

a) compression-type joints, using copper or copper alloy fittings,

b) Deleted by amendment No. 2.

| c) Deleted by amendment No. 2.

| d) crimped or cruxed-type joints, using approved fittings.

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85.2 In stainless steel pipework that exceed 25 mm in size shall be

a) butt welded, using a tungsten inert gas argon arc method, or

b) flanged joints with flanges drilled in accordance with SANS 1123.

8.6 Laying of pipes

laid underground

86.1 Where approved, pipes shall have a soil cover over the outside, of at least

a) 450 mm for any pipe of nominal diameter less than 75 mm, or

b) 750 mm for any pipe of nominal diameter 75 mm and above, keeping in mind that, if the soil cover is less than that required, appropriate steps shall be taken to protect any such pipes against

1) freezing, where necessary, and

2) the transmission of excessive superimposed loads direct to the pipes.

86.2 Where approved, pipes shall have a soil cover of not more than 1 m over the outside.

86.3 Sanitary drain pipe and a pipe that conveys potable water are laid underground horizontally next to each other, they shall be laid at least 500 mm apart.

86.4 Sanitary drain pipe and a pipe that conveys potable water cross each other, the pipe that conveys the water shall be laid at least 100 mm above the line of the sockets of the drain pipe.

| 86.5 Excavations, bedding and backfilling shall be carried out in accordance with SANS 2001-DP2 and SANS 2001-DP6 and pipes, shall be so laid that

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a) they are evenly supported throughout their lengths, and

b) no pipes rest on their sockets, or on bricks, tiles or other makeshift supports.

| 86.6 Use of pipework with flexible joints, adequate measures shall be taken to prevent movement of the pipework due to water pressure effects. Thrust blocks shall be designed and installed in accordance with SANS 2001-DP2 and SANS 2001-DP6.

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86.7 Following precautions shall be taken to minimize the effects of ground movement on pipes and fittings:

a) suitable types of pipework and fittings shall be used where the ground is liable to move; and

b) continuous longitudinal support shall be provided where the pipes or the joints are not sufficiently flexible to accommodate movement of the pipeline.

laid under walls or under surface slabs

Where any portion of a pipe passes under a building or under a surface slab, and unless otherwise approved, the following shall apply:

- a) such portion shall be installed inside a sleeve of internal diameter of at least 15 mm plus the outside nominal diameter of such portion;
- b) such portion shall be protected against the transmission of any load to it;
- c) such portion shall be laid without any change of direction, and without any junctions; and
- d) the trench in which such portion is laid shall in no way impair the stability of any building, or interfere with, or affect, any existing services.

laid in or through floors, concrete slabs or walls

86.1 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.

86.2 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).

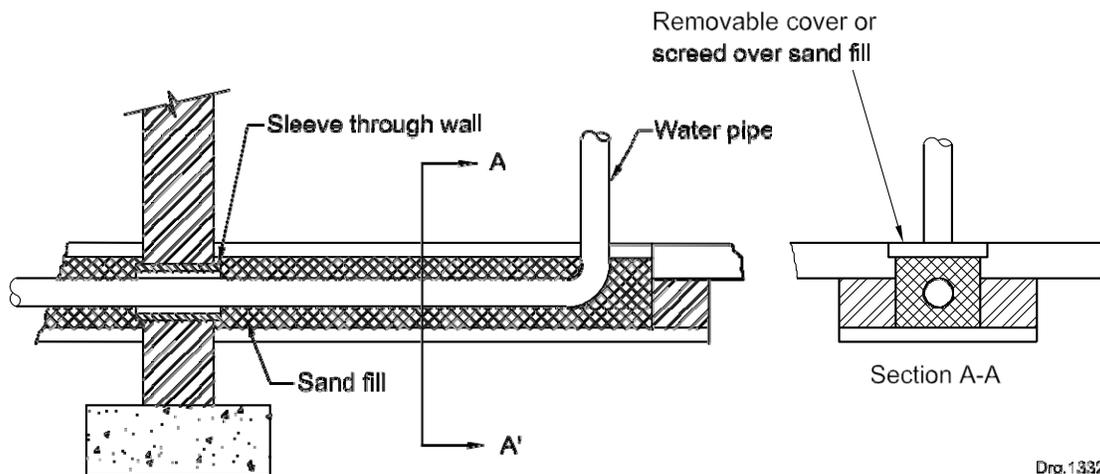


Figure 15 — Example of a duct for installing a water pipe within a surface slab or a floor

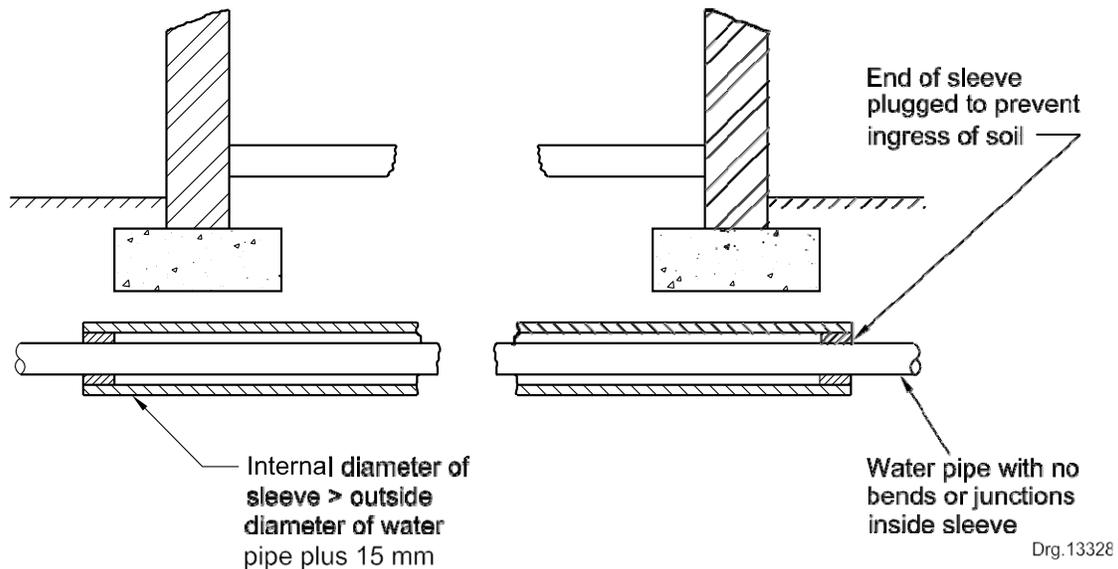


Figure 16 — Sleeve for installing a water pipe under a building or under a surface slab

86.3 stalled within a cavity dry 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. Amdt 2

86.4 ed piping in reinforced concrete structures shall be

- a) housed in properly constructed builders' work ducts, or wall chases, and
- b) laid in continuous lengths without joints or fittings except where such joints or fittings are located within access ports of sufficient size to permit maintenance and inspection (see figure 17).

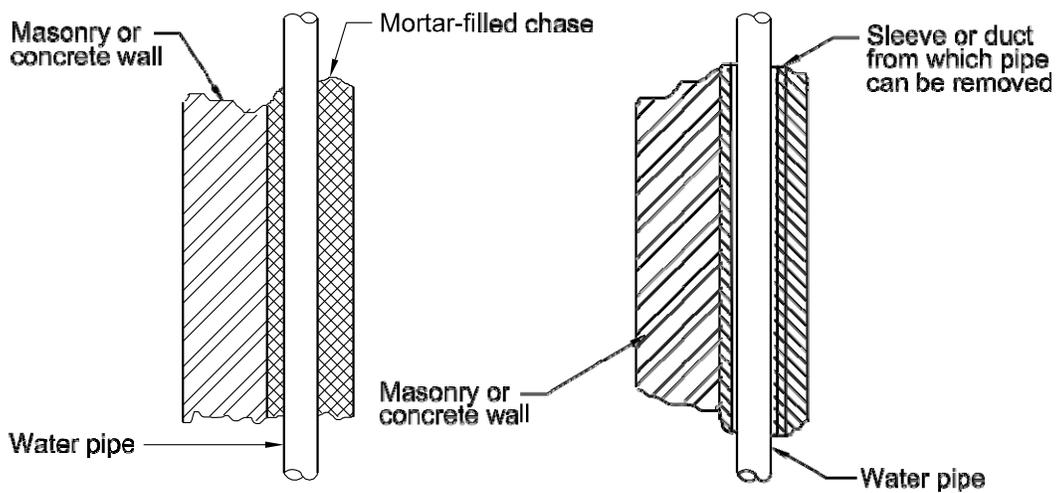


Figure 17— Installation of pipes in walls and structural elements

86.5 treated, compartment walls, floors and fire barriers shall be fire-stopped to prevent the passage of smoke and flame.

86.6 Water piping (including relief drain pipes), that is encased in concrete, plaster or similar material that can restrict the movement of such piping owing to expansion or contraction, shall be lagged throughout the whole encased length with hair felt or other approved flexible lagging material of thickness of at least 6 mm, or in accordance with the manufacturer's instructions.

86.7 To prevent unwanted heat transfer, hot and cold water pipes shall not be laid against each other. Pipes chased and fixed in solid walls shall be at least 100 mm apart. **Amdt 2**

Work above ground

86.1 Provision for expansion shall be made in pipe runs by allowing freedom of movement at bends or branches. Reference shall be made to the pipe manufacturer's instructions and such provision for expansion shall include

- a) a clear space to permit movement,
- b) sufficient free length of tubing around the bend or along the branch, to prevent overstressing of the tube, and
- c) an offset or loop to allow the pipe to be sprung should it be required to allow for disconnecting unions, to remove, or replace in-line valves, or other functional components.

In the case of tubing of length exceeding 18 m and that conveys hot water, provision shall be made for expansion and contraction, preferably close to the midpoint of the tubing.

Expansion-absorbing devices are shown in figure 18.

NOTE Provision for expansion could include the forming of expansion loops and offsets, introducing changes in direction in order to avoid long straight pipe runs, and the fitting of proprietary expansion joints. Expansion loops and offsets are simple and effective but require space, which might not be available. (See 6.7.3.)

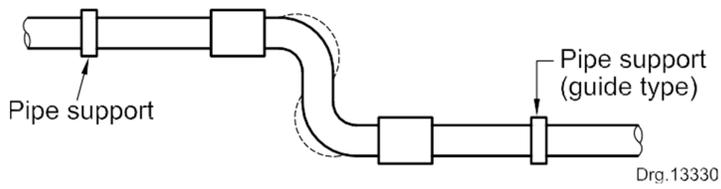
86.2 It shall be so installed that noise and water hammer that occur in such pipework are limited to an acceptable minimum.

86.3 If supports are installed in open spaces and are not otherwise held in place, they shall be securely fixed with pipe supports to any structural member of a building with which they come into contact.

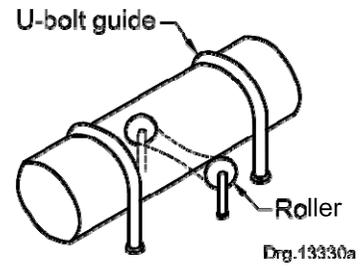
86.4 Pipe supports shall be of a type and material appropriate to the pipe, shall be capable of withstanding the applied loads and shall be corrosion resistant when pipes are installed in locations exposed to corrosive conditions.

86.5 Nailbats shall not be used for the fixing of steel piping.

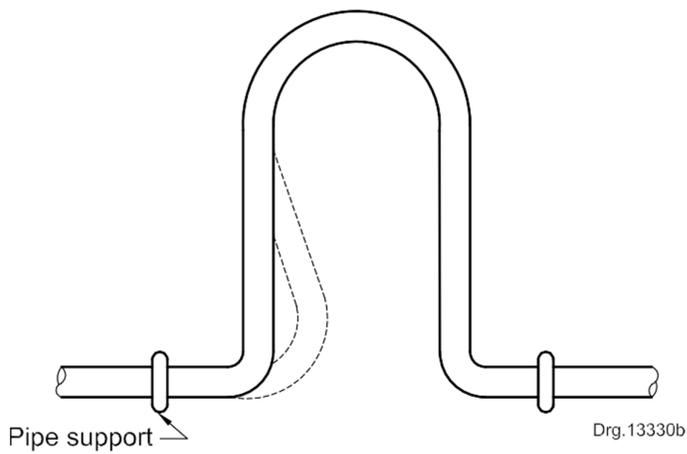
86.6 Supports shall be either built into, or bolted to, the structure of a building.



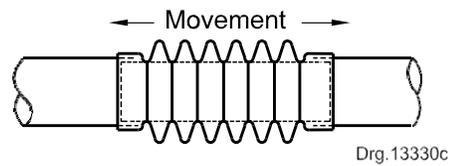
a) Expansion offset



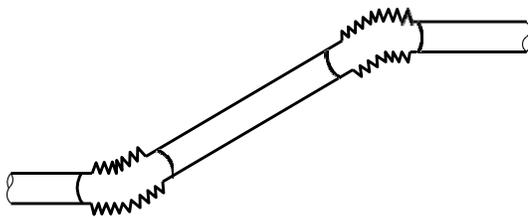
b) Pipe support (guide type)



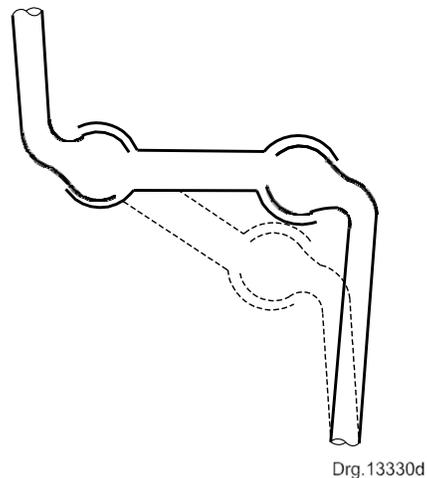
c) Expansion loop



d) Axial expansion bellows



e) Articulated expansion bellows



f) Ball joint connections

Figure 18 — Expansion-absorbing devices

86.7 S and clips shall be securely fixed in one of the following ways:

- a) by drilling and bolting through;
- b) by drilling and caulking with lead (wooden plugs shall not be used);
- c) by securing with a screwed or bolted masonry anchor;
- d) by percussive fasteners used in accordance with the manufacturer's instructions; or
- e) by other approved means.

When fittings are used that allow pipes to rotate, such as push-fit types, additional supports shall be installed to prevent rotation and to ensure that the pipe-work is not unstable. **Amdt 2**

86.8 Spacing of pipe supports shall be determined as follows:

- a) the spacing is acceptable if, under normal operating conditions,
 - 1) the permissible maximum stress for the material from which a pipe is manufactured is not exceeded, and
 - 2) the maximum deflection of the pipe from a straight line between neighbouring supports does not exceed $\frac{1}{150}$ of the distance between the supports;
- b) if the requirements in (a) are not complied with, then
 - 1) in the case of metal pipes, the spacing of pipe supports shall not exceed the values given in columns 2 and 3 of table 21, for the size of pipe given in column 1 of table 21, and
 - 2) in the case of PVC-U or polyethylene pipes, the spacing of pipe supports shall not exceed the values given in columns 2 and 3 or 4 and 5, respectively, of table 22, for the size of pipe given in column 1 of table 22, except that,
 - 3) in the case of polyethylene pipes where the ambient temperatures or the temperature of the piped fluids are such that the temperature of the pipework exceeds 20 °C, the spacing of the pipe supports shall be so reduced that the requirements given in (a) are complied with for the design life of the pipe system, taking into account the creep behaviour of the pipe material and normal operating conditions and loads.

Table 21 — Maximum spacing of supports for metallic pipes installed horizontally, inclined or vertically, in open spaces

1	2	3
Nominal pipe diameter mm	Distance between pipe supports when pipes are installed m	
	Non-vertically	Vertically
15 to ≤ 25	1,6	3,0
> 25 to ≤ 40	2,7	3,0
> 40 to ≤ 50	3,0	3,6
> 50 to ≤ 65	3,6	4,5
> 65 to ≤ 150	4,0	4,5

Table 22 — Maximum spacing of supports for plastics pipes installed horizontally, inclined or vertically, in open spaces

1	2	3	4	5
Nominal pipe diameter mm	PVC-U piping		Polyethylene piping	
	Distance between pipe supports, when pipes are installed			
	m			
	Non-vertically	Vertically	Non-vertically	Vertically
≤ 20	0,6	1,2	0,3	0,6
> 20 to ≤ 32	0,8	1,7	0,4	0,8
> 32 to ≤ 50	1,0	1,75	0,42	0,87
> 50 to ≤ 80	1,15	2,25	0,55	1,10
> 80 to ≤ 100	1,35	2,70	0,67	1,35
> 100 to ≤ 150	1,5	3,0	0,75	1,5

pipes

86.1 Pipes connected to water installations shall be securely supported by fixing to walls of buildings or, when necessary, shall be suitably supported by other means.

86.2 Pipe draw-off taps shall be at a height of at least 450 mm, measured above ground level or above the gully top, as applicable.

NOTE Standpipes leaking direct over gulleys discourage repairs and result in unnecessary water wastage.

86.3 Pipes shall not be connected between the water mains and the lower outlet bend of the water meter assembly.

res and equipment with electrical power

Fixtures and equipment that use electrical power and their application in ablution facilities shall be installed to comply with the requirements in SANS 10142-1.

9 Flushing, inspection, testing and disinfection

9.1 Flushing

Where a general or combined water installation is disinfected, or is pressure-tested for acceptance, it shall be properly cleared of all foreign matter.

NOTE Flushing out a system with water often fails to remove matter, such as non-water-soluble cutting oils, corrosion products, mortar or foreign objects that might have wedged in a fitting. Problems experienced with installations that have not been properly cleaned out include poor hydraulic performance, or a bad taste to the water which could linger for several months (or both). The presence of dirt in a system could also, to some extent, negate the effectiveness of chlorination.

ective method of cleaning out installations is to pass a specially designed "pig" through the system. A pig is usually a bullet-shaped polyurethane foam cylinder with or without strips of harder material such as urethane rubber on its surface. Figure 19 shows a pig in position, ready for launching. Figure 20 shows a typical arrangement for launching of pigs in a water installation.

NOTE 1 Suitably designed pigs can negotiate elbows and tees. A pig of appropriate diameter can be introduced into an empty pipeline through a tee or blanked-off pipe end and be propelled along the pipeline by water pressure.

NOTE 2 Water for propelling the pig could be introduced behind the pig either direct from a storage tank connected to the system, or via a hose connected to another part of the installation that is supplied with water. The pressure needed for propelling a pig is usually substantially less than the operating pressure for the system, but should generally be at least 100 kPa to 300 kPa, depending on the diameter of the pipeline and the type of pig used.

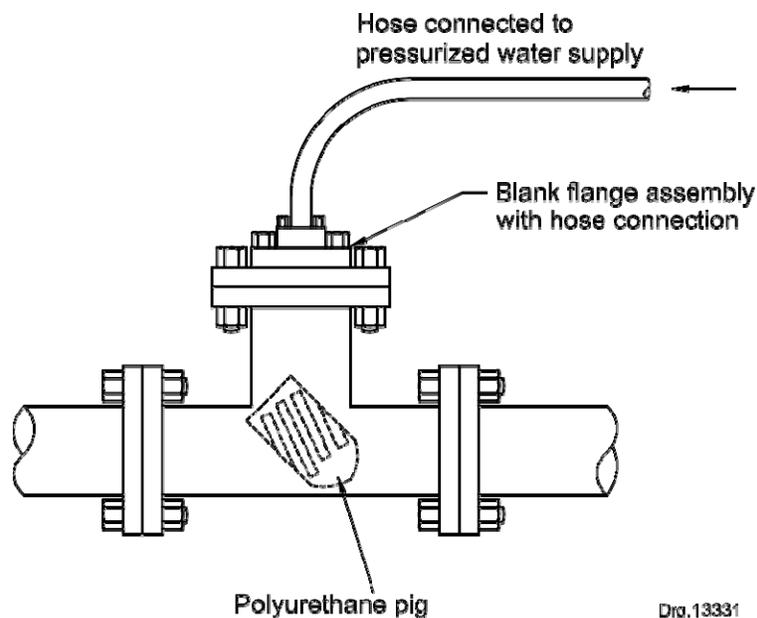


Figure 19 — Provision for launching a cleaning pig

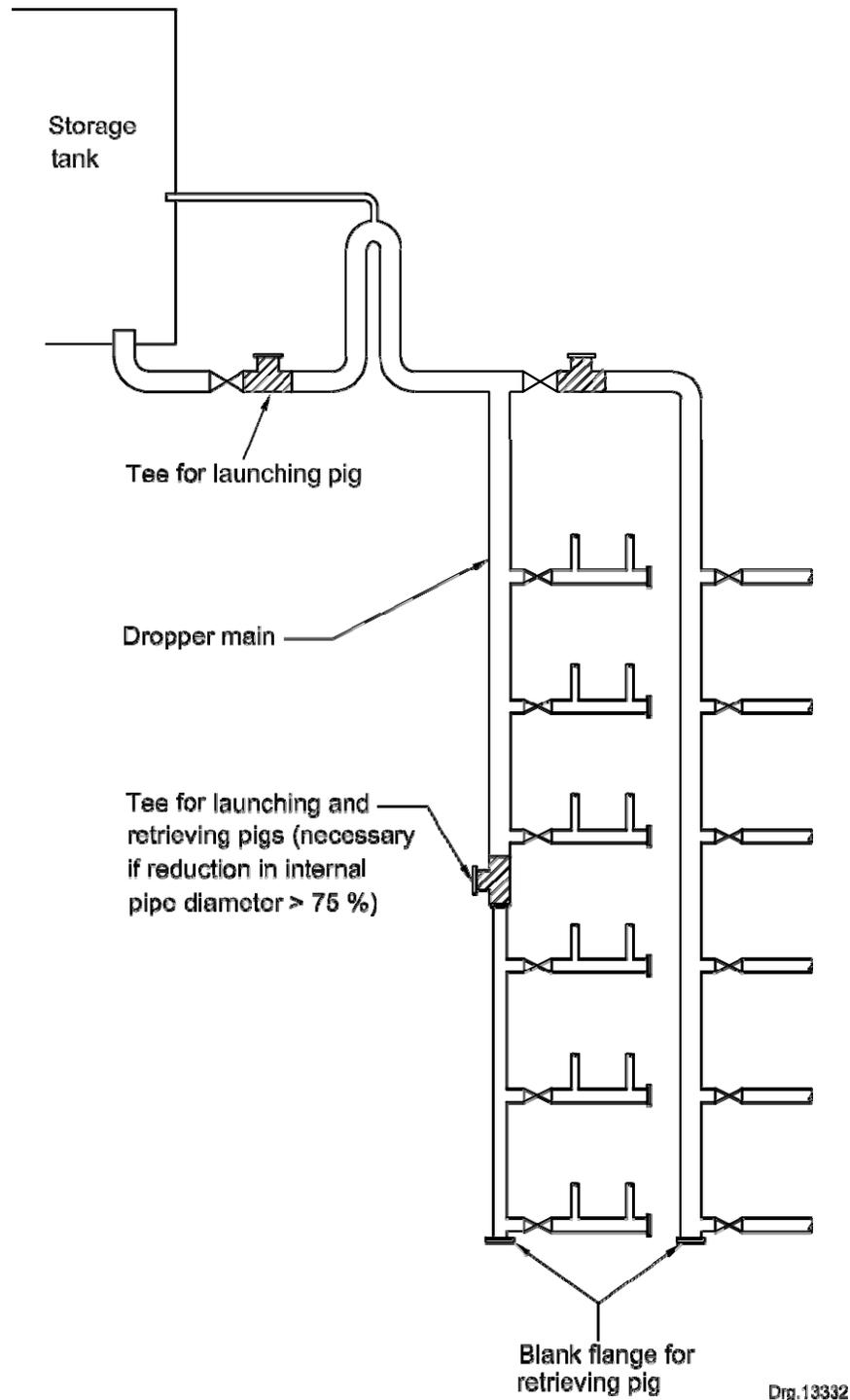


Figure 20 — Typical arrangement for launching and retrieving cleaning pigs in a general installation

9.2 Section and testing

Section

Before testing, the installation shall be inspected

- a) visually, to detect faults in construction or materials, and
- b) for compliance with drawings, specifications and requirements.

NOTE Particular attention should be paid to the pipe beds, levels of pipes, irregularities at joints, the installation of fittings and components (especially the correct fitting and installation of safety devices), protective coatings, and the supporting and fixing of pipes, fittings and components (especially for storage tanks and heaters), and to verifying that the appropriate backflow prevention devices have been selected and are installed correctly.

92.1 Fill the installation with water, with the highest draw-off point open, to allow air to be expelled from the system.

92.2 Check terminal fitting for rate of flow against the specified requirements.

92.3 Otherwise required,

- a) subject any water installation other than a fire installation or a combined installation to a test pressure of at least 1 500 kPa, but not less than 1,5 times the maximum working pressure of the installation, and maintain such test pressure for at least 1 h, and
- b) subject any fire installation or combined installation to a test pressure of at least 2 000 kPa, but not less than twice the maximum working pressure of the installation, and maintain such test pressure for at least 1 h.

92.4 That there is no loss of water and no visual evidence of leakage anywhere in the installation.

92.5 For leaded pipelines, test the pipeline in accordance with SANS 1200 L.

9.3 Disinfection

Disinfection of installations

When any extension or modification has been made to a water installation on any premises separately occupied, or any private dwelling that has its own separate service pipe, then that water installation shall, immediately before being taken into use, be thoroughly flushed with fresh water drawn direct from the mains.

Disinfection of tanks

93.1 Use the following disinfection procedure to any storage tank:

- a) remove all visible dirt and debris from the inside of the storage tank;
- b) fill the storage tank with clean water and then drained until empty;

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- c) refill the storage tank with clean water and add a solution of sodium hypochlorite to the water until a free residual chlorine level of 50 mg/L in the water is measured;
- d) leave the chlorinated water in the tank for not less than 1 h and not more than 3 h, after which (in turn) open each terminal fitting served by the storage tank, starting at the one closest to the tank and working progressively away from the tank, until the water discharged begins to smell of chlorine, then close each terminal again;
- e) do not allow the storage tank to become empty during the discharging described in (d); refill and re-chlorinate the tank as in (c), as necessary;
- f) when the discharging is carried out on the terminal fitting furthest from the tank and the smell of chlorine becomes evident, measure the level of free residual chlorine in the water discharged. If the concentration of free residual chlorine is less than 30 mg/L, repeat the disinfecting process, starting from (c); and
- g) keep the tank and pipes charged with the chlorinated water for at least 16 h and then thoroughly flush them with clean water until the free residual chlorine level at any terminal fitting does not exceed that present in the clean water from the mains.

93.2 Use of pipework under pressure, apply the following procedure:

- a) carry out chlorination treatment through a properly installed injection point, using a chemical pump at the start of the installation until the measured free residual chlorine at the end of the installation is at least 20 mg/L; and
- b) leave the chlorinated water in the system for at least 24 h, after which flush the installation with clean water until the free residual chlorine level in the water, measured at the furthest point from the injection point, does not exceed that present in the clean water of the mains.

NOTE 1 Disinfection should be compatible with the pipe system manufacturer's specifications.

NOTE 2 Should the use of alternative disinfection systems be considered, the process should be performed under the supervision of and the results certified by a suitably qualified specialist personnel as specified by the manufacturer of the materials and equipment.

NOTE 3 Following the performance of the disinfection process, it is recommended that a water sample be obtained and submitted for quality analysis in terms of the requirements given in SANS 241-1 and SANS 241-2.

Annex A
(informative)

Gas appliance installation requirements

A.1 General

Where any gas appliance needs to be installed it shall be installed by an authorized person (i.e. a registered gas practitioner as defined in the relevant national legislation (see foreword), and shall be installed according to the requirements of SANS 10087-1. **Amdt 1**

A.2 Installation of appliances

A.2.1 Fixed appliances shall be installed by a registered installer in accordance with the relevant national legislation (see foreword). When siting an appliance, due regard shall be paid to convenience in use, to protection from draughts and damage, and to the layout of the gas piping system. Pipe runs shall be as neat, tidy and as short as possible. Pressure regulators shall be of an approved type. Low-pressure regulators shall comply with SANS 1237.

A.2.2 Appliances shall be installed on a firm and level base (this is specially important in the case of refrigerators which require checking with a spirit level during installation). A table or shelf used as a support for an appliance shall be large enough to accommodate the appliance and, unless the support has edges that are flanged upwards, shall provide margins that are wide enough to prevent the appliance from slipping off the support. All appliance supports (including floors, walls and ceilings) shall be strong enough to carry the appliance(s) and all superimposed loads.

A.2.3 Appliances shall be connected to the pipework of an installation in a way that will eliminate undue strain on the pipework and fittings and, if rigid connections are used, the appliances shall also be so rigidly fixed that they are not capable of being moved after their installation. If an appliance is, for example, to be moved for cleaning, it shall be connected to the pipework by means of flexible tubing or hose. To prevent the hose or tubing from being ruptured or torn from its mountings, the appliance shall have a restraining mechanism of a length that is shorter than the hose or tube. Tubing and hoses shall comply with the appropriate requirements given in SANS 1539 and SANS 1156-1.

A.2.4 Appliances shall be installed in such a way as to avoid draughts that are strong enough to extinguish the burners when they are set on "low" flame.

A.2.5 Appliances shall not be installed in small, confined spaces that are poorly ventilated. Gas burners require an unrestricted supply of fresh air and when a cooking appliance is built in, the supply of fresh air for combustion shall not be impeded. Provision shall be made for any accumulations of un-burnt gas to disperse safely, and also for the free escape of products of combustion. Where gas appliances that require back ventilation are installed against a wall, there shall be a gap of at least 50 mm between the appliance and the wall.

A.2.6 In any bathroom in which a conventional gas water heater is installed, the heater shall be flued to the outside and provision shall be made to ensure permanent ventilation.

A.3 Instantaneous gas water heater — General requirements

A.3.1 Where any gas appliance is installed it shall be done by an authorized person (i.e. a registered gas practitioner) as defined in the relevant national legislation (see foreword).

A.3.2 All gas appliances (LP gas and natural gas) shall comply with the safety requirements of SANS 1539 and the installation requirements as given in SANS 10087-1 and SANS 827.

A.3.3 The water heaters are categorized into several types according to the method of evacuation of the combustion products and the admission of the combustion air (see A.4.1). The type of water heater installed shall be indicated on either the data plate or by additional labelling.

A.3.4 The temperature sensing device (overheat protection) fitted to an instantaneous water heater shall be subjected to the requirements given in SANS 1539. The sensor shall shut off the gas supply to the main burner within the nominal value as set by the manufacturer, not exceeding 10 % above the nominal.

A.3.5 Where a water heater is fitted with a combustion fan it shall be subjected to the requirements given in SANS 1539. The gas supply shall be shut off to the main burner within 1 min of the fan stopping.

A.3.6 Permanent air supply (which is a continuous supply of fresh air through an open vent (for example an open air brick)), shall be provided. Permanent ventilation (which is an opening to the outside atmosphere and which is fixed in the open position), shall be provided where instantaneous water heaters are installed in bathrooms

A.4 Type A instantaneous water heaters

A.4.1 General

Type A instantaneous water heaters are appliances with a maximum rated heat input of 42 MJ (11,7 kW·h) primarily for indoor use and are not intended to be connected to a flue or other device for evacuating the combustion products to the outside of the room. This type of appliance is intended for short delivery periods only.

A.4.2 Requirements for type A instantaneous water heaters

Type A instantaneous water heaters shall be fitted with

- a) a flame-failure device,
- b) an atmospheric sensing device which shall shut down the appliance in the event that the air quality in the room in which the appliance is installed reaches a preset level of oxygen depletion,
- c) a deflector that is an integral part of the appliance, and which is intended to deflect the combustion products away from the wall against which it is installed, and
- d) a temperature sensing device that shall shut down the appliance in the event that the water temperature in the heat exchanger reaches a preset limit.

NOTE This device is factory set by the manufacturer.

A.4.3 Additional requirements

In addition to the marking requirements given in SANS 1539, the following additional markings shall apply to type A instantaneous water heaters:

- a) the following information shall be included in the user instructions:
 - 1) this appliance is fitted with an atmospheric sensing device; and
 - 2) this appliance may only be used for short delivery periods and may not be used for the purpose of supplying hot water to a shower, bath or washing machine; and
- b) the following information shall be included in the installer instructions:
 - 1) this appliance may only be installed in a room if the room meets the appropriate ventilation requirements (see SANS 10087-1); and
 - 2) this appliance shall not be connected to a flue.

A.5 Type B instantaneous water heaters

A.5.1 General

Type B instantaneous water heaters are appliances primarily for indoor use and shall be connected to a flue for evacuating the combustion products to the outside of the building in which the appliance is installed and where the combustion air is drawn directly from the room in which the appliance is installed.

A.5.2 Requirements for type B instantaneous water heaters

Type B instantaneous water heaters shall be fitted with

- a) a flame-failure device,
- b) a draught diverter in the combustion products circuit,
- c) a combustion products discharge safety device (flue sensor), which shall shut down the appliance in the event of a spillage of combustion products into the room in which the appliance is installed, and
- d) a temperature sensing device that will shut down the appliance in the event that the water temperature in the heat exchanger reaches a preset limit.

NOTE This device is factory set by the manufacturer.

A.5.3 Additional requirements

A.5.3.1 Where the appliance is fitted with a fan in the combustion circuit

- a) apart from the provision of air from the air supply circuit, the remainder of the combustion products circuit shall be sealed from the room to prevent the combustion products discharge from entering the room, and

- b) the appliance shall be fitted with a mechanism that will shut off the gas supply to the burner in the event of fan failure or a flue blockage or back draft that could cause an overheat situation and then A.5.2(c) shall not apply.

A.5.3.2 No additional markings are required for type B instantaneous water heaters.

A.6 Type C instantaneous water heaters

A.6.1 General

Type C instantaneous water heaters are appliances for indoor use where the complete combustion circuit is sealed with respect to the room in which it is installed and are intended to be connected to a flue or other device for evacuating the combustion products to the outside of the building. Combustion air is taken from outside of the building.

A.6.2 Requirements for type C instantaneous water heaters

A.6.2.1 Type C instantaneous water heaters shall be fitted with

- a) a flame-failure device,
- b) an inlet/outlet connection designed to accept the ducts to be fitted to the appliance, and
- c) a temperature sensing device that will shut down the appliance in the event that the water temperature in the heat exchanger reaches a preset limit.

NOTE This device is factory set by the manufacturer.

A.2.6.2 Where a fan is fitted in the combustion circuit, a mechanism that will shut off the gas supply to the burner in the event of fan failure shall be fitted.

A.6.3 Additional requirements

In addition to the marking requirements given in SANS 1539, the following statement shall be included in the appliance installation instructions:

"This appliance is required to be connected to a dual duct flue system incorporating separate paths for provision of the combustion air and the exhaust of the combustion products to and from the exterior of the building. Note the manufacturer's specific instructions regarding installation of the appliance."

A.7 Type D instantaneous water heaters

A.7.1 General

Type D instantaneous water heaters are appliances for outdoor installation only.

A.7.2 Requirements for type D instantaneous water heaters

A.7.2.1 Type D instantaneous water heaters shall be fitted with

- a) a flame-failure device,

- b) a deflector that is an integral part of the appliance, where the appliance is of the type for use without a flue, and which is intended to deflect the combustion products away from the wall against which it is installed, and
- c) a temperature sensing device that will shut down the appliance in the event that the water temperature in the heat exchanger reaches a preset limit.

NOTE This device is factory set by the manufacturer.

A.7.2.2 Where the appliance is fitted with a fan in the combustion circuit, the appliance shall be fitted with a mechanism that will shut off the gas supply to the burner in the event of fan failure.

A.7.3 Additional requirements

In addition to the marking requirements given in SANS 1539, the following additional markings shall be applied to type D instantaneous water heaters:

- a) A label with the words

"For outdoor use only"

shall be permanently attached to the appliance. This label shall be in addition to and separate from other labelling information or markings. The wording shall be at least 10 mm in height.

- b) The following information shall be included on a label on the packaging:

"For outdoor use only".

This label shall be in addition to and separate from other labelling information or markings. The wording shall be at least 10 mm in height.

- c) A statement indicating the following shall be included in the appliance installation instructions:

"This appliance shall only be installed in an outside location".

Annex B

Deleted by amendment No. 1.

Annex C

(informative)

Pumping of water

C.1 Pumping of water

C.1.1 Types of pumps

Generally, two groups of pumps can be distinguished, namely positive displacement pumps and rotodynamic pumps. Rotodynamic pumps are the group most commonly in use and include pumps of the following types:

- a) radial-flow (centrifugal) pumps;
- b) mixed-flow pumps; and
- c) axial-flow pumps.

The difference between the three types of pumps is the way in which water flows through the pump; this depends on the construction of the pump and determines the use of any particular pump.

C.1.2 Specific speed

The specific speed, N_s , of a homologous series of pumps can be defined as the rotating speed of any one unit of the series and of such a size that it delivers 1 m³/s at a head of 1 m, at its point of peak efficiency.

The specific speed gives an indication of which of the three types of rotodynamic pumps given in C.1.1, should be used in a given situation.

From the theory of homologous pumps, the following equation for specific speed can be derived:

$$N_s = n \cdot Q^{0.5} / H^{0.75} \quad (\text{C.1})$$

where

- N_s is the specific speed, in revolutions per minute (r/min);
- n is the drive speed, in revolutions per minute (r/min);
- Q is the volume discharge rate of the pump, in cubic metres (m³);
- H is the total pressure head per stage, if a multistage pump is used, in metres (m).

By means of equation C.1 and table C.1, the type of rotodynamic pump to be used can be determined.

Table C.1 — The specific speed for different types of rotodynamic pumps

1	2
Type of rotodynamic pump	Specific speed N_s r/min
Radial flow (centrifugal)	10 to 80
Mixed flow	70 to 80
Axial flow	150 to 315

C.1.3 Pump characteristic curves

C.1.3.1 General

Pump characteristic curves consist of the three curves of pump head, H , power input, P , and pumping efficiency drawn to a common baseline of discharge rate, Q . In the usual case of a fixed-speed electric motor, only the set of curves for the given speed is required. In special cases, it is possible to plot all three variables against a fourth. As the power of a pump is dependent on the efficiency of the pump over its utilization range, the shape of the characteristic curve should be carefully studied.

C.1.3.2 Head-discharge characteristic curve

C.1.3.2.1 General

Among all the possible shapes that can occur with radial-flow pumps, the following two distinct shapes should be recognized, namely, a stable head-discharge characteristic and an unstable head-discharge characteristic.

C.1.3.2.2 Stable head-discharge characteristic

In a stable curve, there is only one rate of discharge corresponding to a specified head (except perhaps at very small percentage flows). Such curves usually have fairly steep falling head-discharge characteristics, as indicated by the solid line in figure C.1(a).

C.1.3.2.3 Unstable head-discharge characteristic

In an unstable head-discharge curve, the curve is reasonably flat and therefore there can be more than one rate of discharge corresponding to a specified head (see the dotted curve in figure C.1(a)). When one pump is connected in parallel with an identical pump, the rate of discharge will keep fluctuating between the two possibilities and will cause severely harmful pulses to occur in the pipelines.

C.1.3.3 Overloading versus non-overloading curve

C.1.3.3.1 General

Corresponding to the two classes of head-discharge curve, there are two types of power-discharge characteristics. They are shown in figure C.1(b) and are called non-overloading and overloading curves.

C.1.3.3.2 Non-overloading curve

This curve is related to the stable head-discharge curve, has a somewhat flat gradient and rises to a limited height. Therefore, a varying pressure head cannot jeopardize the motor.

C.1.3.3.3 Overloading curve

This curve is related to the unstable head-discharge curve and continues to rise indefinitely. This means that the pump should operate at a pressure head lower than the design point. With such a pump setup, should certain friction-loss elements be eliminated (i.e. the bursting of a pipe), the motor will be overloaded and will consequently burn out.

In the case of a water supply system with a varying pressure head, a pump that has non-overloading characteristics should be installed, or the motor itself should be overload-protected, or an overload pump that has a motor that considerably exceeds the design point power should be used, whichever would be most economical.

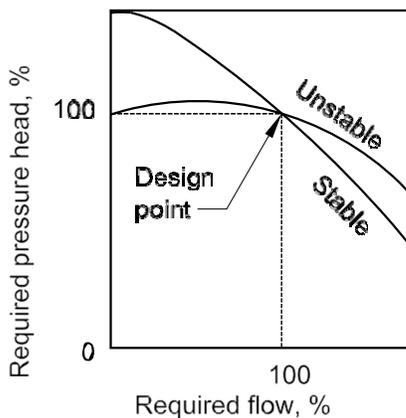


Figure C.1(a) — Stable and unstable head discharge curve

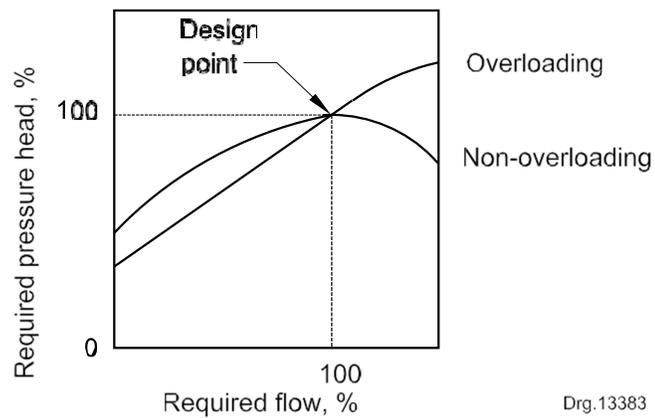


Figure C.1(b) — Overloading and non-overloading curve

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Figure C.1 — Pump characteristic curves

C.2 Series connection of radial-flow pumps

When identical pumps are connected in a series, the installation will have a characteristic curve of pressure head versus discharge rate (H/Q curve) that is derived using the following equation (see figure C.2):

$$H_w = H \cdot n \tag{C.2}$$

where

H_w is the pressure head for the series-connected pumps at delivery rate Q , in metres (m);

n is the number of pumps connected in a series.

When a number, n , of non-identical pumps is connected in a series, the installation will have an H/Q curve composed of the sum of the individual n and H values, of each discharge rate, Q .

When the total pressure head required exceeds, with acceptable efficiency, the limit that can be developed in commercially obtainable single-stage pumps, multistage pumps can be used.

However, multistage pumps are commercially obtainable only in the low and medium discharge classes. Almost the same results as those obtainable with a multistage pump can be obtained by connecting single-stage pumps in a series by means of external piping (instead of the internal flow channels normally used in multistage pumps). It is essential that identical pumps be used, but it is important that the delivery at maximum efficiency for the individual pumps does not differ too much. Where one pump does produce a considerable larger discharge, this pump should be used as the first stage.

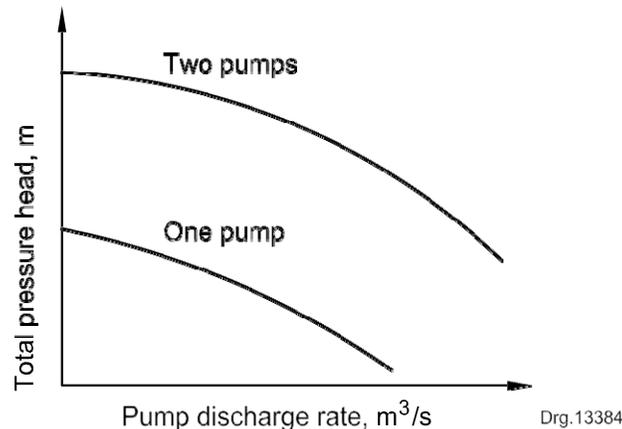


Figure C.2 — A series connection of pumps

C.3 Parallel connection of radial-flow pumps

C.3.1 Performance curves

When identical pumps are connected in parallel, the installation will have an H/Q curve composed of the sum of the individual n and Q values at each H , as shown in figure C.3.

C.3.2 Use of parallel connection

C.3.2.1 The demand in pump installations can fluctuate over a wide spectrum. If a pump has been selected for maximum delivery, it is almost certain that the pump will operate at low efficiency during times of lower demand. Furthermore, in cases where high reliability is required (for example, for urban water supply), a duplicate pump of the same capacity should be installed.

C.3.2.2 In cases where stand-by pumping capacity is required, it is best to connect two or more smaller units in parallel; this offers the advantage of one or more pumps remaining switched off at the lower demand and those pumps that do work, operating at the design point (i.e. maximum efficiency).

C.3.2.3 In high-reliability installations, one or more pumps will be used as stand-by substitutes. The advantage here is that the "idle" capital locked up in such a "dormant" pump will be much less than for a (large) single pump, because pumps connected in parallel are mostly much smaller. Even when constant delivery is required, two or more pumps connected in parallel are preferable, especially since some installations are so large that a single pump that can fully supply the demand is not readily available. Besides, two or more pumps in parallel can be used to utilize the most efficient speed of existing drive motors.

C.3.2.4 In many pump installations where a combination of pumps (each with a half, a third, a quarter or smaller fractional capacity of the demand) are used together with one or more stand-by pumps, the aggregate installation cost is lower than it would have been if two full-sized pumps had been installed.

C.3.2.5 It is not necessary that pumps connected in parallel be identical. However, as already stated, pumps that have unstable H/Q curves can cause problems when connected in parallel.

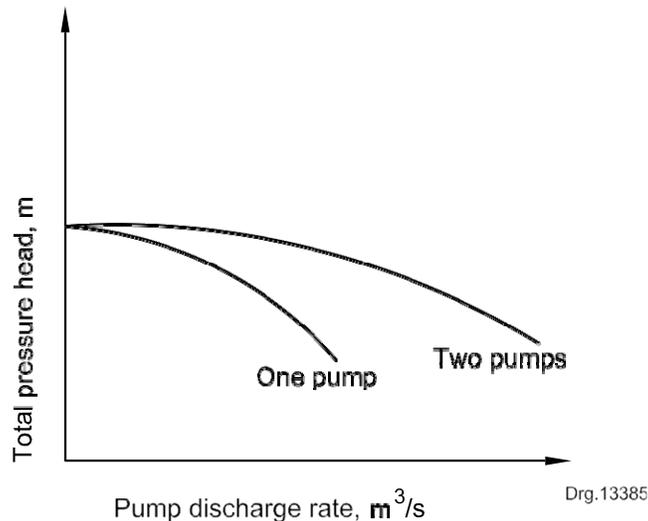


Figure C.3 — Parallel connection of pumps

C.4 System characteristic curves

C.4.1 Determination of operating point

C.4.1.1 The operating point of a pump is that point on the pump characteristic curve at which the pump can supply a given discharge rate to a given system, at a given drive speed, and at a given pressure head.

C.4.1.2 It is important to first determine the working point at which any pump will function when connected to any specific pipe system. The required pressure head for a discharge rate, Q , is given using the following equation:

$$H_{\text{req}} = H_{\text{stat}} + H_{\text{loss}} \quad (\text{C.3})$$

$$= (H_s + H_d) + (h_{fs} + h_{fd}) \quad (\text{C.4})$$

where

H_{req} is the required pressure head for a discharge, Q , in the relevant system, in metres (m);

H_{stat} is the static head, in metres (m);

H_{loss} is the energy head loss due to friction and secondary losses, in metres (m);

H_s is the static suction head, in metres (m);

- H_d is the static discharge head, in metres (m);
- h_{fs} is the energy head loss in the suction branch, in metres (m);
- h_{fd} is the energy head loss in the discharge branch, in metres (m).

Applying Bernoulli's equation to the suction and delivery branches in turn,

$$h_{fs} \frac{P_s}{w} = H_s + \frac{(V_s)^2}{2g} + \frac{h}{s} \quad (C.5)$$

where

- P_s is the pressure at the pump inlet, in pascals (Pa);
- w is the density of water, in kilograms per litre (kg/L);
- V_s is the characteristic velocity in the suction branch, in metres per second (m/s);
- g is the gravitational acceleration, in metres per square second (m/s²).

C.4.1.3 It is clear, therefore, that the total head pumped against comprises the static lift plus the system energy losses. The latter can all be expressed as a function of Q^2 , which is a quadratic relationship.

This relationship can be graphically illustrated by a curve that has a parabolic shape and is called the pumping installation characteristic curve.

When the pumping installation characteristic curve is superimposed over the pump head versus the discharge characteristic curve, the point of intersection of the two curves will present the working point. As the working point is a point of dynamic equilibrium, it means that at the working point on the characteristic curve, a balance exists between the added total energy and the energy required by the system.

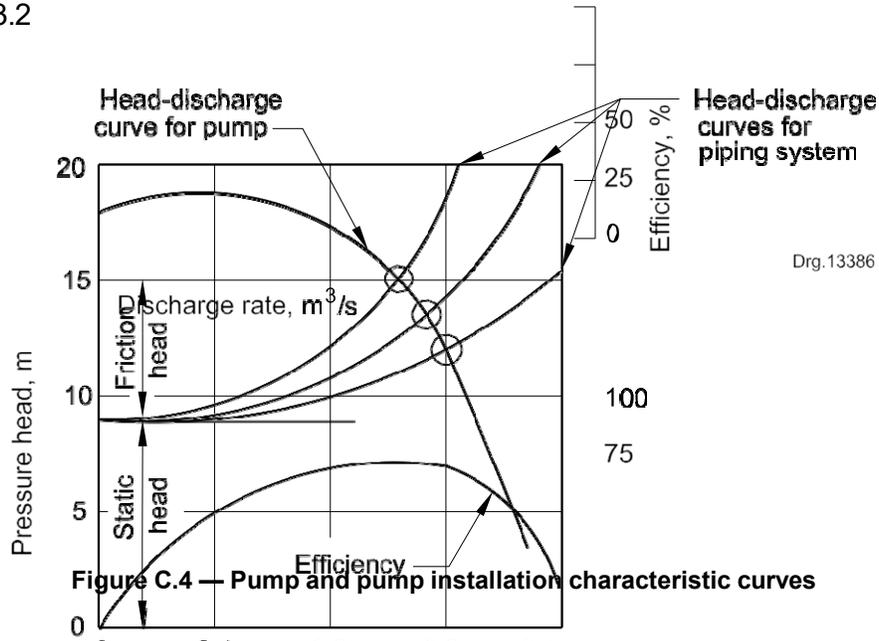
C.4.1.4 In an economic analysis, the piping system cannot be considered in isolation from the pump, since the pump performance and the external piping characteristics are interrelated. A pump should be so selected for a particular application that the pump is not only capable of delivering the stipulated discharge rate, but it also does so at, or near, its peak efficiency.

The piping layout is an important feature of any pumping installation, and considerable care should be taken to ensure that the design is efficient. On the suction side, the aim should be to reduce head losses to a minimum so as to keep the total suction lift within the prescribed limits (see C.4.2).

Economic considerations are involved in deciding the best diameter for the discharge pipework. The larger the diameter, the higher the capital cost, but also the lower the running cost because of reduced frictional losses. Usually the pipe sizes selected result in velocities of between 1,5 m/s and 3 m/s.

The pump can only deliver according to its H/Q characteristic curve. The total head pumped against, however, comprises the static lift plus the pipe system energy losses (see equation (C.3)).

A family of parabolic curves based on different pipe diameters can be drawn, and if these curves are super-imposed on the pump performance curves as in figure C.4, and the relevant working points are noted, the actual discharge and efficiency can be determined for delivery piping of any given diameter.



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C.4.2 Determination of the maximum permissible suction head

C.4.2.1 The term "suction head" denotes the total static pressure head difference between the surface of the water on the suction side of the pump impeller and the point in the pump where the absolute pressure, P_{sa} , is at its minimum (usually in the impeller eye). To avoid cavitation, the pressure at the inlet to the pump should not fall below a certain minimum, which is dictated by the further reduction in pressure that occurs within the pump passages.

C.4.2.2 From equation (C.5), the absolute pressure at the inlet is given, using the following equation:

$$\frac{P_{sa}}{w} = H_a - \left[H_s + \frac{V_s}{2g} + h_{fs} \right] \quad (C.6)$$

where

P_{sa} is the absolute pressure at the inlet, in pascals (Pa);

H_a is the atmospheric pressure head, in metres (m).

C.4.2.3 From equation (C.6), it can be seen that the maximum static suction head, H_s , is limited by the atmospheric pressure head, H_a , the total energy loss on the suction side (function of V_s), and the absolute pressure, P_{sa} .

C.4.2.4 The head required to force the water from the suction inlet into the impeller is called the net positive suction head (*NPSH*). By definition, it is equal to the inlet head minus the vapour pressure head, or

$$NPSH = \left[\frac{P_{sa}}{w} \right] - \frac{P_v}{w} \quad (C.7)$$

C.4.2.5 Using equation (C.7), the following is obtained:

$$NPSH = H_a - \frac{P_v}{w} - H_s - h_{fs} \quad (C.8)$$

where

NPSH is the net positive suction head, in metres (m);

P_{sa} is the absolute pressure at the inlet, in pascals (Pa);

w is the density of water, in kilograms per litre (kg/L);

P_v is the vapour pressure of the liquid to be pumped at the temperature prevailing inside the pump, in pascals (Pa);

H_a is the height of a water barometer, in metres (m);

H_s is the static suction head, in metres (m);

h_{fs} is the energy head loss in the suction branch, in metres (m).

C.4.2.6 The *NPSH* is dependent on the pump design. The relationship between the *NPSH* and the pump discharge rate, Q that applies to any specific commercial pump, is normally determined by the manufacturer under laboratory conditions and is supplied with the pump (normally as a graph of *NPSH* versus Q).

C.4.2.7 In equation (C.8), the sum of H_s and h_{fs} is the effective suction lift, H_{es} , so that

$$NPSH = \frac{P_a}{w} - \frac{P_v}{w} - h_{es} \quad (C.9)$$

C.4.2.8 Using equation (C.9), the maximum permissible suction head can then be calculated using the following equation:

$$H_{ms} = \left(\frac{P_v}{w} \right) - \left(\frac{P_a}{w} \right) + NPSH \quad (C.10)$$

where

H_{ms} is the maximum permissible suction head, in metres (m);

P_v is the vapour pressure of the liquid to be pumped at the temperature prevailing inside the pump, in pascals (Pa);

w is the density of water, in kilograms per litre (kg/L);

P_a is the local atmospheric pressure, in pascals (Pa);

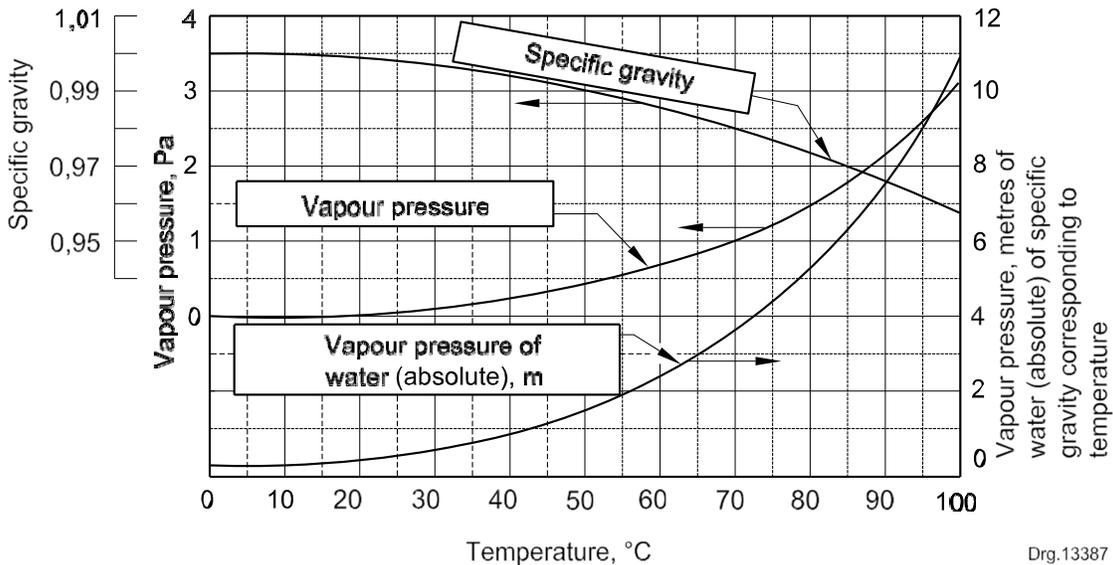
H_{es} is the effective suction lift, in metres (m);

$NPSH$ is the net positive suction head, in metres (m).

C.4.2.9 The local atmospheric pressure can be determined physically with an atmospheric pressure gauge or barometer, or it can be established from table C.2. The relationship between vapour pressure and atmospheric pressure can be established from those given in figure C.5.

Table C.2 — Atmospheric pressure as a function of altitude

1	2
Altitude	Atmospheric pressure
m	kPa
0	101,3
500	95,3
1 000	89,9
1 500	84,4
2 000	79,5



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Figure C.5 — Relationship between vapour pressure and atmospheric pressure for water

C.4.2.10 If the suction head is fixed for a given pump arrangement, the required $NPSH$ can be calculated using equation (C.10). With the aid of the pump characteristic curve supplied by the pump manufacturer, a check can then be carried out to determine whether a pump meets the required $NPSH$.

As for the required *NPSH*, a curve can also be drawn of the available *NPSH* against *Q*, where the available *NPSH* will decrease as *Q* decreases. The point of intersection of the available and required *NPSH* curves represents the maximum *Q* at which the pump will still function satisfactorily.

C.5 Pump installation layout

C.5.1 General

The layout of the pump station should be such that maintenance on any part of it can be carried out without difficulty, and that another motor or pump can be so installed during the servicing of the relevant motor or pump that the water supply system will remain operative.

The installation and specifically the discharge pipeline should also be protected against dynamic pressures that can develop after the pump has been switched on and off, or as a result of any other cause. Backflow should be avoided by the use of one-way control valves.

Attention should be given to the location of the plant, to minimize noise so as not to affect the user of the service.

C.5.2 Stand-by pumps

To ensure that the pump system remains at least partially operative during maintenance or repair work, it is sound practice to so select pump units that between 50 % and 100 % of additional pump capacity remains available. Another approach that can be adopted is to ensure that the total pump capacity is equal to at least four times the average demand.

C.5.3 Inlets to pumps

The pump inlets of water installations, especially larger water installations, should be protected by grids placed in front of the inlet openings. The grids should be of such design that unwanted objects are kept away from the pump without causing an unacceptable loss of energy.

Any pump should be protected against low water pressure in the suction pipe. The pump inlets should be so located that eddying does not occur, since this will cause air to enter the suction pipe, especially when water levels drop on the suction side. Prevention of eddying is particularly important in the suction pipes of booster pumps for fire protection. It is important to provide for the decrease in the flow rate of water that will still be available after the introduction of anti-eddy measures.

C.5.4 Ventilation and lighting

Adequate ventilation should be provided to prevent overheating of the pump motors. Likewise, lighting should be adequate to allow effective inspection and maintenance of the pump installation.

C.5.5 Instructions for operation and maintenance

A clear description of the operation of the pump installation together with a schematic indication of the positions of the shut-off valves should be available in a user friendly format at the pump installation.

A clear indication of the maintenance required should be given. Log books should be kept ready for signature as proof that the necessary maintenance has been carried out.

An electrical diagram of the installation should also be kept in a conspicuous place at the installation, in accordance with SANS 10142-1.

C.6 Electric motors for pumps

C.6.1 Applicable specifications

The following standards are generally applicable to electric motors (see C.1):

- a) SANS 1804-1;
- b) SANS 1804-2;
- c) SANS 1804-3; and
- d) SANS 1804-4.

C.6.2 General design approach

The following general aspects should be considered:

- a) single-phase motors can be used for ratings up to and including 3 kW;
- b) motors larger than 3 kW are generally of the three-phase type;
- c) wherever possible, the speed of motors should not exceed 5 000 r/min; and
- d) motors should be rated to cope with continuous full-load working conditions.

C.6.3 Methods of starting pump motors

The following starting methods are in general use:

- a) motors up to 5 kW – direct on-line;
- b) motors from 5 kW up to 50 kW – reduced voltage, half-wound or slip-ring starting methods; and
- c) motors larger than 50 kW – reduced voltage, half-wound or slip-ring starting methods (closed cross-over only).

Generally, pump motor control systems should be so designed that switching on and off of the motor does not occur more than 15 times/h. Note should also be taken of the manufacturer's recommendations in this regard and of the types of starters that should be used.

C.6.4 Protection of motors

C.6.4.1 The following equipment should be installed on the control panel as standard equipment for the pump installation:

- a) a main isolating switch;
- b) circuit-breaker protection for each motor;
- c) contactors for each motor;
- d) thermal overcurrent protection for each motor;
- e) surge breakers when the installation is exposed to the weather;

- f) undervoltage and overvoltage protection in accordance with the relevant standards;
- g) phase-failure and rotation protection (three-phase motors);
- h) low water level protection; and
- i) short-circuit protection.

C.6.4.2 The size and characteristics of the equipment given in C.6.4.1 are determined by the following factors:

- a) the electrical fault level of installation;
- b) the starting current of pumps;
- c) the running current of pumps; and
- d) the supply voltage to the installation.

C.6.5 Control systems for pumps

C.6.5.1 Pumps that are controlled by float switches, or by surface sensors (surface switches), should be installed in reservoirs so that the oscillation of the water does not affect them. Surface switches should be operated only by low voltage, up to a maximum of 48 V.

C.6.5.2 Each pump should be fitted with a three-position selector switch that allows the pump to be switched to automatic, manual control and off.

C.6.5.3 The pump installation should at least be fitted with the pilot lights indicated in table C.3. The pilot lights can also be duplicated on a central control panel or on a mimic panel, if so required.

C.6.5.4 It is also good practice to connect the high water level alarm, low water level alarm and pump-faulty alarm to a siren for early warning.

Table C.3 — Pilot lights for pump installations

1	2
Description	Colour of light
Pump ON	Red
Pump FAULTY	Orange
Ground storage tank low-level alarm	Orange
High-level storage tank high-level alarm	Orange
Pump system on automatic control	Green
Pump system on manual control	Red
Undervoltage or overvoltage, phase failure or phase rotation fault	Orange

Annex D

(normative)

Cross connection control and backflow prevention

D.1 Protection of potable water supplies

D.1.1 Design, installation and maintenance

All water supply systems shall be designed, installed, and maintained so as to prevent contaminants from being introduced into the potable water supply system.

D.1.2 Protection of fixtures

Only potable water shall be supplied to plumbing fixtures or outlets.

D.1.3 Prevention of contaminants

No device or system that may permit the introduction of any foreign substance into the water service, shall be connected directly or indirectly to any part of the water supply system.

D.1.4 Combined tanks serving flush valves (other than directly connected)

D.1.4.1 Combined tanks storing potable water and water for other purposes shall be separated by a double partition wall installed internally.

D.1.4.2 The space between the partition walls shall be so arranged to ensure that any leakage shall not be able to enter the other compartment of the tank.

D.1.4.3 The tank shall be drained so that any discharge is externally and readily noticed.

D.1.5 Alternative water supplies

D.1.5.1 Where water supplied from one source is connected to another water source

- a) a suitable backflow prevention device shall be fitted, and
- b) the installation shall be approved.

D.1.5.2 Where the alternative supply is a non-potable water supply, it shall be clearly and permanently labelled "Drinking of this water is prohibited", at every outlet.

D.1.5.3 Such labels (see D.1.5.2) shall meet the requirements of SANS 10140-3 for the distribution pipes, and SANS 1186-1 for the outlets.

D.1.5.4 Where the non-potable water supply is installed below ground the service shall have a continuous marker tape, stating the pipe below contains non-potable water and is installed in the trench above the service.

D.1.5.5 Piping conveying water downstream of a high or medium hazard backflow prevention other than which is used for containment shall be clearly and permanently labelled "DRINKING OF THIS WATER IS PROHIBITED", at every outlet.

D.1.5.6 The caution sign shall comply with SANS 1186-1 and the distribution pipes shall be clearly marked in accordance with SANS 10140-3.

D.1.6 Fixtures, appliances or apparatus

D.1.6.1 Where backflow prevention devices are provided as an integral part of a fixture, appliance or apparatus, and are suitable to the cross-connection hazard generated by the fixture, appliance or apparatus, no additional backflow prevention shall be required upstream of the point of connection to the water supply system.

D.1.6.2 Where a cross-connection is found in the water service at any property or if the water service is installed in a manner that will enable backflow to occur, such cross-connection shall be reported to the water supply authority.

D.2 Cross-connection hazard rating

Cross-connection shall be rated as one of the following:

- a) high hazard;
- b) medium hazard; or
- c) low hazard.

D.3 Provision of backflow prevention devices

D.3.1 General

D.3.1.1 The backflow protection required shall be determined by first identifying the individual hazard(s) within the premises.

D.3.1.2 Working upstream from each hazard, the water shall be regarded as non-potable until a backflow prevention device is provided suitable to the degree of hazard (see figure D.1).

D.3.1.3 Backflow prevention devices shall comply with AS/NZS 2845.1.

NOTE 1 In assessing a potential backflow condition, consideration should be given to the complexity of piping, the probability of piping change, and negligent or incorrect use of equipment resulting in a backflow condition.

NOTE 2 Typical potential cross-connection examples are given in AS/NZS 3500.1.

D.3.2 Type of backflow protection

Backflow prevention devices shall be provided in accordance with

- a) the hazard rating given in D.2; and
- b) the suitability of the device shown in table D.1.

NOTE See appendix E of AS/NZS 3500.1:2015 for examples of devices relative to levels of protection.

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D.3.3 Hose taps

Hose taps within 18 m of a zone protected area within the same premises shall have a backflow protection device of the same hazard rating as the zone protection near which they are installed.

| NOTE An example of backflow prevention is given in table C.2 of AS/NZS 3500.1:2015.

Amdt 2

D.3.4 Additional backflow protection

In water supply installations where there is potential for unprotected cross-connections, additional backflow protection shall be provided if required by the local authority or by the installation of the supplementary containment zone or individual backflow prevention devices.

D.3.5 Water downstream of backflow prevention device

D.3.5.1 The water service downstream of the backflow prevention device shall not be reconnected to the water service upstream of the backflow prevention device without the installation of an additional backflow prevention device of the same hazard rating.

D.3.5.2 Water downstream of a containment device shall be considered to be potable unless there are unprotected hazards within the premises. Individual or zone protection against these hazards shall be provided to preserve the potability of the internal water supply.

D.3.5.3 Piping downstream of the zone protection shall be identified as not potable.

D.3.6 Inspection and maintenance

D.3.6.1 Testable backflow prevention devices shall be inspected and tested after installation and prior to service.

D.3.6.2 Testable backflow prevention devices shall be maintained in working order and inspected for operational functions at intervals not exceeding 12 months.

D.3.6.3 Where there is no such program, these devices shall not be fitted and the standard air gap requirements shall apply.

D.3.7 Hot water systems

D.3.7.1 Backflow prevention devices shall be installed in hot water supply systems in the same way as cold water supply systems.

D.3.7.2 The backflow prevention device used shall be suitable for the specific hot water installation.

D.4 Suitability of devices for hazards

The actual device selected for each hazard rating shall comply with table D.1, and be approved.

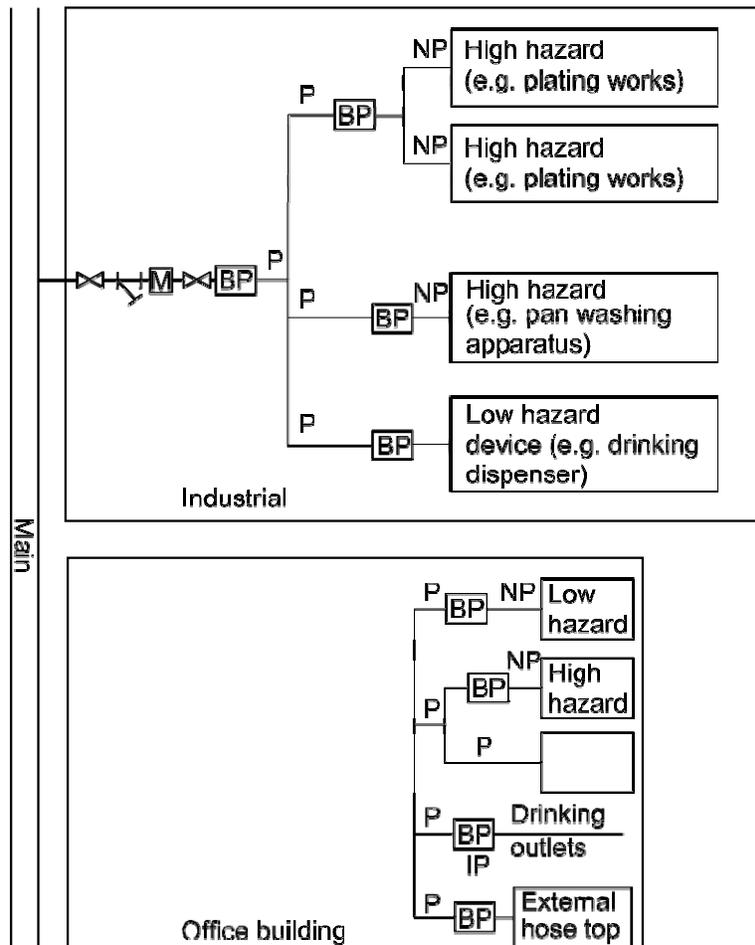
Table D.1 — Suitability of devices

1	2	3	4	5
Testable backflow prevention device	Device	Cross-connection hazard rating	Protection against back pressure	Protection against back siphonage
	Break tank (BT)	High/medium/low	Yes	Yes
	Air gap (AG)	High/medium/low	Yes	Yes
	Reduced pressure zone device (RPZD) ^a	High/medium/low	Yes	Yes
	Reduced pressure detector assembly (RPDA) ^a	High/medium/low	Yes	Yes
	Double-checkvalve assembly (DCV) ^a	Medium/low	Yes	Yes
	Double-check detector assembly (DCDA) ^a	Medium/low	Yes	Yes
	Anti-spill pressure type vacuum breakers (APVD) ^a	Medium/low ^b	No	Yes
	Pressure type vacuum breakers (PVD) ^a	High/medium/low	No	Yes
Non-testable backflow prevention device	Dual-check valve with atmospheric port (DCAP) ^c	Low	Yes	Yes
	Dual-check valve (DUAL CV) ^c	Low	Yes	Yes
	Dual-check valve with intermediate vent (DuCV) ^c	Low	Yes	Yes
	Air gap (AG)	Low	Yes	Yes
	Break tank (BT)	Low	No	Yes
	Atmospheric vacuum breaker (AVB) ^c	Low	No	Yes
	Hose connection vacuum breaker (HCVB) ^c (see note 3)	Low	No	Yes
	Beverage dispenser dual-check valve (BDDC)	Low	Yes	Yes

Table D.1 (concluded)

1	2	3	4	5
Non-testable backflow prevention device	Device	Cross-connection hazard rating	Protection against back pressure	Protection against back siphonage
	Vacuum break-check valve	Low	No	Yes
	Single-check valve	Fire services only in accordance with appendix C of AS/NZS 3500.1:2015.		
<p>NOTE 1 Pressure type vacuum breakers are designed to vent at 7 KPa, or less. However, they may require a significantly higher pressure to reseal and should only be installed in systems which provide pressures sufficient to ensure full closing of the valve and should not be installed close to water outlets where low pressures could be encountered.</p> <p>NOTE 2 In areas where water spillage may cause nuisance, tundishes or alternative drainage should be installed to receive the charges from</p> <ul style="list-style-type: none"> a) reduced pressure zone devices, b) pressure type vacuum breakers, c) dual check with atmospheric port, or d) atmospheric vacuum breakers. <p>NOTE 3 Hose connection vacuum breakers are designed to withstand the small amount of back pressure that would occur if the end of hose is higher than the hose tap.</p> <p>NOTE 4 Pressure type vacuum breakers, atmospheric vacuum breakers and hose connection vacuum breakers, should only be used to protect against back siphonage.</p> <p>NOTE 5 A single-check valve is not considered a backflow prevention device in accordance with AS/NZS 2845.1.</p> <ul style="list-style-type: none"> ^a Backflow prevention devices that are provided with test taps for the purposes of testing the operation of the devices, and do not necessarily include isolating valves. ^b Anti-spill vacuum breakers are suitable for high hazard installation for mains pressure flushing valves. ^c Backflow prevention devices that are not provided with test taps for the purposes of testing the operation of the devices. 				

Amdt 2



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Key

BP backflow prevention device

NP non-potable water

P potable water

IP individual protection

Figure D.1 — Typical backflow prevention setup

D.5 Installation of backflow prevention devices

D.5.1 General

D.5.1.1 No heat shall be applied to any device during installation.

D.5.1.2 Installation for pressure type vacuum breakers (PVB), anti-spill pressure type vacuum breakers (APVB), double check valves (DCV), and double detector check valve (DDCV), as well as reduced pressure zone devices (RPZD) and dual reduced pressure zone devices (DRPZD), shall be fitted with line strainers in accordance with D.5.1.4.

D.5.1.3 Except where used in fire service installations, line strainer elements shall comply with the requirements given in table D.2.

Table D.2 — Maximum orifice diameters and maximum centre distance of line strainer element perforations

1	2	3
Size (nominal diameter) DN	Max. orifice diameter mm	Max. centre diameter mm
20	1,6	2,4
25	1,6	2,4
32-40-50	3,25	5,6
80-100-150	4,6	5,6
200-250-300	4,6	5,6

D.5.1.4 For all testable devices, resilient seated (drop tight when closed) isolating valves shall be installed in the following positions:

- a) immediately upstream of the line strainer, or immediately upstream of the device in cases where no integral line strainer is fitted (see D.5.1.2); and
- b) immediately downstream of the device.

D.5.1.5 Piping shall be flushed before devices are connected.

D.5.2 Installation of devices

D.5.2.1 Unprotected bypasses shall not be installed around backflow prevention devices.

D.5.2.2 The devices shall be installed in accordance with D.5.6 and the manufacturers written instructions.

D.5.2.3 The devices shall be protected from damage, including freezing.

D.5.2.4 Where continuous water supply is essential, devices shall be installed in parallel to permit the shut down of a device.

D.5.2.5 In-line devices should have a capability for easy removal and replacement.

NOTE For typical installations see AS/NZS 3500.1.

D.5.3 Location of devices

D.5.3.1 Backflow prevention devices shall not be located in a corrosive or polluted atmosphere, where the contaminated air can enter the piping system through the air gap or open vent port, or cause the device to malfunction.

D.5.3.2 Insulation or any other protection of a backflow prevention device shall not interfere with its operation, testing or maintenance.

D.5.3.3 Vented testable backflow prevention devices shall not be located in pits.

D.5.3.4 Backflow prevention devices shall not be buried in the ground.

D.5.3.5 Where water hammer occurs it should be rectified by the installation of a surge protector or water hammer arrestor.

D.5.3.6 All in-line devices shall be installed with connections that permit the removal and replacement of the device.

D.5.4 Accessibility

D.5.4.1 All devices shall be readily accessible for ease of maintenance or testing.

D.5.4.2 Where the device is fitted with test taps, their location shall ensure the accessibility necessary for the performance of the applicable test procedure and maintenance as given in AS 2845.3.

D.5.5 Drainage and leakage

Backflow prevention devices shall be positioned so that any leakage from the air ports of vacuum breakers, or drainage from reduced pressure zone devices and vented double check valves shall be readily visible, but not constitute a hazard or a nuisance.

D.5.6 Specific installation requirements for testable and non-testable devices

D.5.6.1 General

Backflow prevention devices shall be installed in accordance with D.5.1, D.5.2 and the requirements given in D.5.6.2.1 to D.5.6.2.6.

NOTE For examples of backflow prevention devices see AS/NZS 3500.1.

D.5.6.2 Testable devices

D.5.6.2.1 Break tanks shall comply with section 8 of AS/NZS 3500.1:2015, and the following air gap requirements: **Amdt 2**

- a) The unobstructed vertical distance through the free atmosphere between the lowest opening for a water service pipe or fixed outlet supplying water to a break tank (BT), and the highest possible water level of such BT, shall be as given in table D.3.
- b) Where any break tank receives water from two or more water services of different diameter, the air gap shall be not less than the air gap required for the largest effective opening of the water service outlets as given in table D.3.

D.5.6.2.2 Pressure type vacuum breakers shall

- a) be located not less than 300 mm above the surrounding surface,
- b) be ventilated to the atmosphere at all times, and
- c) not be located in an area that may be subject to ponding or freezing.

Table D.3 — Minimum air gap

Dimensions in millimetres

1	2	3
Diameter of the effective opening of the water service outlet	Minimum air gap	
	When not affected by near wall	When affected by near wall
≤ 9	20	25
> 9 ≤ 12	25	40
> 12 ≤ 20	40	55
> 20 ≤ 25	50	75
> 25	2 × effective opening	3 × effective opening

D.5.6.2.3 Double check valves shall be located so as not to be subject to freezing.

D.5.6.2.4 Double check valves and reduced pressure detector assemblies shall

- a) have free ventilation to the atmosphere for the relief valve outlet at all times,
- b) not be located in an area that may be subject to ponding,
- c) have the relief drain outlet located not less than 300 mm above the surrounding surface, and
- d) be located so that they are not subject to freezing.

D.5.6.2.5 Double check detector assemblies (DCDA) shall be located so that they are not subject to freezing.

D.5.6.2.6 Anti-spill pressure vacuum breakers (APVB) shall

- a) be located not less than 300 mm above the highest outlet,
- b) be ventilated to the atmosphere at all times, and
- c) not be located to an area subject to ponding.

D.5.6.3 Non-testable devices

D.5.6.3.1 General

Although non-testable devices are not subject to verification for on-going effective operation, they should be checked for effective operation (at least every two years).

D.5.6.3.2 Atmospheric vacuum breakers (AVB)

Atmospheric vacuum breakers shall

- a) be located not less than 150 mm above the highest outlet,
- b) have no isolating valves located downstream of the vacuum breaker,
- c) not, under normal operation, remain continuously pressurized for 12 h (see AS/NZS 2845.1),

- d) be ventilated to the atmosphere at all times,
- e) not be located in an area that may be subject to ponding, and
- f) be located in line and be at least the same size as the supply and discharge piping.

D.5.6.3.3 Hose connection vacuum breakers (HCVB)

Hose connection vacuum breakers shall

- a) be located downstream of the isolating valve,
- b) not, under normal operation, remain continuously pressurized with water for more than 12 h, and
- c) be ventilated to the atmosphere at all times.

D.5.6.3.4 Dual-check valves with atmospheric port (DCAP)

Dual-check valves with atmospheric port shall

- a) not be located in an area that is subject to ponding or freezing, and
- b) have the vent port located not less than 300 mm above the surrounding surface so that the device is freely drained.

D.5.6.3.5 Dual-check valves (DUAL CV)

Dual-check valves shall be located in an area not subject to freezing.

D.5.6.3.6 Dual-check valves with intermediate vent (DuCV)

Dual-check valves with an intermediate vent shall

- a) not be located in an area subject to ponding, and
- b) have the vent port located in accordance with figure E.5 of AS/NZS 3500.1:2015.

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NOTE See D.5.5 regarding leakage from devices.

D.5.6.3.7 Beverage dispenser dual check valves (BDDC)

Beverage dispenser dual check valves shall

- a) be located in an area not subject to freezing, and
- b) have the vent port located not less than 300 mm above the surrounding surface so that the device can drain freely.

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D.5.6.3.8 Vacuum breaker check valves (VBCV)

Vacuum breaker check valves shall

- a) be located in an area not subject to freezing, and
- b) have the vent port located not less than 300 mm above the surrounding surface so that the device can drain freely.

D.5.6.3.9 Single check valves (spring loaded)

Single check valves shall

- a) have an isolating valve installed upstream and adjacent to the device,
- b) be fitted in an accessible position, and
- c) only be used in fire services.

Annex E
(informative)

Hot water systems

E.1 Types of generating plants

E.1.1 Direct and indirect hot water generating plants

In a direct hot water generating plant, the potable water is heated through direct contact with the heater elements. In an indirect hot water generating plant, the potable water is heated indirectly by means of a heat exchanger in which heat is transferred from a circulating fluid inside a primary circuit to the potable water in a secondary system.

In direct systems, scale formation in pipes or corrosion of pipes is more prevalent than in indirect systems. While the indirect system is commonly used in large installations, it is expensive for small installations. Indirect systems are less efficient than direct systems owing to performance losses at the heat exchanger.

E.1.2 Storage and non-storage systems

Hot water systems can incorporate storage or can be of a non-storage type. A storage system is characterized by the storage of the bulk of the water which is heated at a more or less constant rate, and hot water is drawn from the storage on demand. A non-storage system or an "instantaneous water heater" that heats the water on demand is usually a localized type of system, with each fitting usually needing its own heater.

A storage system can supply hot water at a high discharge rate, but the total quantity of hot water that can be drawn is limited. On the other hand, a non-storage system usually delivers hot water at a rather slow rate, but can keep it up almost indefinitely.

The cold water that enters near the bottom of the heater should not mix appreciably with the hot water in the heater. The satisfactory delivery of the total hot water demand from a storage system is often dependent on the effects of temperature stratification within the storage vessel. Stratification can be defined as the floating of hot water on a layer of cold feed water, which occurs naturally owing to the different densities of hot and cold water. This phenomenon enables hot water to be drawn from the top of a storage vessel.

Figure E.1 shows a water heater that delivers into a storage tank or into a distribution network, and figure E.2 shows a water heater that delivers into storage only.

E.2 Energy sources and heat transfer equipment

Energy sources include fuel combustion, electrical energy conversion, solar energy collection, and the transfer of heat between sources and recipients. Sources that can release energy include ambient air, water, soil or recovered waste heat from flue gases, process waste water or ventilation and air-conditioning systems.

Heat transfer equipment can be solid-fuel fired, oil fired, gas fired, solar powered, or heated by electricity. Direct heating by electricity can be accomplished with immersion elements, dry elements or external heater elements and indirect heating by electricity with a heat pump or a steam heater (calorifier).

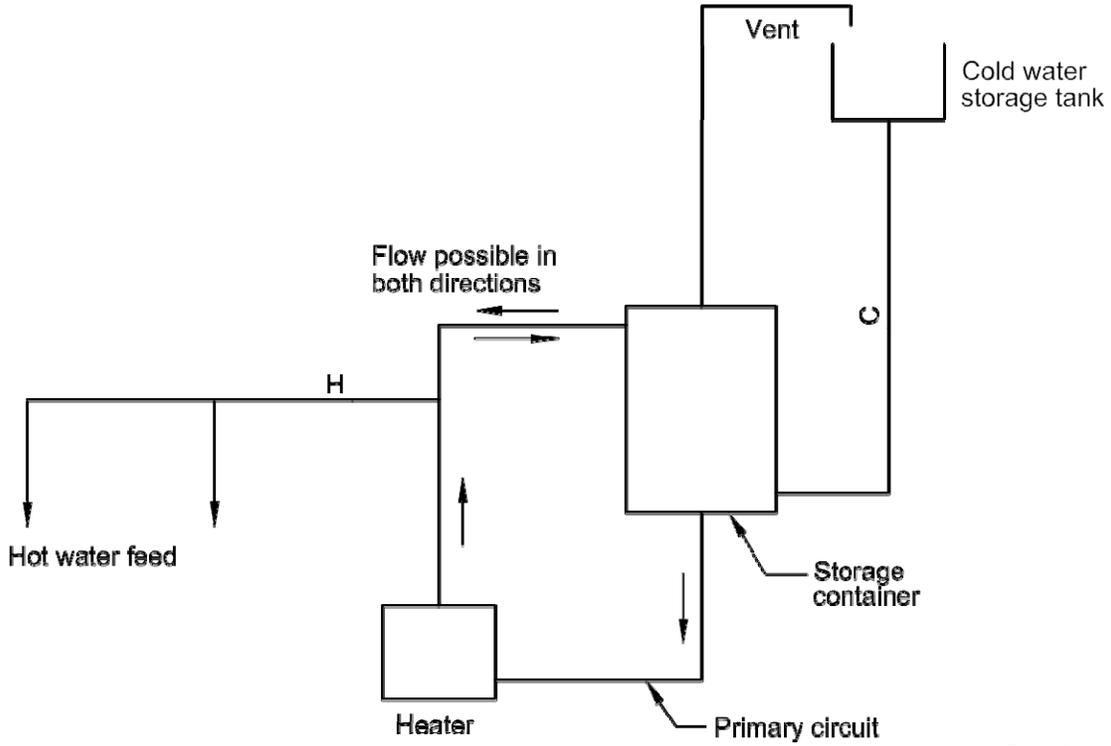


Figure E.1 — Schematic layout of a water heater that delivers into the distribution network or into the storage container

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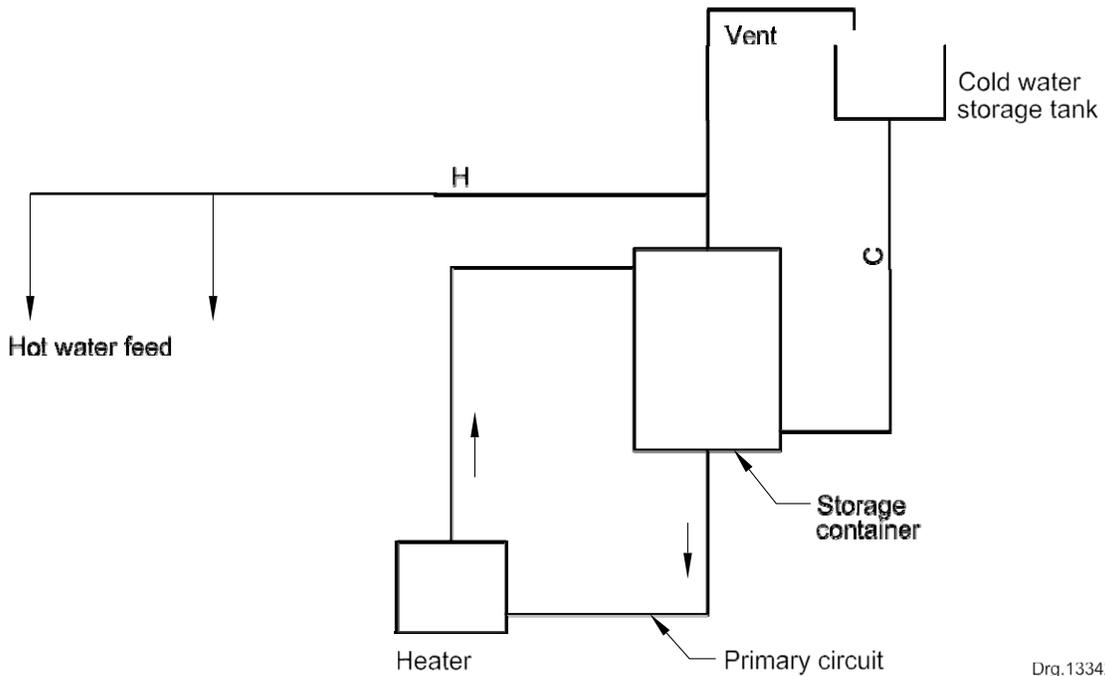


Figure E.2 — Schematic layout of a water heater that delivers into storage only

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E.3 Types of water heaters

E.3.1 Fuel water heaters

E.3.1.1 Fossil-fuel type direct-fired heating

E.3.1.1.1 Fuel-type direct-fired water heaters utilize fossil fuel fired in a boiler, and the hot water can be used for space heating as well as for domestic purposes, without the need for a heat exchanger.

E.3.1.1.2 The high temperatures attained in boilers can result in disadvantages such as

- a) where the water is soft and therefore corrosive, discoloration of the water due to corrosion can occur,
- b) where the water is hard, discoloration will be less serious but the formation of scale and the accumulation of sludge could occur, and
- c) the water temperature that is usually far from uniform.

E.3.1.1.3 Particular note should be taken of statutory requirements regarding these types of systems.

E.3.1.1.4 A typical fuel-type direct-fired hot water system is shown in figure E.3.

The two types of fossil fuels that can be fired in the boiler are described in E.3.1.2 and E.3.1.3.

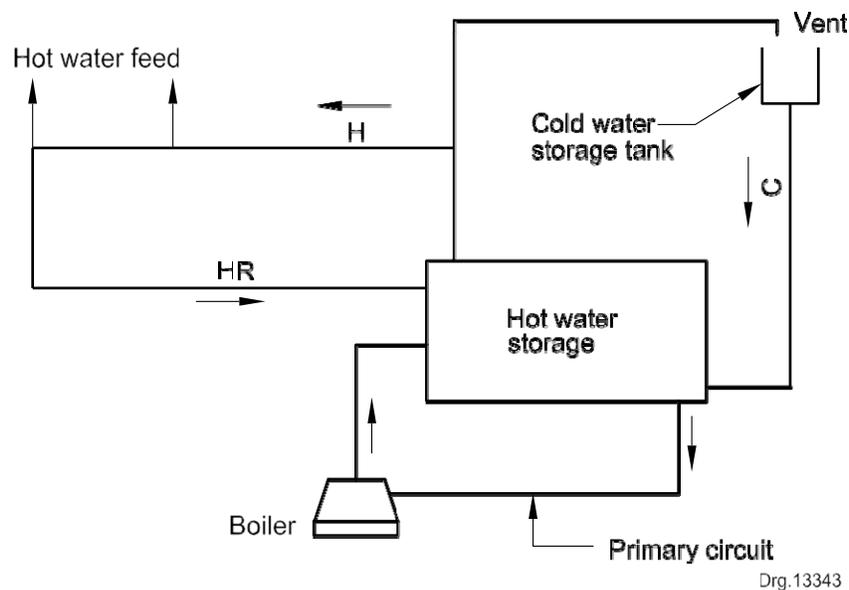


Figure E.3 — Fuel-type direct-fired hot water system

E.3.1.2 Solid-fuel-fired boilers

The solid fuel burned in solid-fuel-fired boilers is usually coke. Such boilers should be located close to ground level because of installation requirements such as fuel delivery and storage, and the removal of ash. Since the flue should be taken up to a level where the combustion products could be discharged harmlessly and without creating a nuisance, this often requires that the flue be taken above the highest part of the building and this further limits the location of the boiler and flue. Where the boiler room is remote from the flue, it is possible to run a portion of the flue horizontally, but induced draught fans would be needed to assist the flow of the gases. Ventilation of the boiler room is essential, not only for combustion, but also to control temperatures in the boiler room.

E.3.1.3 Oil-fired heaters

Oil-fired heaters are generally of the storage type, but could also be of the instantaneous type. A characteristic of an oil-fired heater is its high energy yield. This type of heater can utilize a system, of pressure-atomizing aspirating or vaporizing burners. The energy delivery rate can range from approximately 2,5 L/min, undergoing a temperature rise of approximately 55 °C with 75 L of storage, to 80 L/min undergoing the same temperature rise with 750 L of storage. As far as their location on the site is concerned, oil-fired heaters are less restricted than solid-fuel-fired boilers, since oil can be pumped up to a small boiler feeder tank if necessary. A flue is also required to carry the products of combustion to a place where they can be harmlessly discharged.

E.3.2 Instantaneous water heaters

E.3.2.1 General

Instantaneous water heaters heat and deliver water on demand. These heaters are often used where a supplementary hot water supply is required, for example, at a single outlet in a position remote from the main hot water system. The advantage of an instantaneous heater is the fact that it is compact and does not waste energy in keeping stored water hot. Two types of instantaneous heaters are described in E.3.2.2 and E.3.2.3.

E.3.2.2 Gas-fired instantaneous heaters

A gas-fired instantaneous heater is self-contained and can be either of the automatic instantaneous or of the continuous flow type. Water is heated as it flows through a copper coil or tube while the opening of the gas valve is controlled by a water flow switch or a pressure switch. Most instantaneous heaters have a modulating gas valve that varies the gas flow to cater for changing water flow rate demands. Usually a pilot burner ignites the main burners on demand.

In general, gas-fired instantaneous heaters are most suited for installations in which water flow rates are mainly steady and where accurate temperature control is not needed. Automatic gas-fired instantaneous heaters are more suitable for domestic purposes, and continuous flow storage/circulation tank types for industrial use. Circulation types in effect comprise a separate heater that is connected to a storage tank although the burner, storage tank, steel jacket, insulation and controls are housed in a single unit. These systems require forced circulation of the water and usually both the heater and the pump are controlled by a temperature sensor in the tank. Generally, a copper coil (or tube) heater is used as a heat exchanger. A typical gas-fired instantaneous water heater is shown in figure E.4.

E.3.2.3 Instantaneous electric heaters

The delivery rate of hot water is dependent on the flow rate, the temperatures of the incoming and outgoing water and the power rating of the element. For example, with an incoming water temperature of 15 °C, a required flow rate of 10 L/min and a required temperature rise of 20 °C, a 14 kW element would be necessary. Local authorities in South Africa do not permit elements for domestic single-phase equipment that exceed a rating of 3 kW to 4 Kw, to be connected to their electricity supply systems.

A thermostatic mixing valve can be used in conjunction with an instantaneous electric water heater, to maintain the hot water supply at a uniform temperature and to limit the danger of scalding.

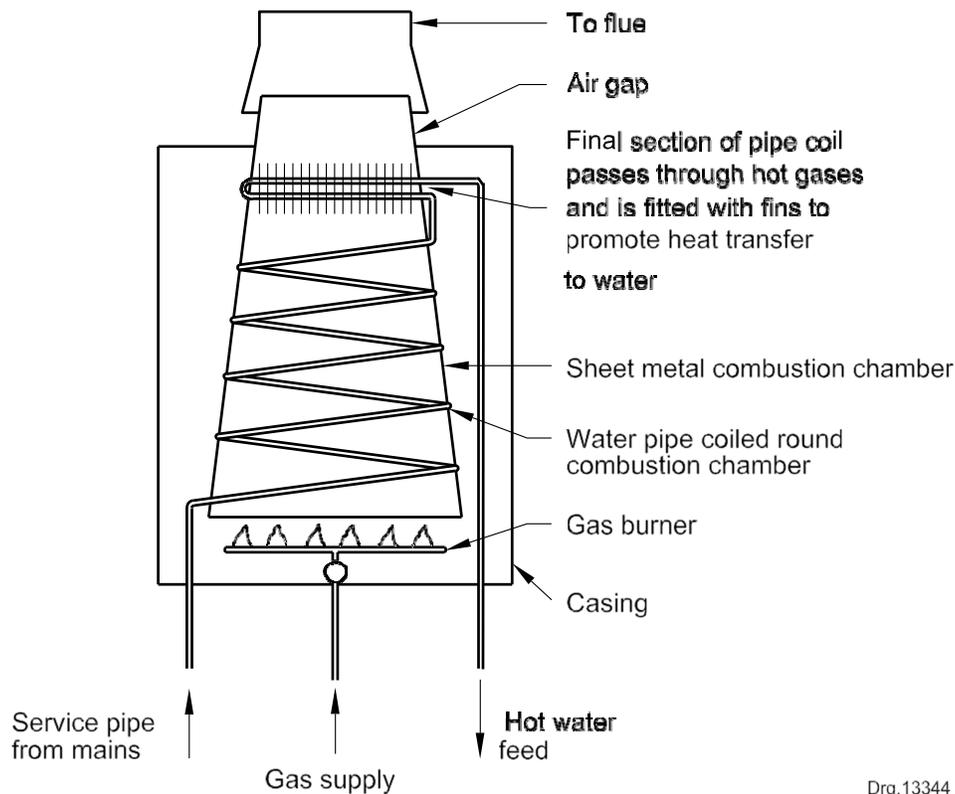


Figure E.4 — Gas-fired instantaneous water heater

E.3.3 Hot water generating plant that uses steam heating

Because of the large energy transfers obtained with steam, accurate temperature control is very difficult and this type of system is therefore usually not appropriate for producing hot water for domestic purposes.

Hot water can be generated by making use of steam from an external source, either by introducing it direct into the cold water by means of an injection process, as it is sometimes used in commercial laundry or industrial process equipment, or by circulating it through a coil immersed in an auxiliary storage vessel. The latter is an indirect system, known as a calorifier, in which heat is transmitted from the coil to the water in the storage cylinder, without direct contact between the steam and the water.

Calorifiers are designed for service conditions where hot water requirements are not constant and where large volumes of heated water have to be held in storage for periods of peak load. Calorifiers are often used where steam is already available, or where a building requires central heating and a central hot water supply in addition to a central steam supply, as is often the case in a hospital.

Corrosion and scale formation are usually not a problem in a calorifier because very little make-up water, and hence very little oxygen, is introduced into the primary (steam) circulating system. It is good practice to provide a condensate trap on the return side of the coil to prevent a condensate build-up that can promote corrosion. Space is to be provided to allow for the removal of steam coils or tubes.

A typical calorifier system is shown in figure E.5. A spiral coil calorifier is shown in figure E.6 and a U-tube battery calorifier is shown in figure E.7.

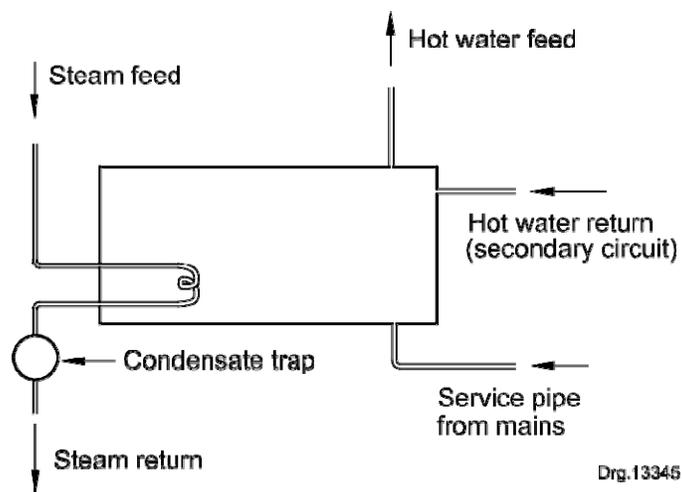


Figure E.5 — Calorifier system

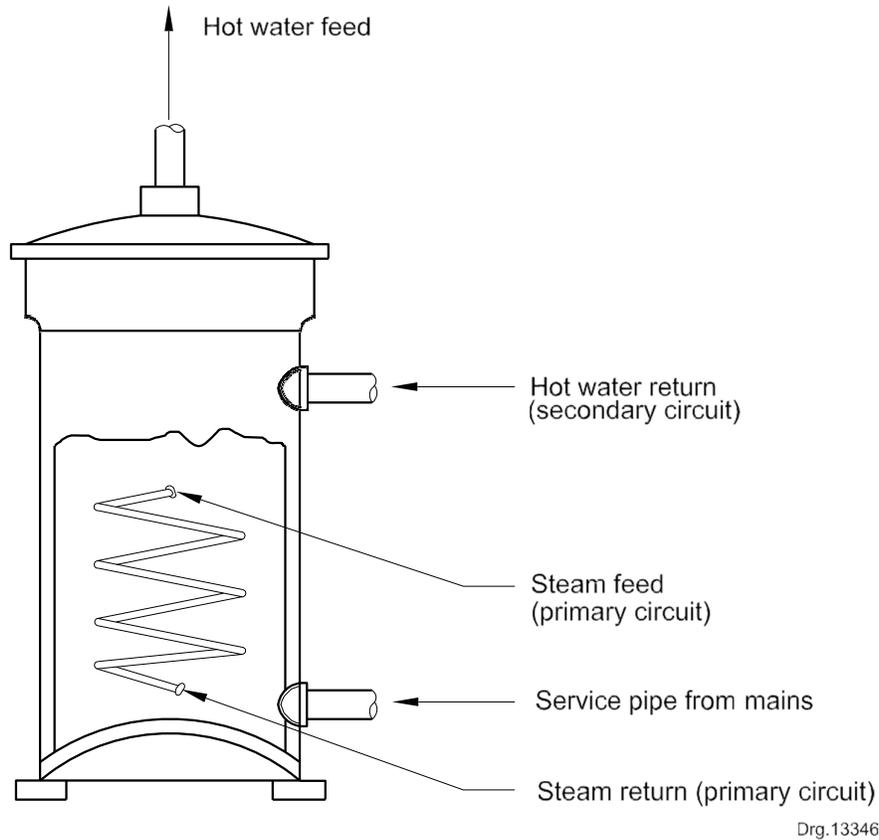


Figure E.6 — Spiral coil calorifier

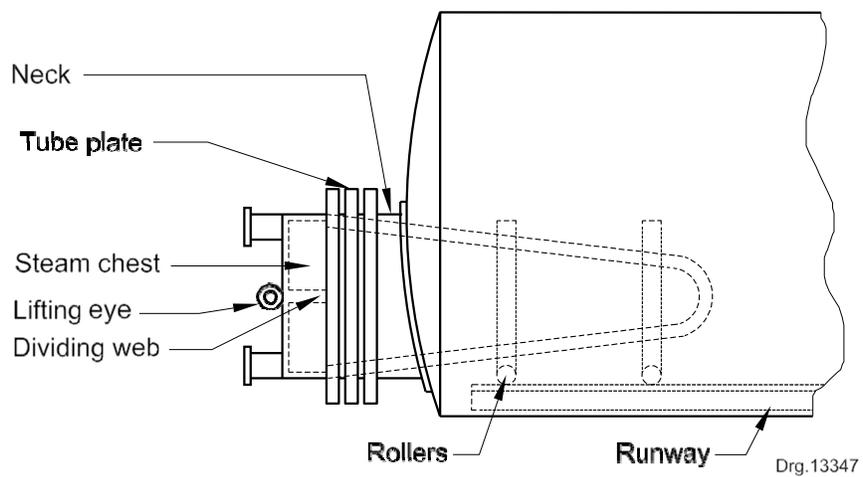


Figure E.7 — U-tube battery calorifier

E.3.4 Solar hot water generating plant

E.3.4.1 Solar heaters effectively absorb heat from the sun from approximately 10:00 until approximately 16:00. Solar irradiance is at its peak between approximately 12:00 and 14:00. However, sufficient quantities of hot water are stored for use after 16:00. Solar heaters currently available cannot meet the hot water demands of a modern household on their own. Savings in electricity consumption are obtained when a solar heater is used to pre-heat water for an electric storage water heater. On average, the electricity used for water heating in a domestic dwelling constitutes approximately 50 % of the total electricity consumption. A well designed solar heating system generally provides approximately 80 % of the hot water requirement, thereby reducing the electricity account by 40 %. The average efficiency of different types of solar absorbers is given in table E.1.

E.3.4.2 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 winter¹⁾ 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.

E.3.4.3 The shadows of tall objects nearby can severely limit the satisfactory operation of a solar system.

E.3.4.4 All solar water heaters consist basically of an absorber unit that collects the incident solar radiation during the day and a storage tank to contain the heated water. These two main components are separate in most conventional systems, as shown in figures E.8 and E.9, but can also be combined to form a single absorber/storage unit.

E.3.4.5 The design of the absorber unit can vary from a simple flat plate to a more sophisticated reflector type absorber. The latter unit is usually costly. The absorber unit consists of a solar collector and insulation, housed in a weatherproof box with a transparent cover. The flat plate collector, which is useful for domestic water heating, basically consists of a sheet of more or less flat material constructed in such a way that channels are formed through which water can circulate.

E.3.4.6 Ideally, the exposed surface of the collector should absorb the maximum amount of incident solar radiation with a minimum of heat loss. The exposed absorber surface is usually coated with a non-reflective or matt black paint. Unfortunately, ordinary black painted surfaces also re-radiate heat rather well, causing undesirable heat losses that have to be minimized, especially when the ambient temperature is low.

E.3.4.7 Heat losses to the rear, on the unexposed side of the collector plate, are minimized with a layer of insulation. Heat losses will still take place owing to infra-red re-radiation from the plate, air convection around the plate and, to a lesser extent, conduction losses by direct contact between the plate and the atmosphere.

E.3.4.8 The transparent cover over the collector plate prevents ingress of rain, reduces the cooling effect of outside air movement over the collector plate and restricts re-radiation losses, the latter probably being the most important. This means that the incident solar radiation is transmitted through the transparent cover with a minimum loss of heat energy due to absorption, therefore, the cover should also be opaque to infra-red in order to reduce the re-radiation losses from the collector plate. Average achievable absorber efficiencies are given in table E.1.

1) A shallower angle may be chosen in winter rain regions.

E.3.4.9 Water circulates between the storage tank and the absorber unit in well insulated pipes. The primary flow pipe carries heated water from the absorber to the tank while the primary return pipe carries cooler water from the tank back to the absorber unit.

E.3.4.10 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. A typical solar thermosiphonic system is shown in figure E.10. In systems where the storage tank is below the absorber unit, reverse circulation will tend to occur at night; this can be prevented by the installation of a non-return valve in the primary return pipe.

E.3.4.11 While the thermosiphonic system, as shown in figure E.10, 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 E.11. Pumped systems can be direct (where the potable water itself circulates through the solar collector) or indirect as shown in figure E.8, 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 E.9 shows a more complex arrangement in which a solar installation is used to pre-heat the feed water for the main hot water storage tank.

E.3.4.12 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;
- 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.

Table E.1 — Average efficiencies of different types of solar absorbers

1	2
Type of absorber	Average efficiency
	%
Aluminium tube-in-strip	57
Commercial radiator	56
Low-cost unit: Galvanized steel	56
Low-cost unit: Fibreglass	56
Galvanized steel pipe framework on copper strips	55
Black polyethylene piping	54
Two corrugated galvanized steel sheets	51
Corrugated galvanized steel sheet on flat galvanized steel sheet	50
Copper tube-in-strip	59
Two flat steel plates	49
Fibre cement, insulated	44
Fibre cement, uninsulated	35

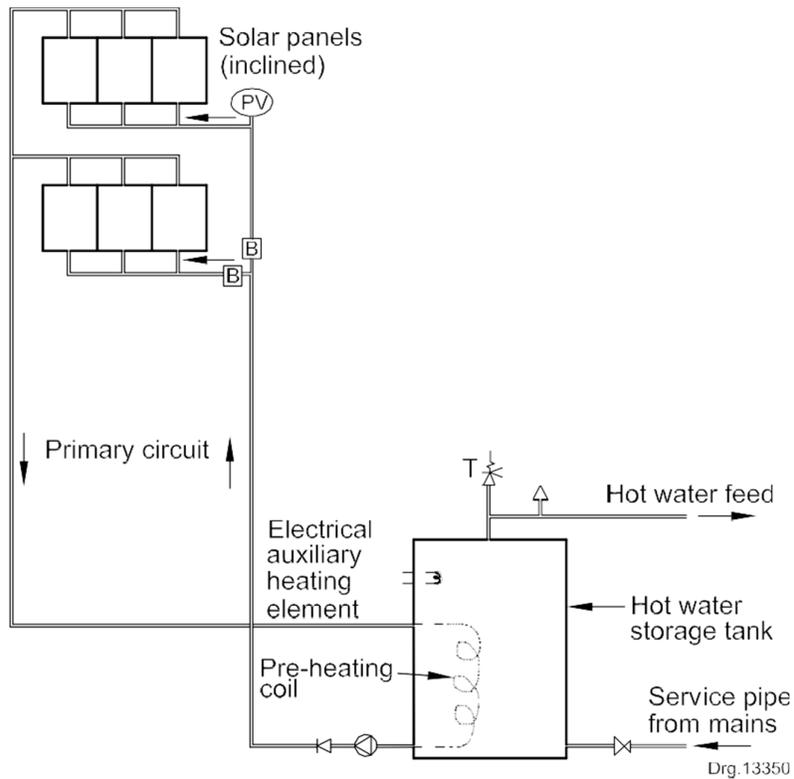


Figure E.8 — Pumped indirect solar water system

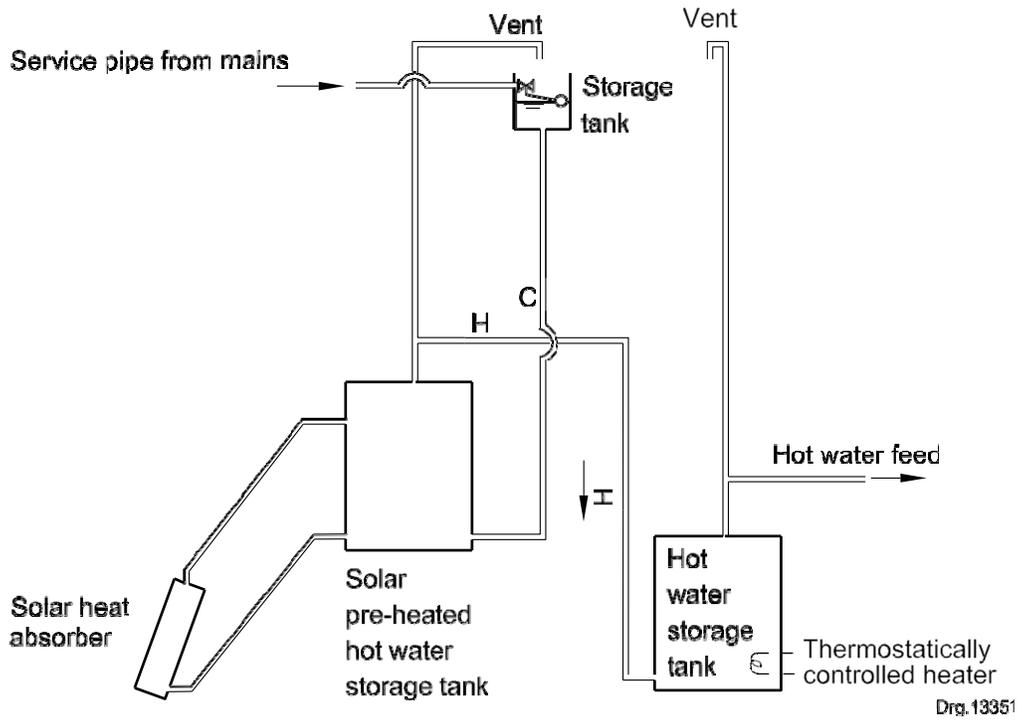


Figure E.9 — Solar water heater used for pre-heating in a hot water system

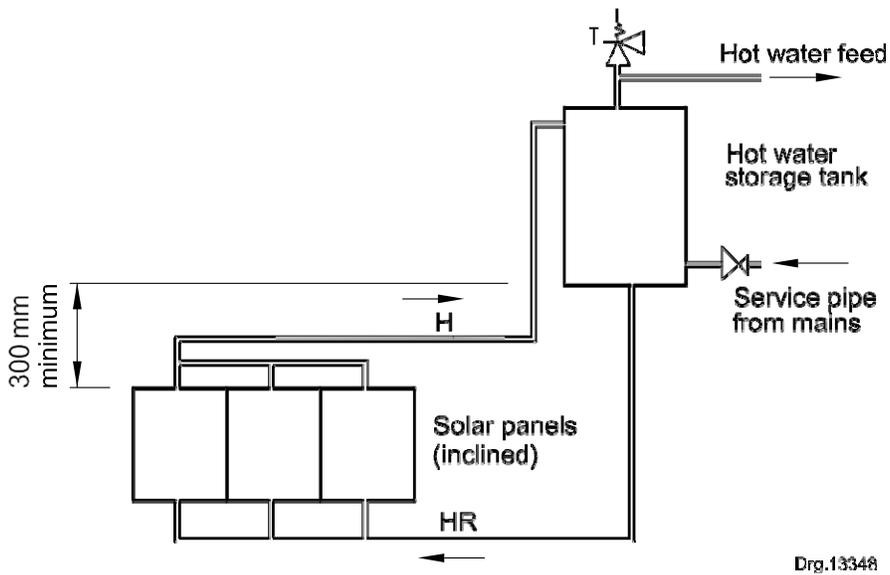


Figure E.10 — Thermosiphonic hot water system

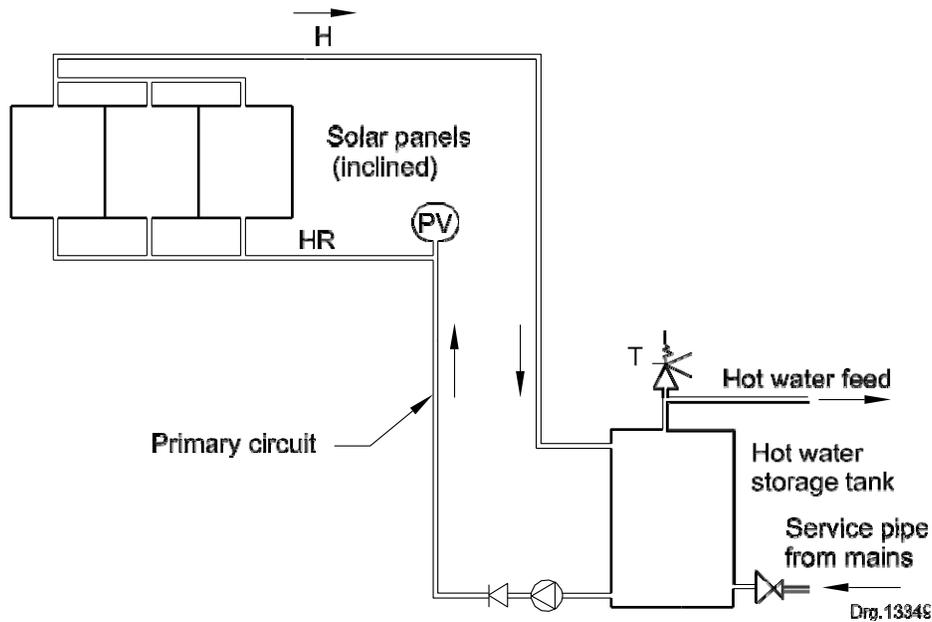


Figure E.11 — Pumped direct solar hot water system

E.4 Supply systems

E.4.1 Local and central hot water supply systems

In large buildings, both dead-leg pipes (in which hot water remains stationary between draw-offs (local system)) and central hot water supply systems can be used. In the former, water is heated locally (or is heated and stored locally) for local use, whereas in the latter, water is heated and stored centrally for general distribution.

Large and continuous hot water demands, particularly if they are close to the central plant, are best provided for by a central installation, while scattered hot water demand points, particularly if the demand is very intermittent, can often be served more economically by local water heaters where water is usually distributed on demand through dead legs.

E.4.2 Non-pressurized and pressurized hot water supply systems

A non-pressurized system is one in which the storage water heater is vented directly into the atmosphere; in a pressurized system, the heater is not vented directly into the atmosphere. The major advantage of the pressurized system is the fact that balanced pressures can be obtained at mixer fittings. However, air can be entrapped in pressurized systems and, should a circulating pump be in use, can cause cavitation in that pump. Air release valves located at all the high points of the system are therefore often necessary.

The pressure in a hot water system depends on the available head and is usually controlled by an in-line pressure reducing control valve, while expansion water is released via an expansion relief device. Pressurized systems also require the installation of pressure and temperature relief safety valves.

In the case of low-pressure rated water heaters (100 kPa or 200 kPa working pressure), vacuum relief protection should also be provided. In the case of high-pressure rated water heaters (300 kPa working pressure and higher), vacuum protection is not necessary because the inherent strength of the cylinder (required by the higher working pressure) renders it safe against vacuum collapse.

E.4.3 Unheated dead-leg hot water systems

The local (or dead-leg) type of hot water supply system conveys water direct from the heating equipment to terminal fittings, without secondary circulation. Such a system is generally only used where pipe runs are short, resulting in low pressure and heat losses, or where tenants in a building are responsible individually for the payment of separate water/electricity accounts.

E.4.4 Trace heating

A recent alternative development for maintaining elevated water temperatures within pipes for the immediate draw-off of hot water is the use of trace heating. In this system, the heat losses are replaced by an electric heating tape strapped to the pipework underneath the thermal insulation.

The trace incorporates a self-regulating electrical strip that automatically varies its power output in response to sensed temperatures at various points along its entire circuit. This heating action continues until a stage of thermal stability is reached, where the heat input matches the heat loss. Trace heating, compared with a circulation system, is both energy efficient and cost effective.

The use of trace heating would enable an existing hot water system to be upgraded without the need for enlarging, or installing return pipes and a circulation pump. Trace heating enables a single supply pipe reticulation to be installed, instead of a complete main circulating ring. However, for most domestic hot water installations, the use of trace heating cannot be economically justified because of relatively short pipe runs.

E.4.5 Hot water circulation systems

E.4.5.1 General

The objective of a circulation system is to reduce the length of dead legs and to maintain an acceptable hot water temperature even at the supply branch serving the last fixture. A hot water circulation system enables hot water to be available at a terminal fitting, with a minimum of initial cold water draw-off. The continuous circulation of hot water offsets heat losses in the supply piping. Energy losses can also be made up by means of a secondary heating element installed in the return piping of the circulating system. A central hot water system usually requires the circulation of hot water because of the lengths of piping involved (in order to reduce the quantity of cold water drawn off before hot water arrives at terminal fittings), unless trace heating is provided.

Circulation can be induced by means of thermosiphonic action, or forced by means of a pump. In the former case, heat losses are allowed to occur in the return piping in order to promote circulation by gravity owing to the higher density of the colder water in the return piping. In modern hot water systems, the forced-flow circulation principle is used almost exclusively. In large installations, circulation by booster pump is used almost exclusively, while in smaller installations, the thermosiphonic type of circulation is more popular. The circulating hot water supply can be a single-ring or a multiple-ring, up-feed or down-feed system. The down-feed system is often used in high-rise buildings that have a succession of floors with identical draw-off arrangements in adjacent bathroom or kitchen units. Generally, the down-feed system has less pipework than the up-feed system and is thus more economical.

E.4.5.2 The up-feed circulation system

Supply and return pipes from and to the hot water container run horizontally in the building, usually at soffit level in the basement. Riser pipes are taken from the supply and return pipes and run up through the building in convenient positions. Feed pipes to terminal fittings are taken from the supply riser pipes which continue to the top of the building to join the return pipes to the container. The appropriateness of an up-feed system is often governed by the layout of terminal draw-off points in the building. A typical up-feed system is shown in figure E.12.

E.4.5.3 The down-feed circulation system

In a down-feed system, the hot water feed main is taken from the hot water storage container to the top of the building from where it is distributed horizontally to serve a drop pipe or pipes. Feed pipes to terminal fittings are taken from the drop pipes which continue to the basement to join the return pipes that reconnect to the container. A typical down-feed system is shown in figure E.13.

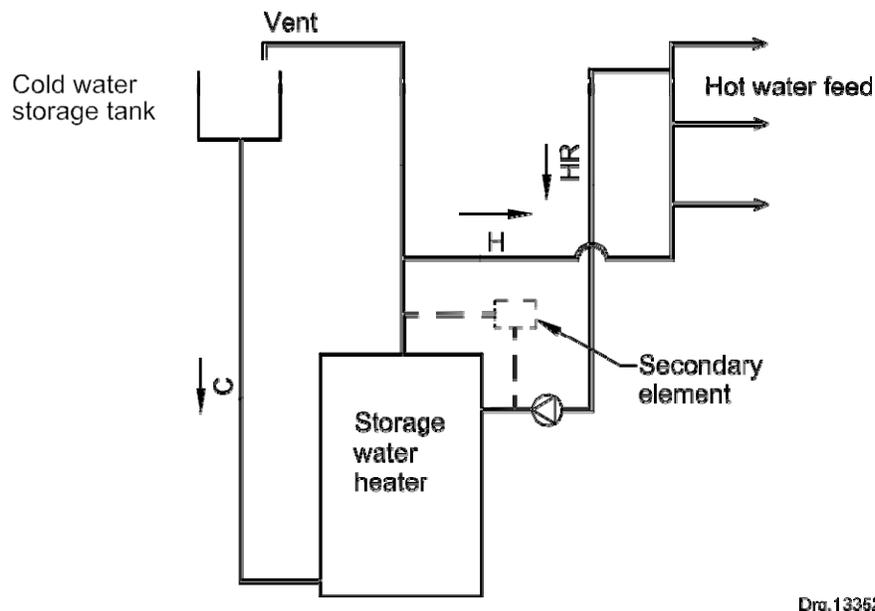
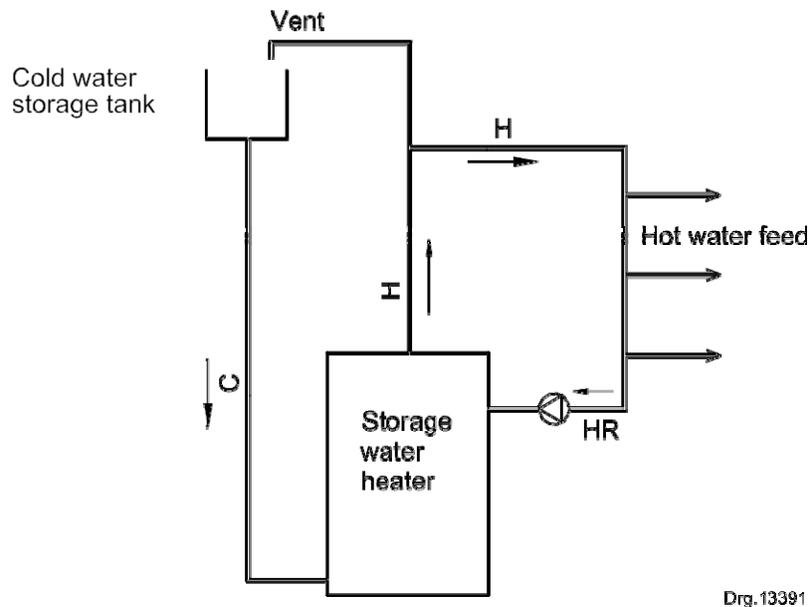


Figure E.12 — An up-feed circulation system



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Figure E.13 — A down-feed circulation system

E.4.5.4 Multiple-ring and single-ring hot water systems

A multiple-ring hot water system is an extension of a single up-feed or down-feed (or both) circulation system, since circulation takes place in more than one circuit simultaneously. This layout is usually provided in large multistorey buildings. Either thermosiphonic or forced-flow principles can be used, but the latter is usually preferable.

Multiple-ring hot water systems normally function poorly if not properly balanced. In improperly balanced systems, long waiting periods often occur till hot water arrives at terminal fittings remote from the heating equipment. Each individual return pipe should be provided with a balancing valve (and temperature gauge) to control the flow of water and, in circuits situated close to the circulating pump, such valves should be adjusted to produce sufficient hydraulic resistance to prevent short-circuiting of the flow through other branches.

A balancing action can be obtained by using suitably pre-adjusted standard balancing valves or by making use of the so-called checker tee. The checker tee is basically a standard tee-piece with a plug screwed into one branch in order to throttle the flow passing through the branch. Another practical, and possibly easier, way of balancing the return reticulation is by making use of a ball valve (with a temperature gauge) and a sight glass in each circuit. The sight glass permits a visual evaluation of the water flow in each circuit while the ball valve is sensitive to small adjustments.

An example of a multiple-ring up-feed forced-flow system is shown in figure E.14.

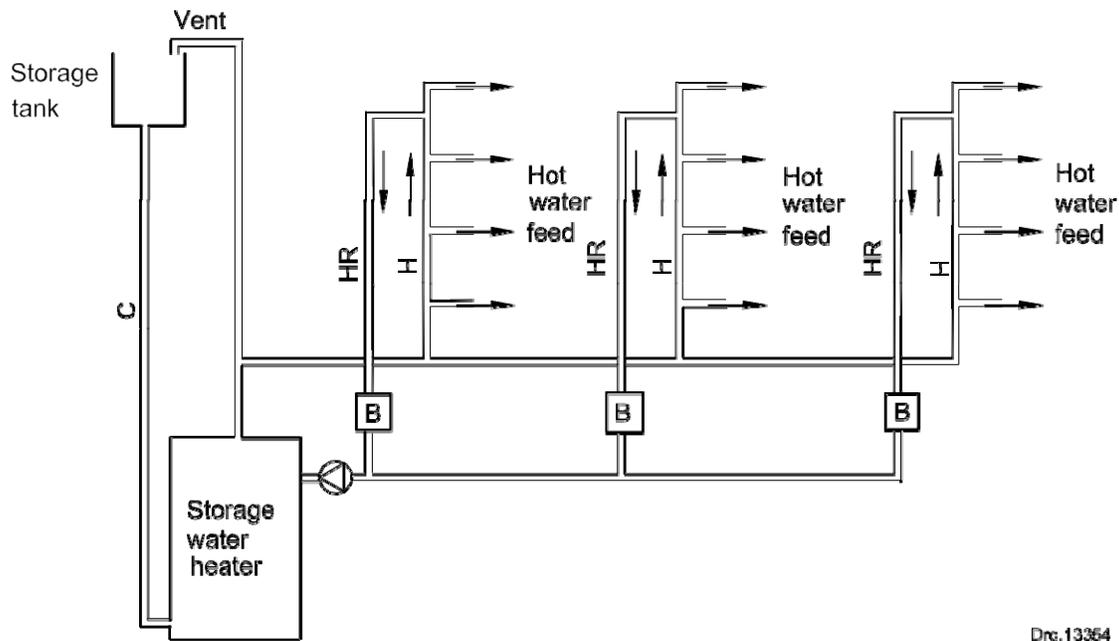


Figure E.14 — Multiple-ring up-feed forced-flow hot water system

E.5 Replenishment/storage capacity curves for various categories of premises

All categories of premises within which similar types of activity take place and which have the same operating period will have similarly shaped replenishment/storage curves. The only variable will be the quantitative values of storage and the recovery co-ordinates.

Figures E.15 to E.22 show the relationship between replenishment and storage capacities for various categories of premises. Any point on any given curve represents a combination of storage and replenishment capacities that will satisfy the net requirements of the occupants.

If the minimum replenishment rate and the maximum storage capacity on any curve are used, this will yield the smallest hot water capacity capable of satisfying the hot water requirements of that building. The higher the replenishment capacity, the greater the required heating capacity and the smaller the required storage capacity.

The replenishment capacities shown in figures E.15 to E.22 do not make allowance for heat losses in the system. The storage volumes represent net usable volumes to which an allowance should be added to compensate for the mixing of hot and cold water and for heat losses within the system.

NOTE 1 Figures E.15 to E.22 are derived from the ASHRAE Handbook (see bibliography).

NOTE 2 Additional replenishment capacity is added to offset the heat losses in the system.

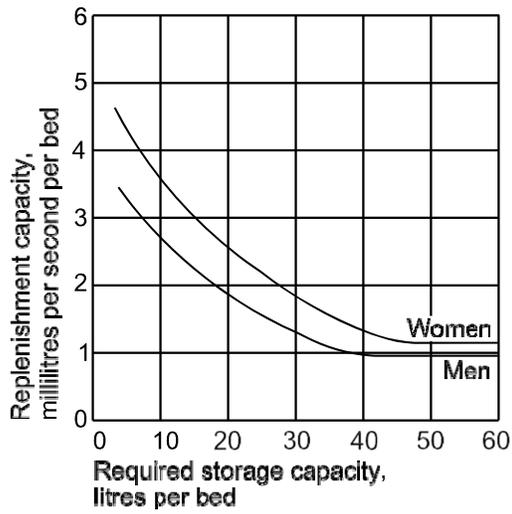


Figure E.15 — Dormitories

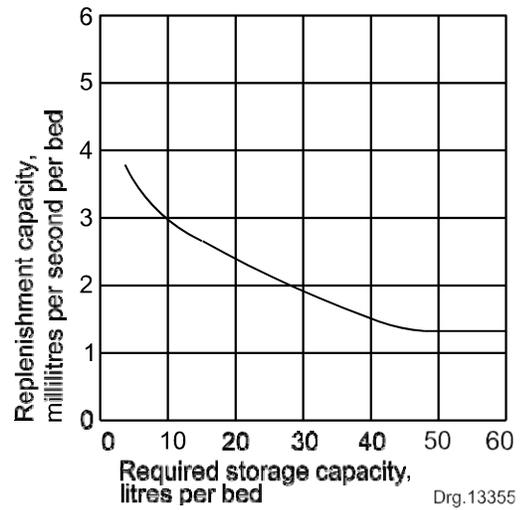


Figure E.16 — Nursing homes

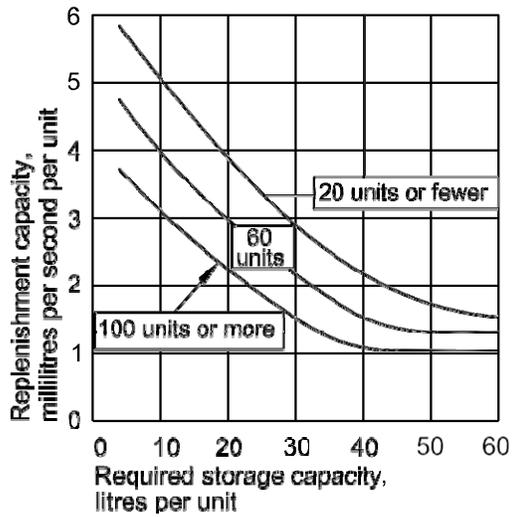


Figure E.17 — Hotels

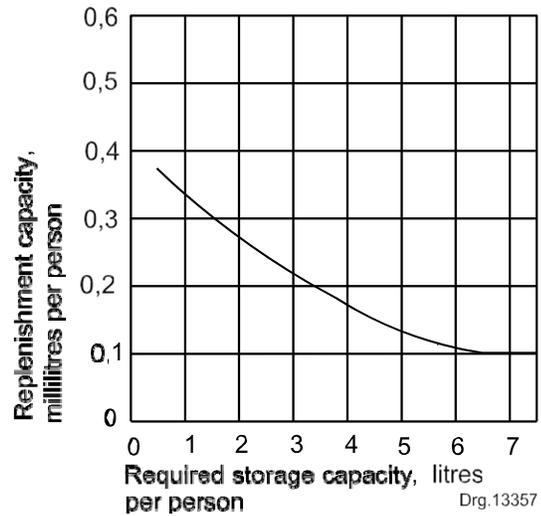


Figure E.18 — Office buildings

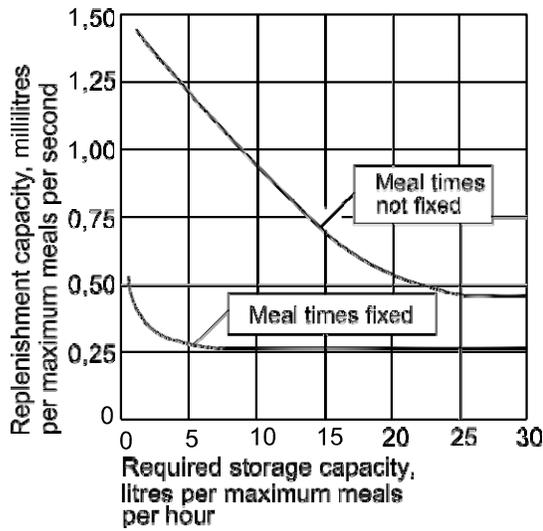


Figure E.19 — Food services

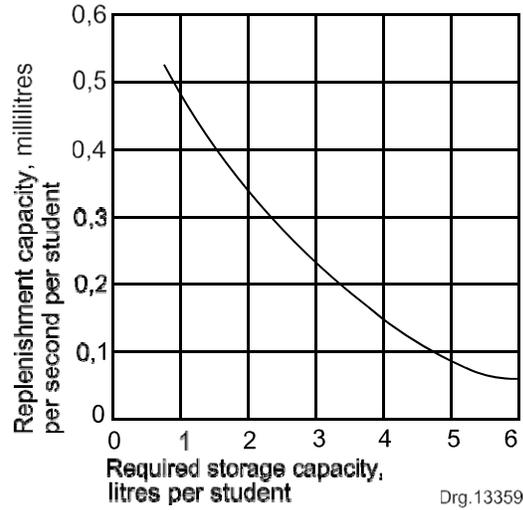


Figure E.20 — Primary schools

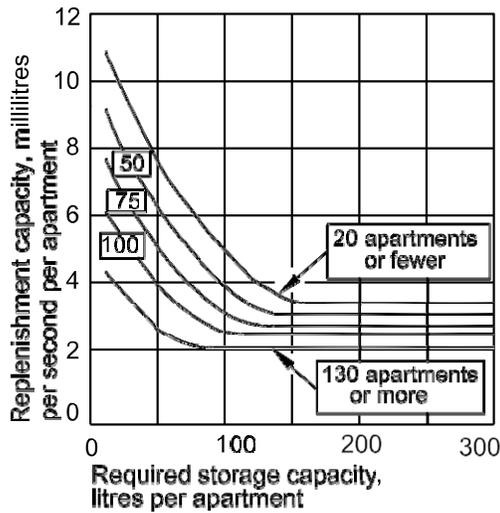


Figure E.21 — Apartments

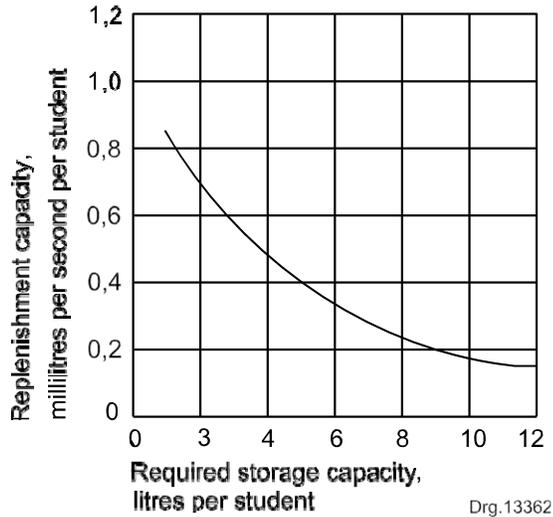


Figure E.22 — High schools

Annex F
(informative)

**Installations of hot and cold supply systems for
dwelling houses (domestic installations)**

F.1 General

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.

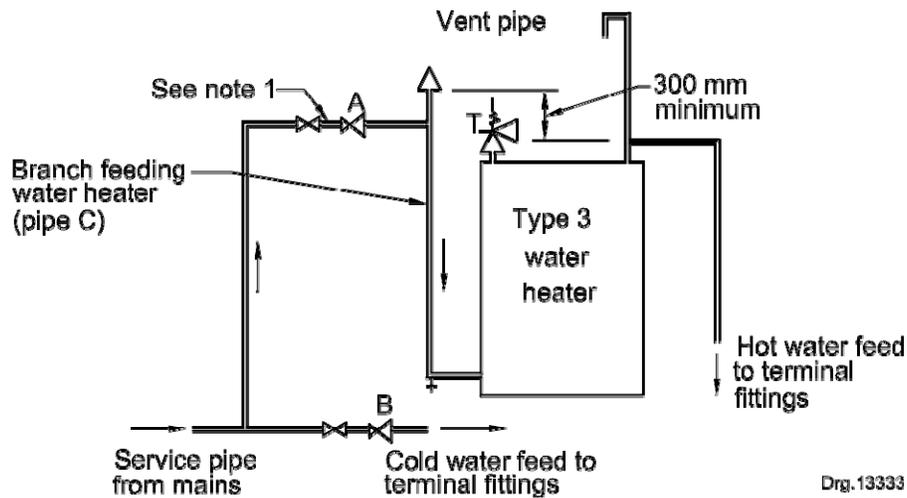
NOTE 1 Where the cold and hot water pressures at terminal water fittings are unbalanced, the use of mixing valves is not recommended.

NOTE 2 Where a pressure control or reducing valve is installed in the service pipe from the mains, the installation of additional pressure control valves (as shown in figures F.1 to F.5) in the cold water feed to terminal water fittings, or to the water heater might not be necessary.

NOTE 3 Depending on the size and slope of the site and the location of the house, the size of the pipe could drastically influence the available pressure at the house.

**F.2 Installations that incorporate a mains-fed SANS 151 type 3
standard water heater**

The recommended pipe sizes for in-house installations that incorporate a mains-fed type 3 standard water heater as given in SANS 151, are given in table F.1. Such installations are shown in figures F.1 to F.5.



Drq.13333

NOTE 1 The horizontal branch that feeds the water heater should not be installed below the top of the water heater.

NOTE 2 Where a pressure control valve or reducing valve is installed in the service pipe, pressure control valves (A) or (B) (or both) may not be necessary.

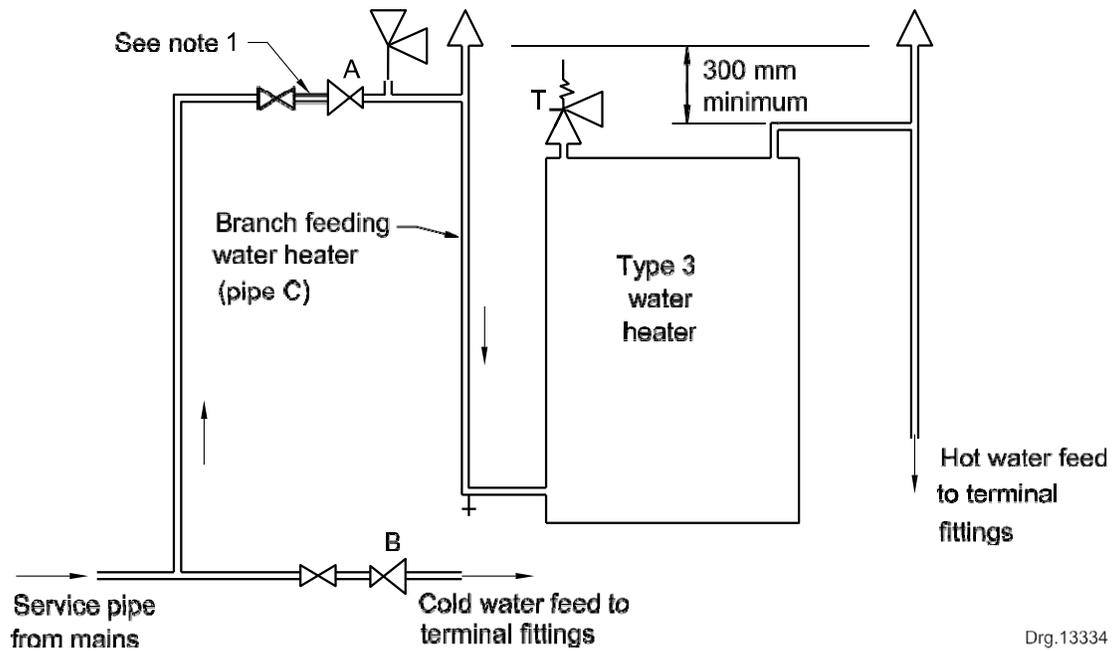
NOTE 3 Any pipes that feed cold water terminal fittings should not be connected to the branch that feeds the water heater (pipe C).

NOTE 4 The height of the vacuum breaker should comply with requirements of the local bylaws and SANS 10254.

Figure F.1 — System that incorporates a standard water heater, two pressure control valves and an atmospheric vent pipe

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)

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.		



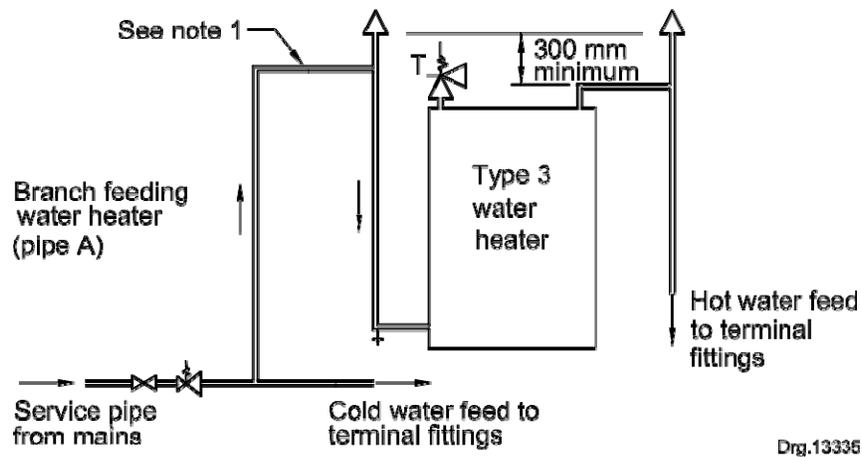
NOTE 1 The horizontal branch that feeds the water heater should not be installed below the top of the water heater.

NOTE 2 Where a pressure control valve or reducing valve is installed in the service pipe, pressure control valves (A) or (B) (or both) may not be necessary.

NOTE 3 Any pipes that feed cold water terminal fittings should not be connected to the branch that feeds the water heater (pipe C).

NOTE 4 The height of the vacuum breaker should comply with requirements of the local bylaws and SANS 10254.

Figure F.2 — System that incorporates a standard water heater, two pressure control valves and a separate expansion relief valve

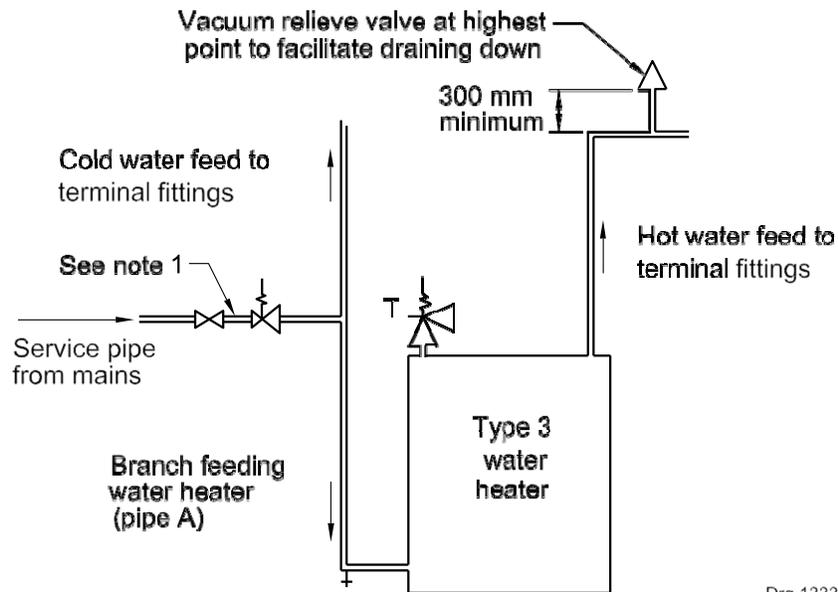


NOTE 1 The horizontal branch that feeds the water heater should not be installed below the top of the water heater.

NOTE 2 Any pipes that feed cold water terminal fittings should not be connected to the branch that feeds the water heater (pipe A).

NOTE 3 The height of the vacuum breaker should comply with requirements of the local bylaws and SANS 10254.

Figure F.3 — System that incorporates a standard water heater and a pressure control valve with integral expansion relief valve



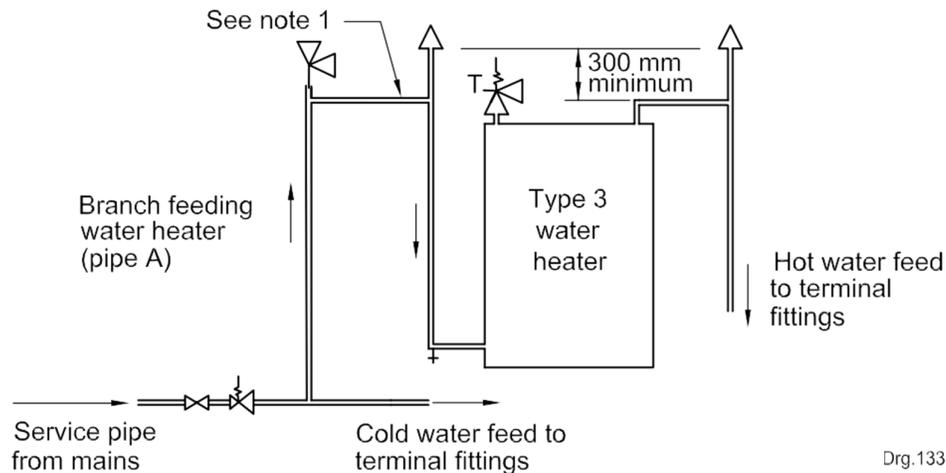
Drg.13336

NOTE 1 The horizontal branch that feeds the water heater should not be installed below the top of the water heater.

NOTE 2 Any pipes that feed cold water terminal fittings should not be connected to the branch that feeds the water heater (pipe A).

NOTE 3 The height of the vacuum breaker should comply with requirements of the local bylaws and SANS 10254.

Figure F.4 — System where the water heater is located below all outlet points and that incorporates a pressure control valve with integral expansion relief valve



NOTE 1 The horizontal branch that feeds the water heater should not be installed below the top of the water heater.

NOTE 2 Any pipes that feed cold water terminal fittings should not be connected to the branch that feeds the water heater (pipe A).

NOTE 3 The height of the vacuum breaker should comply with requirements of the local bylaws and SANS 10254.

Figure F.5 — System that incorporates a standard water heater, pressure control valve and a separate expansion relief valve

F.3 Installations that incorporate a storage tank and a type 3 standard water heater given in SANS 151

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. Such an installation is shown in figure F.6.

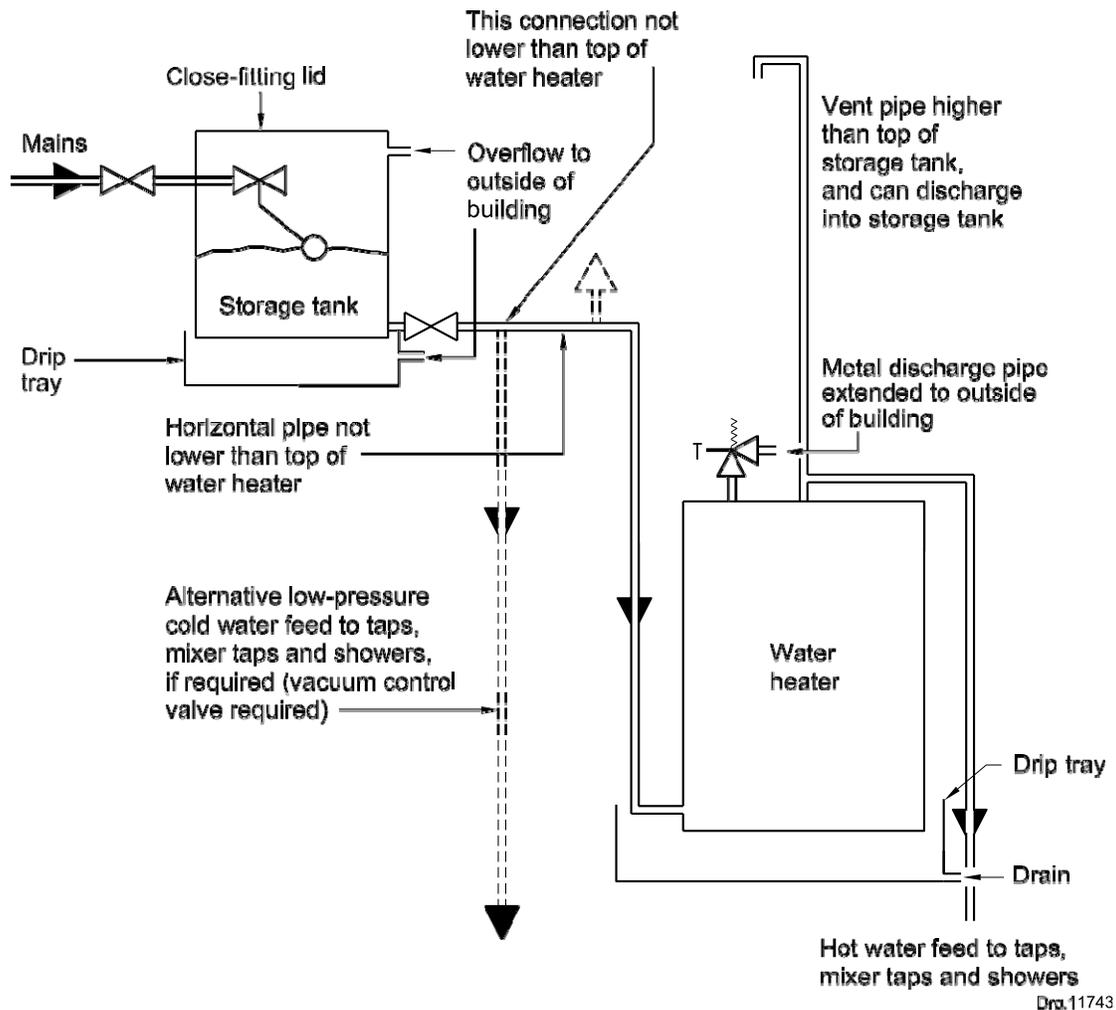
NOTE 1 Where the cold and hot water pressures at terminal water fittings are unbalanced, the use of mixing valves is not recommended.

NOTE 2 Where practicable, the vent/expansion pipe could terminate in the storage tank above the overflow level. This arrangement is preferable to having the vent/expansion pipe project above the roof.

NOTE 3 A safety tray with drain should be provided under the storage tank (2 kL capacity and smaller), to accept accidental leakage or overflow.

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



Drq.11743

NOTE 1 Where a pressure control valve or reducing valve is installed in the service pipe, the pressure reducing valve in the cold feed may not be necessary.

NOTE 2 The horizontal branch that feeds the water heater should not be installed below the top of the water heater.

NOTE 3 A safety tray with drain should be provided under the storage tank (2 kL capacity and smaller), to accept accidental leakage or overflow.

NOTE 4 Where practicable, the vent/expansion pipe could terminate in the storage tank above the overflow level. This arrangement is preferable to having the vent/expansion pipe project above the roof.

NOTE 5 The use of high pressure mixing valves is not recommended with this system.

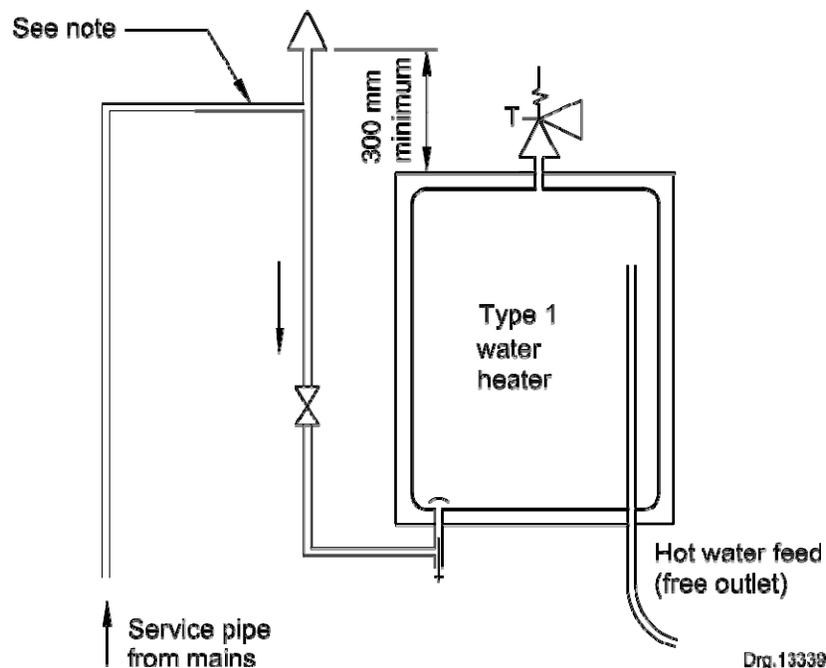
Figure F.6 — System that incorporates a standard water heater and a storage tank

F.4 Installations that incorporate a type 1 free-outlet water heater given in SANS 151

The recommended pipe sizes for in-house installations that incorporate a type 1 free-outlet water heater given in SANS 151, are given in table F.3. Such an installation is shown in figure F.7.

Table F.3 — Recommended pipe sizes for in-house installations that incorporate a free-outlet type water heater

1	2	3
Capacity of water heater L	Pipe	Recommended pipe size (nominal internal diameter) mm
< 25	Branch from cold water supply to water heater	13 to 16
> 25 and < 250	Branch from cold water supply to water heater	19 to 21



NOTE The horizontal branch that feeds the water heater should not be installed below the top of the water heater.

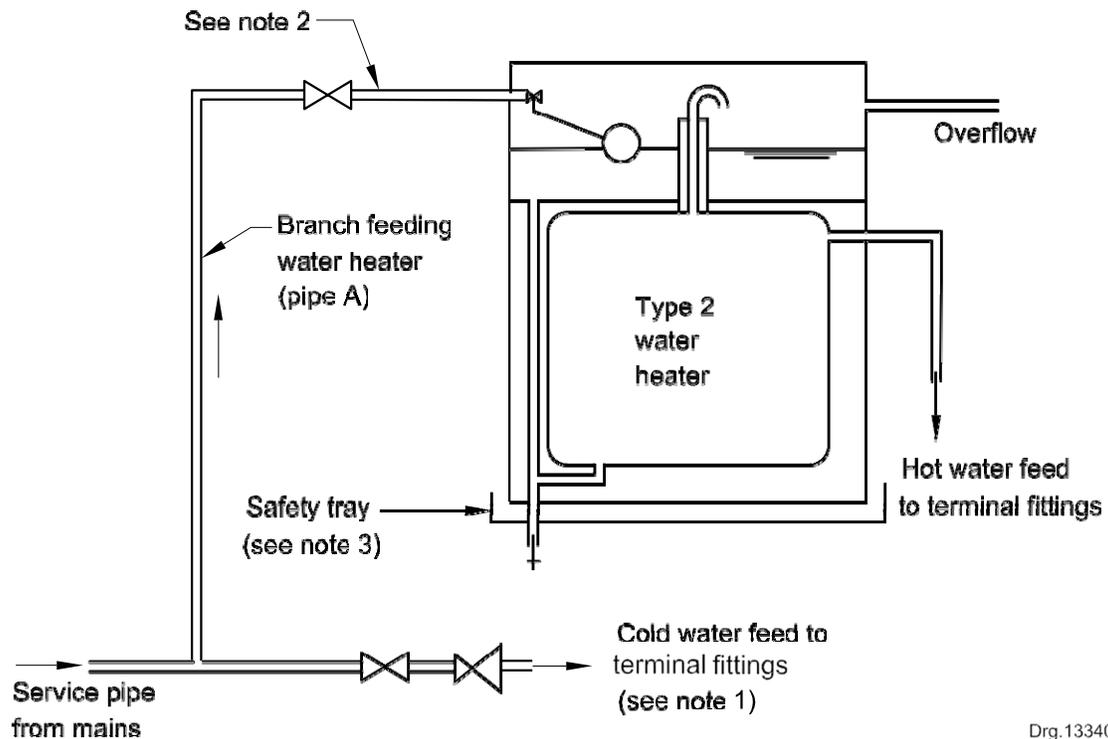
Figure F.7 — System that incorporates a free-outlet type water heater

F.5 Installations that incorporate a type 2 combination water heater given in SANS 151

The recommended pipe sizes for installations that incorporate a type 2 combination water heater given in SANS 151, are given in table F.4. Such an installation is shown in figure F.8.

Table F.4 — Recommended pipe sizes for installations that incorporate a type 2 combination water heater in SANS 151

1	2
Pipe	Recommended pipe size (average internal diameter) mm
Branch from service pipe to water heater cistern	13 to 19
Cold water feed to first branch	Smaller of 19 and the service pipe
Hot water feed from water heater to first branch	Larger of 19 and the service pipe
All other pipes	13 to 19



Drg.13340

NOTE 1 Where a pressure control valve or reducing valve is installed in the service pipe, the pressure reducing valve in the cold feed to the water heater may not be necessary.

NOTE 2 Any pipes that feed cold water terminal fittings should not be connected to the branch that feeds the water heater (pipe A).

NOTE 3 A safety tray with drain should be provided under a type 2 water heater, to accept accidental leakage or overflow.

NOTE 4 The use of high pressure mixing valves is not recommended with this system.

Figure F.8 — System that incorporates a type 2 combination water heater and pressure control valve given in SANS 151

Annex G
(informative)

Thermal insulation for pipework

G.1 General

This annex details the application of thermal insulation to pipework and equipment and does not cover structural insulation of buildings and cold stores, fire protection of structures, refractory linings of plant, airborne installations and all external underground mains. This annex explains the basic principles that should be followed in selecting insulating systems for specific requirements.

G.2 Purpose of pipe insulation

G.2.1 General

Proper insulation improves the thermal efficiency, limiting heat transfer and providing a vapor barrier against moisture. Proper pipe insulation materials also eliminate condensation formation, which accelerates pipe deterioration.

If there is a temperature differential between the heating or cooling process and ambient conditions, heat will flow from the higher to the lower temperature.

G.2.2 Corrosion protection

Where the operating temperature is less than 130 °C and the equipment or pipework is other than austenitic alloy, the surfaces should be coated with a suitable paint. It has been found that below this temperature corrosion conditions can occur.

Most thermal insulations will not, of themselves, cause stress corrosion cracking as may be shown by tests. When exposed to elevated temperature (with a boiling point range of between 80 °C and 200 °C), environments containing chlorides, moisture and oxygen, insulation systems may act as collecting media, transmigrating and concentrating chlorides on heating stainless steel surfaces. If moisture is not present, the chloride salt cannot migrate, and stress corrosion cracking because of chloride contaminated insulation cannot take place. (See ASTM C 692.)

If insulation is to be applied over certain austenitic alloy steel where the operating temperature is between 80 °C and 200 °C, it is recommended that a stress corrosion barrier is applied before the application of the insulation so as to prevent stress corrosion. At 500 °C and above none of the stress corrosion barrier materials can withstand the temperatures and therefore should not be used.

It should be noted that during start up and shutdown, operating temperatures might occur within 80 °C to 200 °C temperature band and under such circumstances stress corrosion could occur.

The barrier might be of aluminium foil not less than 0,06 mm thick or a specially formulated paint that is applied. The recommendations of the manufacturer should be followed particularly in respect of the limiting temperature of the dried film.

G.3 Designing insulation systems

G.3.1 General

Factors that influence the design of a pipe insulation system are given in G.3.2 to G.3.5.

G.3.2 Location

The following are possible locations for insulating systems:

- a) indoors;
- b) outdoors protected from the weather; and
- c) outdoors exposed to the weather.

It is important to consider shape, size and elevation when designing insulation systems.

G.3.3 Temperature conditions

The following temperature conditions should be considered:

- a) the normal operating temperature;
- b) extreme temperature, if other than the normal operating temperature;
- c) any fluctuating temperature; and
- d) the duration of extreme or fluctuating temperature.

G.3.4 Surrounding atmospheric conditions

The following surrounding atmospheric conditions should be considered:

- a) the ambient temperature;
- b) the relative humidity, in order to establish the dew point for cold insulation;
- c) flammable conditions;
- d) potentially corrosive atmosphere;
- e) acidic conditions in the atmosphere; and
- f) the air flow over the insulated surface (wind velocity).

G.3.5 Service condition requirements

The following requirements for service conditions should be considered:

- a) resistance to compression, for example, foot traffic;
- b) resistance to fire;
- c) resistance to vibration;
- d) resistance to mechanical damage;
- d) resistance to corrosive fluids or gases;
- e) the anticipated wide fluctuations of temperature, for example, steam out;

- f) resistance of insulation protection to ingress of oils and flammable liquids;
- g) the application of insulation over special alloys;
- h) resistance to moisture and other weather conditions; and
- i) resistance to vermin.

G.4 Insulation materials

G.4.1 General

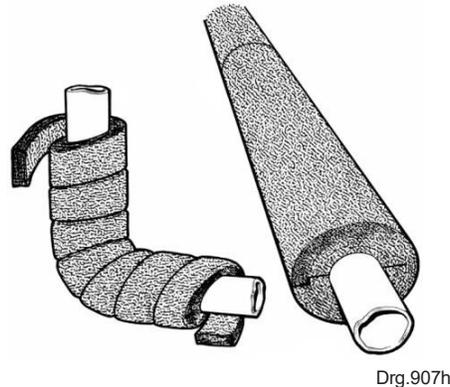
The types of materials used will depend upon whether the installation is underground, outside of buildings, underground within buildings, or aboveground within buildings. The availability of certain types of desired piping materials and fittings may also determine the type of pipe used.

G.4.2 Insulation types

The following are types of insulation materials:

- a) Boards or batts: Rigid binder bound fibrous insulation for use on flat or large cylindrical surfaces.
- b) Felt: Semi-flexible binder bound fibrous insulation for use on all surfaces where vibration is of a low order, for example boilers.
- c) Loose granulated insulation with a low binder content for filling voids.
- d) Mattress: Flexible low binder fibrous insulation for use on all surfaces. A wire mesh fixed to one or both sides by through stitching maintains the shape of the mattress. Because of the low binder content the material is able to withstand higher temperature without binder breakdown.
- e) Pipe section: Insulation preformed to fit in two halves round cylindrical surfaces of various diameters.
- f) Pipe section covered: As for pipe section except that the outer surface is fitted with a cover by the manufacturer, for example, canvas or foil.
- g) Segments: Cylindrical insulation for fitting around large cylindrical surfaces with more than two parts. This type is confined to the closed cell insulants.
- h) Slab: All the closed cell flat insulation and expanded/extruded insulants fall into this category and may be applied to all surfaces provided they are suitably shaped.
- i) Rope: Usually of fibrous material, used for spirally wrapping around small pipes.
- j) Spray fibre: Used for insulating irregular shapes such as turbines, and also used for fireproofing.
- k) Spray foam: Usually of polyurethane or polyisocyanurate, the main applications of which are for large regular surfaces such as roofs or tanks and for cavity filling.
- l) Foam rubber: Placed over the pipes, wrapped at the ends, and secured with duct tape.

- m) Pipe sleeves: Made from polyethylene or neoprene foam and presented in a wide variety of sizes. Pipe sleeves are easy to install and very effective. Match the pipe sleeve with the pipe's outside diameter to get a snug fit. To secure the insulation to the pipe, use wire or tape, or clamp it with a cable. If more than one sleeve is needed, duct tape the seam where the pipes meet.
- n) Tape: Usually of fibre and used for spiral wrapping on pipe work where conditions so demand.



a) Insulation wrapped round pipe

b) Preformed insulation

Figure G.1 — Typical insulation of water pipes

G.4.3 Recommendations for use

G.4.3.1 The use of felt or mattress is not recommended over cylindrical shapes with an outside diameter of less than 200 mm. Under certain circumstances boards or slab may be used on cylindrical surfaces by cutting the insulation into bevelled staves.

G.4.3.2 Generally, with certain applications, when installing where the total insulation thickness exceeds 50 mm, a multi-layer system should be used with staggered joints to reduce the heat loss or gain through direct paths to the atmosphere.

G.4.3.3 When very high or very low temperatures are encountered, expansion or contraction joints should be provided. These are usually 40 mm wide and packed with a suitable insulant.

G.4.3.4 It is incumbent on the manufacturers to provide all the necessary values such as thermal conductivity (k factor) and water vapour permeance, based on the tests conducted by an approved testing authority. If required, the test number and date should be given together with the particular test method and the conditions.

G.5 Vapour barriers

All insulation designated as "cold" shall be provided with a vapour barrier (see table G.1).

Table G.1— Selection guide for vapour barriers

Type	Product name	Temp range °C	D.F.T ^a mm	Wet flam- mable	Exposure resistance	Non- suitable substrate	Water vapour permeance ^b g/s	Method of appli- cation
Bitu- minous	BE2 Bitumen emulsion	-5/55	1,5	No	Internal	None	0,0083	Brush
	BE Emulsion	-5/55	1,5	No	Internal	None	0,0022	Trowel
	570 Rubberized emulsion	-30/60	1,5	No	Internal	None	–	Brush
Epoxy	769 Epoxy paint	-10/8	0,3	Yes	External	EPS		Brush/ spray
	304 Epoxy coating	-10/120	0,3	No	External	None		Brush
	Abecote SF322	Dry 120	± 1,0	Flash 0° C			0,005	Brush
	Flintoat 390	-10/50	± 0,5	Flash 0° C			0,058	Brush
	Ivory 340	-10/90	0,8	No	Internal	None	0,003	Brush
	IC KL		Film	N/A	Internal	None	0,001	N/A
	IC KH		Film	N/A	Internal	None	<0,001	N/A
	IC RH		Film	N/A	Internal	None	Neg.	N/A
Electro- metric	Foster Monolar	-30/120	0,76	Yes	External	EPS	0,006	Brush/ spray/ trowel
	Foster 95- 44	-73/121	Seal't	Yes	External	EPS	–	Trowel/ glove
	Foster 30- 45	-60/149	Seal't	Yes	External	None	–	Trowel/ glove
	800 Hypalon	-40/120	0,3	Yes	External	EPS	0,000	Brush/ spray
	795 PU Coating	-20/180	0,3	Yes	External	EPS	0,000	Brush/ spray
	696 Elastothane	-30/120	1,0	No	External	None	–	Brush
	153 FR Mastic	-30/80	1,9	Yes	External	EPS	N/A	Trowel
	625 Non- slump mastic	-40/120	Bead	Yes	External	EPS	N/A	Gun
	151 Oleo mastic	-70/150	Bead	No	Internal	None	N/A	Gun/ trowel
^a Recommended dry film thickness.								
^b Tested in accordance with ASTM E 96 (desiccant method).								

Table G.1 (concluded)

Type	Product name	Temp range °C	D.F.T ^a mm	Wet flammable	Exposure resistance	Non-suitable substrate	Water vapour permeance ^b g/s	Method of application
Synthetic emulsions	Foster 30-36	-18/82	0,9	No	Internal	None	0,083	Brush/spray
	Foster 30-70 (lagtone)	-46/82	0,4	No	External	None	0,180	Brush/spray
	Foster 35-00	-29/93	1,0	No	External	None	0,090	Trowel/glove
	2415 Plustex	-20/120	0,45	No	External	None	0,057	Brush/trowel
	2191 Plustex	-20/80	0,45	No	External	None	0,072	Brush/trowel
	249 Plustex	-20/90	0,45	No	External	None	0,05	Brush/trowel
	835 Acryl seal	-20/80	0,5	No	External	None	–	Brush
	147 Acryl coat	-20/80	0,2	No	External	None	–	Brush
	158 Vapour seal	-30/85	1,3	No	External	None	–	Brush/trowel
Other	Foster 65-05	-29/93	2,0	Yes	External	EPS	0,007	Brush/spray
	Foil-mylar	-70/100	Film	N/A	Internal	None	0,001	N/A
^a Recommended dry film thickness. ^b Tested in accordance with ASTM E 96 (desiccant method).								

G.6 Protection of insulation

G.6.1 General

The protection of the insulation required to protect the insulation from mechanical damage and the elements (weather barrier). may consist of metal cladding or a coating system.

Metal and non-metallic finishes should generally be as given in the insulation guideline for hot insulation (see G.8). However, care should be taken where piping and equipment is being clad; the cladding should be manufactured and installed so as to prevent the vapour barrier being punctured. Cushioning material applied between screws or rivets and the vapour barrier, or other suitable means, would be the general practice.

G.6.2 Metal Cladding

G.6.2.1 The following main metals are used:

- a) galvanised steel;
- b) pre-painted, or pre-coated steel;

- c) aluminium;
- d) stainless steel; or
- e) other specialised formulations.

G.6.2.2 Depending on the requirements of the application, the metal can be either flat sheet or profiled. The thickness depends on the degree of mechanical damage the cladding is expected to withstand and may vary from 0,5 mm to 1,2 mm. For areas susceptible to heavy damage a thicker gauge may be required.

G.6.2.3 In the application of cladding it should be ensured that

- a) good water shedding exists at all joints or the sealing of joints where a water shedding joint is not possible,
- b) at point where dissimilar metals come into contact with one another, precautions shall be taken to prevent galvanic action,
- c) all metal joints shall be straight and square to preserve a symmetrical appearance,
- d) the cladding system shall be constructed so that due allowance is made for the expansion or contraction of the equipment, and
- e) where the cladding is applied over a vapour barrier, great care shall be taken to avoid puncturing the vapour barrier either during or after erection, for example, a spacer or protective liner.

G.6.3 Plaster finishes

G.6.3.1 The term plaster includes both hard-setting plaster and mastics, which may be used separately or together. Plaster may be used on all surfaces but when exposed to the weather it should be over coated with a mastic or finishing paint.

G.6.3.2 If plaster is used over a fibrous insulation the insulation shall be of sufficient density to withstand the trowel application.

G.6.3.3 A mastic is not suitable for direct application to fibrous insulation. Generally, the purpose of the plaster is to provide a surface resistant to mechanical damage or a foundation (or both) for the mastic, which provides the waterproofing.

G.6.3.4 Both the plaster and the mastic should be applied in two layers with a reinforcing between the layers, i.e., galvanised wire mesh for the plaster and fibreglass mesh for the mastic. The first coat in each case should provide an anchor to ensure a key for the second.

G.6.3.5 Because of its high mass, the plaster coat is subject to slipping on large vertical surfaces. The wire mesh reinforcing shall therefore be tied back, with binding wire, to fixed supports on the equipment.

G.7 Application

G.7.1 General

Before insulation is applied, thoroughly clean all surfaces to be insulated in order to remove dirt, oil, moisture, loose rust or any other foreign matter. Use mild cleanser on an old rag, swiped a few times across the pipe. Do not use a harsh cleanser because it could cause corrosion. Allow the pipe to dry completely before installing insulation. Choose the type of insulation appropriate to the application.

In addition to the basic insulation material, a system may need the following:

- a) supports for the insulation;
- b) fastenings for the insulation;
- c) a vapour seal in case of cold insulation;
- d) mechanical or weather protection of the insulation, for example, metal cladding;
- e) supports for the protection of the cladding;
- f) fastenings for the protection of the cladding; or
- g) finishing, for example, paint coatings, decorative finishes or identification bands.

G.7.2 Pre-installation supports

G.7.2.1 General

Install insulation supports before the application of the insulation.

G.7.2.2 Supports for insulation

The following can support insulation:

- a) adhesive;
- b) pins (plastic or nylon);
- c) strapping bands for large cylindrical surfaces;
- d) pressure-sensitive tape for small diameter surfaces; and
- e) pre-installed insulation support rings, normally used on large vertical vessels.

G.7.3 Installation of pipe insulation

G.7.3.1 Standard foam insulation is installed by wrapping it around the water pipe and securing it with duct tape. Foam insulation can be wrapped with an overlap if required.

G.7.3.2 Tubular sleeve insulation is more convenient because the insulation already comes in tubes that will automatically wrap around the pipe. Cut the insulation to the length required and wrap it around the pipe, also securing it with duct tape.

G.7.3.3 Ensure that the whole pipe is covered as fully as possible, paying special attention to corners and T-joints. The need may arise to cut slits or make miter angles in tubular sleeve insulation to cover joints entirely. Make sure that duct tape is wrapped over the bends because this is where the insulation is most likely to come apart.

G.7.3.4 Use protective attire when installing fibre glass insulation. Before installation begins, switch off the hot water system to prevent burning on the pipes.

G.8 Hot insulation

G.8.1 General

G.8.1.1 Equipment or pipework with an operation temperature greater than 55 °C, in the case of metallic surfaces, and 65 °C in the case of non-metallic surfaces, should be insulated so that the surface temperature after insulation (cold surface temperature) does not exceed 55 °C.

G.8.1.2 It is accepted that temperatures of 60 °C or greater will result in extreme discomfort to personnel and therefore a maximum cold surface temperature of 55 °C should be considered as advisable.

G.8.1.3 If the fluid inside the pipe is likely to remain static for long periods when the ambient temperature is below the freezing point of the fluid, it is important that this shall be stated. Also, the fluid in small diameter pipes may be especially susceptible to freezing, particularly if the rate of flow is intermittent or slow, it may be necessary to consider the use of a supplementary means of heating, possibly only in local areas, for example, heat tracing.

G.8.2 Selection of hot insulation materials

G.8.2.1 Careful consideration should be given to insulation thickness. On pipework an over-specification of thickness creates a needless increase in the cost of the outer protection.

G.8.2.2 When a multi-layer system of insulation is envisaged, the selection of materials is interdependent on the type of protection. For example, an aluminium protection will result in a higher cold surface temperature and a lower heat. (Aluminium protection has a low emissivity and therefore radiates less heat.)

G.8.2.3 Where constant load supports are involved, the mass of the insulation system becomes critical and shall be kept within the tolerances of such constant load supports. Where used for internal linings of ventilation ductwork, the thermal insulating material itself should be non-combustible as given in SANS 10177-5.

G.8.3 Hot insulation materials

G.8.3.1 It is recommended with all hot insulation materials that their use be limited to conditions of 90 % of the manufacturer's limiting temperatures in order to safeguard against a temperature surge at the start-up operations of a plant.

G.8.3.2 The following are examples of typical hot insulation materials:

- a) calcium silicate;
- b) ceramic fibre (blanket);
- c) cellular glass;

- d) glass mineral wool;
- e) melamine foam (flexible);
- f) perlite (expanded);
- g) rock wool; and
- h) vermiculite.

G.8.4 Application of hot insulation

G.8.4.1 Pipe section, mattress or any flexible insulation may be used for pipework. However, practical reasons preclude the use of mattress or flexible insulation where the outside diameter of the pipe or the outside diameter of any previous layer of insulation is 200 mm or less.

G.8.4.2 Where mattress or materials of low density are used and metal is the protection medium, supports should be provided for the metal at not more than 1 m intervals where the pipework is horizontal or inclined up to 45°. Between 45° and the vertical, the spacing of the supports is dependent on temperature and expansion requirements. (See BS 5970.)

G.8.4.3 As a guide, the expansion allowances on pipework are generally 1 mm/running meter/100 °C of temperature. In all applications of insulation the material shall be well butted together and in the case of multi-layer applications all joints of each subsequent layer shall be staggered from the previous layer. Weld pins or clips, binding wire and strapping are used for securing the insulation as a single or composite system dependent on the circumstances.

G.9 Cold insulation

G.9.1 General

G.9.1.1 Cold insulation should be considered where operating temperatures are below ambient and where protection is required against heat gain, condensation or freezing.

G.9.1.2 In designing an insulation system where formulae and surface coefficients are used they should be to an appropriate international standard, for example, BS 5422, is recommended. In selection of material density, it should be considered whether insulation requires being load bearing or not.

G.9.2 Design of cold insulation

G.9.2.1 Whatever the primary reasons for cold insulation, it should be designed to prevent condensation. Condensation occurs when water vapour in the atmosphere comes in contact with a surface at a temperature of less or equal to the dew point. Therefore, if the surface temperature is less than the dew point, condensation will occur.

G.9.2.2 The presence of condensation on the warm side of the vapour barrier has no detrimental effect on the insulation but, nevertheless, it is a condition that has to be avoided. To prevent condensation, the insulation thickness should be so designed that the temperature on the warm side of the vapour barrier is above the dew point.

G.9.2.3 In calculating the thickness of the insulation required to prevent condensation, it is prudent to know or assume conditions of high relative humidity. If the fluid inside the pipe is likely to remain static for long periods when the ambient temperature is below the freezing point of the fluid, it is important that this shall be stated. Also, the fluid in small diameter pipes may be especially susceptible to freezing, particularly if the rate of flow is intermittent or slow, it may be necessary to consider the use of supplementary means of heating, possibly only in local areas, like heat tracing.

G.9.3 Cold insulation materials

The following are examples of cold insulation materials:

- a) cellular glass;
- b) cork;
- c) glass mineral wool;
- d) nitrile rubber (expanded);
- e) perlite (expanded);
- f) phenolic foam;
- g) polyethylene foam;
- h) polyisocyanurate foam (PIC);
- i) polypropylene;
- j) polystyrene (expanded);
- k) polystyrene foam (extruded);
- l) rigid polyurethane foam (PUR);
- m) rock wool; and
- n) synthetic rubber (expanded).

G.9.4 Selection of cold insulation materials

G.9.4.1 General

G.9.4.1.1 Closed-cell insulation is the most commonly specified material used for coldwork because it possesses a degree of resistance to water vapour and because the thermal conductivity (k factor) of some of these materials is better than the fibrous alternative products.

G.9.4.1.2 Selection of insulation materials should be carefully considered where the possibility of steam purging of the equipment is required or for other reasons which may cause the temperature to be increased to a level which exceeds the maximum limiting temperature of the insulation materials, i.e., the material then deteriorates.

G.9.4.1.3 Special precautions to prevent the possibility of combustion shall be exercised when insulating piping, fittings or equipment containing oxygen, as the insulation system should then not contain any organics. It is therefore strongly recommended that the material suppliers are consulted before the selection of the insulation material.

G.9.4.1.4 Fibrous materials may be used for cold insulation where conditions such as fire resistance are present. However, because of their poor resistance to water vapour, extra care shall be taken in the selection and application of the vapour barrier.

G.9.4.1.5 In case of fire, certain insulation systems may generate appreciable quantities of smoke and noxious and toxic fumes. Consideration should be given to the choice of materials, bearing in mind their location (for example, in enclosed areas or adjacent to air ducts through which smoke or fumes may spread), and that they shall be in accordance with the local requirements and specifications.

G.9.4.1.6 If there is a potential hazard from contamination by oil or other flammable chemicals, a suitably resistant finish, for example, a metal sheet or an appropriate non-absorbent coating, shall be applied over the vulnerable areas. The lapped joints of sheet finishes shall be arranged to shed contaminating fluids away from the insulating material.

G.9.4.2 Joint sealers and adhesives

G.9.4.2.1 All materials intended for use for cryogenic insulation of pipes and vessels should be checked for their suitability at low temperatures and if, for example, no acceptable joint mastic is available for 196 °C (such as liquid oxygen or nitrogen) then only the joints on the outer layer on a multi-layer system should be sealed.

G.9.4.2.2 Joint sealers and adhesives should be completely compatible with the insulation barrier and the item being insulated (refer to the manufacturer's instructions).

G.9.4.2.3 When insulating low temperature pipework, it is advisable to create circumferential vapour dams extending from the bare pipe to the vapour seal on the warm side of the insulation. The longitudinal spacing of the dams is arbitrary and as a guide, 2 m, for very low temperatures to 10 m, for example chilled water, should be considered. The purpose of the dams is to prevent the failure of long sections of pipe insulation should the warm side vapour seal be ruptured in any way.

G.9.4.3 Vapour barriers

G.9.4.3.1 General

G.9.4.3.1.1 For whatever purpose cold insulation is required, the insulation system is only as good as its vapour barrier and the care with which it is installed. A vapour barrier is a membrane of very low permeance placed on the warm side of insulation to limit the flow of water vapour into the insulation.

G.9.4.3.1.2 Where there is a differential in temperature or humidity between the cold surface of the equipment and the ambient temperature a differential water vapour pressure occurs. The greater the temperature differential, the greater the differential water vapour pressure. Water vapour should not be confused with moisture. Water vapour is a transparent, tasteless and odourless gas capable of permeating through most materials depending on the pressure differential on either side of the insulation.

G.9.4.3.1.3 Permeability of water through a vapour barrier is expressed in metric perms in the metric system. A metric perm is the passage of 1 g of water through a material with a surface area of 1 m² for 24 h and a pressure difference of 1 mm Hg. Many materials, which are moisture-resistant, are not necessarily vapour-resistant.

G.9.4.3.1.4 All insulation materials are susceptible to water vapour penetration to various degrees. If penetration is not prevented, the water vapour condenses to moisture or ice when its temperature reaches the dew point. This will, in time, saturate the insulation thereby rendering it useless. To prevent this from taking place, a vapour barrier is applied on the warm side of the insulation.

G.9.4.3.2 Selection of a vapour barrier

G.9.4.3.2.1 In selecting a vapour barrier, material comparisons should be made between the various permeability ratings as supplied by manufacturers as there may be vast differences between materials (see BS 5970).

G.9.4.3.2.2 Care should be taken to ensure that the choice of vapour barriers does not affect the fire performance of the whole assembly of insulating and finishing materials. The design of the cold insulation system should assume that at sometime a breakdown of the vapour barrier might occur.

G.9.4.3.2.3 In the case of pipework, it is preferable that the water vapour has free passage to the cold surface where the resultant water or ice will be encased by the insulation.

G.9.4.3.2.4 A break in the vapour barrier of the insulation system will eventually cause the system to fail but its effective life will have been prolonged by a design which permits the through transmission of water vapour.

G.9.4.3.3 Types of vapour barriers

G.9.4.3.3.1 Membrane barriers such as

- a) metal foils,
- b) laminated foils,
- c) treated papers,
- d) plastic films,
- e) plastic sheets,
- f) coated felts, and
- g) coated paper

are either part of the insulation as supplied, or can be supplied separately.

G.9.4.3.3.2 Coating barriers are available in fluid form as a paint or mastic (or semi-fluid of the hot-melt variety); the material can be asphaltic, resinous or polymeric. These provide a seamless coating but require time to dry and are normally reinforced with a membrane sandwiched between layers.

G.9.4.3.3.3 A pinhole through the vapour barrier can eventually render the insulation system useless, therefore, the selection of a vapour barrier needs careful consideration. Foil or sheets usually have the better permeability rating but foil has poor resistance to mechanical damage and needs a protective cover or protective laminate. Sheet metal has a good rating but requires great care in the sealing of joints and fastenings.

G.9.4.3.3.4 Water, solvent and mastic based vapour barriers tend to be resistant to mechanical damage. Their permeability rating varies from water based at the bottom of the scale to cured resins at the top. Most of these types, however, need to be suitably reinforced.

G.9.4.3.3.5 Water-based formulations tend to dry out, and in doing so leave minute pinholes. It is therefore essential that the manufacturer's recommended thickness shall be considered as a minimum to prevent pinholes extending continuously through the coating and, as a further precaution, the application shall consist of multiple coats.

G.9.4.3.3.6 In the case of solvent-based vapour barriers the manufacturer's application procedures shall be carefully followed, as the danger of solvent entrapment exists due to premature over coating resulting in surface "bubbles".

G.9.4.3.3.7 Resin-cured vapour barriers are excellent but again the manufacturer's recommended thickness shall be considered minimum. Adherence to the manufacturer's mixing proportions is mandatory. The application shall consist of multiple coats. Vapour barrier applications are only as good as the applicator. Where the insulation terminates, the vapour barrier shall be returned to the cold equipment so as to totally encapsulate the insulation.

G.9.5 Application of cold insulation materials

G.9.5.1 Generally on pipework, preformed pipe sections should be used, or alternatively, an in-situ or spray application could be considered. All insulation should fit snugly around piping and equipment.

G.9.5.2 On low temperature insulation work all attachments to the piping or equipment and projecting through the insulation should also be insulated for a distance of four times the thickness of the basic insulation from the point where the projection is exposed.

G.9.5.3 All the insulation and the vapour barrier should be continuous at pipe supports. Where metal cradles preformed to the outside diameter of the insulation are provided at the pipe supports, the cradle should be designed to prevent undue compression of the insulation due to the weight of the insulated pipe.

G.9.5.4 Higher density insulation preformed material often manufactured from PUR, PIC, phenolic foam or wood, can be used between the support and the pipe to accommodate the weight if it is considered necessary.

G.9.5.5 Insulation contraction joints should be provided for. Firebreaks should be provided at, for example, 20 m maximum, or where the insulated pipe passes from one building to another.

G.9.5.6 Where the total thickness of insulation exceeds 50 mm it should be applied to multiple layers and all joints should be staggered to prevent direct heat paths to the cold face. The creation of cavities should be avoided.

G.9.5.7 Adhesives or mastics for the application of insulation should be used with care as vapour dams may be created.

Annex H

(informative)

Examples of hot water storage and pipe sizing**H.1 Sizing hot water storage****H.1.1 Example 1**

Example 1 shows how to calculate the amounts of hot, V_2 and cold, V_1 , water required to produce bath water at 40 °C.

Cold water at $T_1 = 15$ °C and hot water at $T_2 = 60$ °C, are to be mixed to give $V_f = 120$ L of water at $T_f = 40$ °C, for bathing.

Calculate the quantity of both hot and cold water required, using the following equations:

a) Volume of cold water required:

$$V_1 = V_f \frac{T_2 - T_f}{T_2 - T_1} = 120\text{L} \frac{60 - 40}{60 - 15} = 53,3\text{L}$$

b) Volume of hot water required:

$$V_2 = V_f - V_1 = 120\text{ L} - 53,3\text{ L} = 66,7\text{ L}$$

or

$$V_2 = V_f \frac{T_f - T_1}{T_2 - T_1} = 120\text{L} \frac{40 - 15}{60 - 15} = 66,7\text{L}$$

H.1.2 Example 2

NOTE Example 2 is based on the *Plumbing services design guide* (see bibliography).

H.1.2.1 Determine the replenishment/storage relationships for the hot water installation serving a hostel with a hot water demand given in table H.1, in which hourly readings of total water consumption are given starting with the hour of peak demand.

NOTE Typical replenishment/storage capacity curves for various categories of premises are given in H.5.

The demand data can be plotted in the form of a histogram as shown in figure H.1.

From the histogram in figure H.1, a series of sequential peak hourly loads can be calculated for groups of hours, from 1 h to the maximum number of hours in the observation period. The average hourly load for each group of hours under consideration can thus be determined.

To construct the graph in figure H.2, proceed as given in H.1.2.1 to H.1.2.4.

Table H.1 — Hot water demand starting with peak period

1	2	3	1	2	3
No. of hours passed	Total volume of water drawn	Average rate of draw-off	No. of hours passed	Total volume of water drawn	Average rate of draw-off
	L	L/h		L	L/h
1	3 400	3 400	13	27 000	1 077
2	6 600	3 300	14	28 300	2 021
3	9 600	3 200	15	28 800	1 920
4	11 600	2 900	16	28 900	1 806
5	13 300	2 660	17	29 000	1 706
6	16 300	2 717	18	29 100	1 617
7	19 300	2 757	19	29 200	1 537
8	22 000	2 750	20	29 300	1 465
9	24 000	2 667	21	29 400	1 400
10	25 600	2 560	22	29 500	1 341
11	26 400	2 400	23	29 600	1 287
12	27 200	2 267	24	29 700	1 238

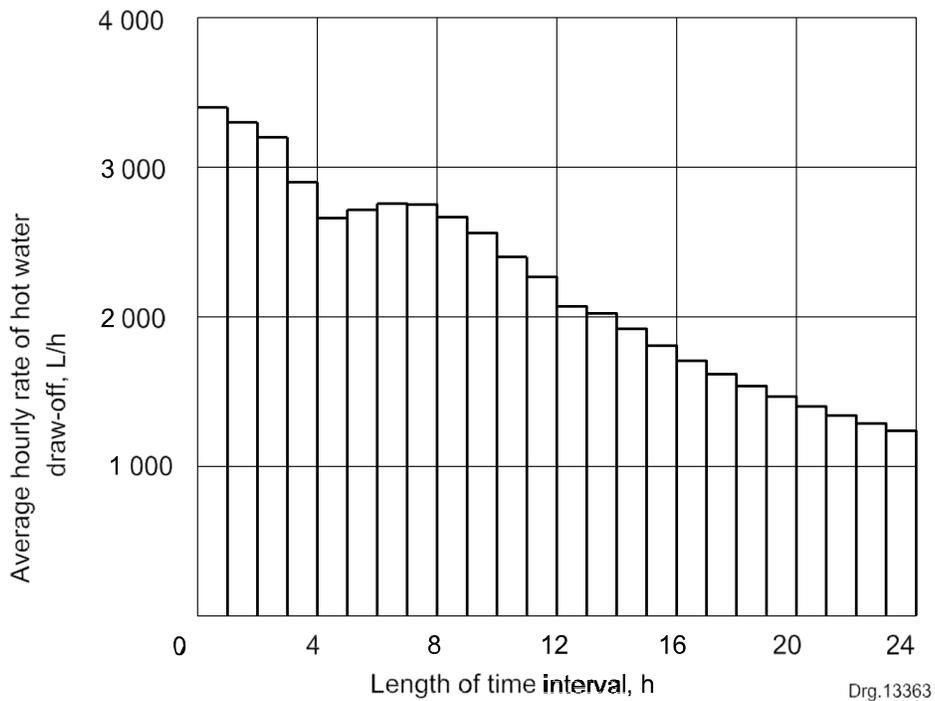


Figure H.1 — Typical demand pattern for hot water on premises

H.1.2.2 For each average value plotted in column 3 of table H.1, draw a straight line that represents the equivalent linear estimate of "volume left" versus "hours passed", for example, the line from the point (0 h, 1 806 L/h) to the point (16 h, 0 L/h).

H.1.2.3 Draw the horizontal line corresponding to the minimum value found in column 3 (in this case, 1 238 L/h corresponding to the 24 h interval).

H.1.2.4 The straight lines drawn in H.1.2.1 and H.1.2.3 should all be tangent to the required graph (the line from H.1.2.3 actually forms the rightmost part of the graph). Beginning at the leftmost top point (in this case, 0 h, 3 400 L/h), draw the best possible smooth curve that touches (but never intersects) as many of the straight lines from H.1.2.1 as possible and that finally goes over into the horizontal line from H.1.2.3.

H.1.2.5 Any point on the resultant graph indicates the maximum draw-off rate which is catered for if a testing period of the indicated length is chosen at random during any day.

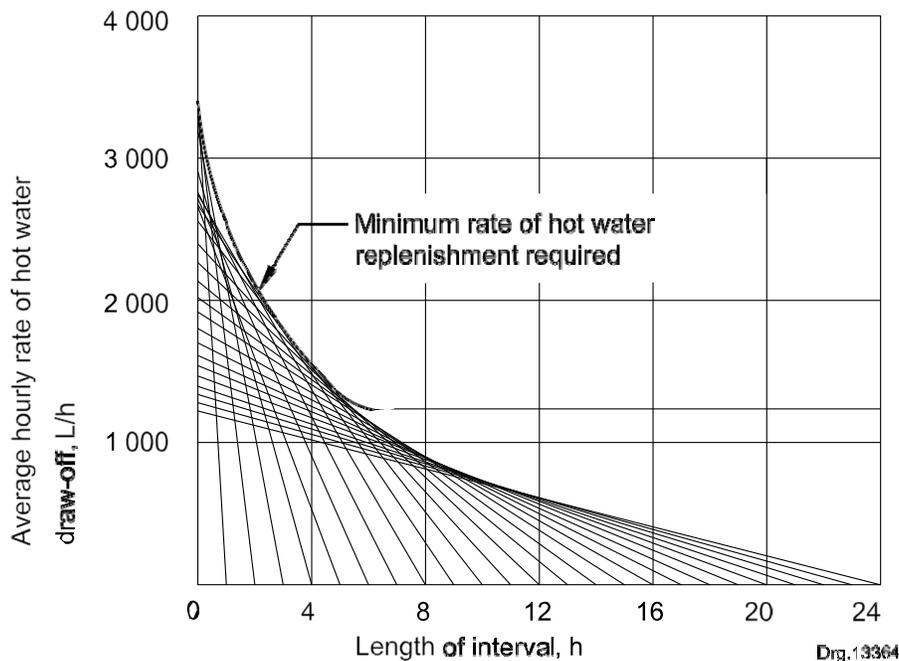


Figure H.2 — Typical minimum hot water recovery rate

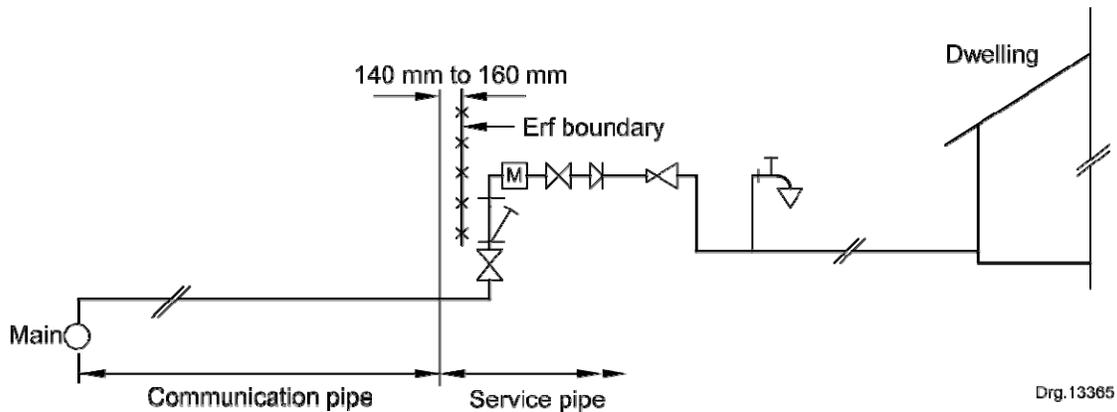
H.2 Sizing of a service pipe serving a dwelling house

H.2.1 Data given

Assume the maximum pressure in the local authority's main is 800 kPa and the minimum pressure (during peak demand) is 700 kPa (the schematic arrangement of the service pipe is shown in figure H.3).

H.2.2 Probable demand

Step one will be to determine the probable demand in the service pipe. Such a calculation is shown in table H.2.



NOTE 1 The pressure control valve may be at the building.

NOTE 2 The relation of boundary to meter in accordance with the local authority.

Figure H.3 — Schematic arrangement of a service pipe

Table H.2 — Probable demand in the service pipe

1	2	3	4
Fixture/Fitting	Number	Design flow rate per tap or fitting (see table 4) L/min	Maximum demand Q L/min
Garden (115 mm taps) ^a	3	15	45
Wash-hand basin (mixer)	2	9	18
Sink (mixer)	1	9	9
Wash trough (15 mm taps)	2	10	20
Bath (mixer)	2	25	50
Showerhead	1	15	15
Water-closet (float valve in cistern)	3	5	15
			Total max. demand: $\Sigma Q = 172$
NOTE 1 Probable maximum demand $Q_p = (\Sigma Q)^{0.7} = 37$ L/min.			
NOTE 2 If the designer prefers to allow for both bath mixers to operate simultaneously at the design flow of 25 L/min each, Q_p becomes 50 L/min.			
^a Included in the total demand for a dwelling for simplicity.			

H.2.3 Alternative approaches to sizing the service pipe

Two alternative approaches to sizing the service pipe are given in table H.3 and table H.4. In table H.3, a 400 kPa rated pressure control valve is used, resulting in the need for a 32 mm diameter service pipe from the pressure control valve to the house in order to reduce the friction loss.

In table H.4, a 500 kPa rated pressure control valve is used, allowing the use of a 25 mm diameter service pipe from the pressure control valve to the house.

H.3 Sizing of a service pipe serving a four-storey hostel

H.3.1 Data

Use the following data to determine the pipe sizing of cold and hot water supply services in a four-storey hostel block:

The four-storey hostel block has four identical ablution facilities which are fed from a storage tank situated on the roof.

NOTE Figures H.4 to H.8 (inclusive), are schematic arrangements for sizing pipes only and do not show provision for venting and expansion.

H.3.2 Determine probable demand

Determine the probable demand in the branch pipe at each floor.

Using table H.5 determine the probable demand for cold water and from table H.6 determine the probable demand for hot water.

Table H.3 — Sizing of the service pipe for a dwelling house (approach 1)

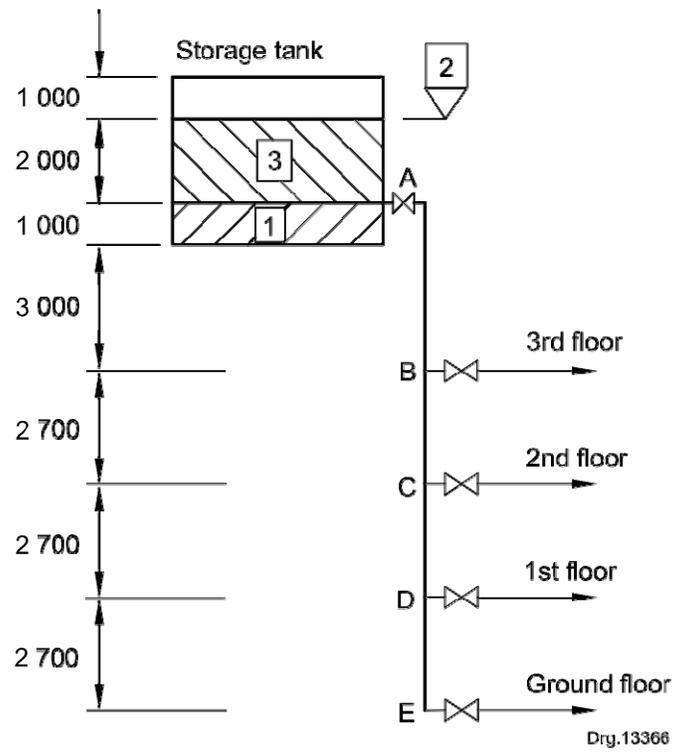
1 Pipe	2 ΣQ L/min	3 Q_p L/min	4 Pipe material pressure class and nominal diameter	5 Pipe length m	6 Pipe friction loss h_f m/m	7 Secondary energy loss				11 Total head loss (5) × (6) + 10 m	12 Available head m	13 Difference in ground level m	14 Net residual head m, min.
						Fittings	K^* (see table 18)	V m/s	$\frac{k^* V^2}{2g}$ m				
Communication	172	50 ^a	HDPE (class 10) 25 mm	11,6	0,35	1 × Sudden contraction	0,5	2,5	0,16	4,2	70	Nil	65,8
Service from communication pipe to pressure control valve	172	50 ^a	Below ground: HDPE (class 10) 25 mm	1,50	0,35	2 × 90° elbows 2 × Gate valve pipe to PCV	2,00 0,12	2,5 2,5	0,64 0,04				
			Above ground: Copper (class 3) 25 mm	b	b	1 × Strainer ^c 1 × Meter (size 3) ^c	5,00 18,8	2,5 2,5	1,59 6,00	8,8	57,0	Nil	57,0 ^d 25 ^e
Service from pressure control valve to house	172	50 ^a	Above ground: Copper (class 3) 22 mm	b	b	2 × 90° elbows 2 × Gate valve 1 × Reducer	2,00 0,12 0,30	2,5 2,5 2,5	0,64 0,04 0,10				
			Below ground: HDPE (class 10) 32 mm	13,5	0,11	1 × Tee	0,35	1,5	0,04	2,3	22,7	1,7	21,0

^a Although Q_p from table H.2 is 37 L/min, assume both bath mixers are operating together. (See note 2 in table H.2.)
^b Length and friction loss is negligible.
^c Obtain the value of k^* from the manufacturer.
^d Residual head upstream of the pressure control valve.
^e Residual head downstream of the pressure control valve, assuming a 400 kPa rated unit.

Table H.4 — Sizing of the service pipe for a dwelling house (approach 2)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pipe	ΣQ L/min	Q_p L/min	Pipe material pressure class and nominal diameter	Pipe length m	Pipe friction loss h_f m/m	Secondary energy loss				Total head loss (5) × (6) + 10 m	Available head m	Difference in ground level m	Net residual head m, min.
						Fittings	k^* (see table 18)	V m/s	$\frac{k^*V^2}{2g}$ m				
Communication	172	50 ^a	HDPE (class 10) 25 mm	11,6	0,35	1 × Sudden contraction	0,5	2,5	0,16	4,2	70	Nil	65,8
Service from communication pipe to pressure control valve	172	50 ^a	Below ground: HDPE (class 10) 25 mm	1,50	0,35	2 × 90° elbows 2 × Gate valve pipe to PCV	2,00 0,12	2,5 2,5	0,64 0,04				
			Above ground: Copper (class 3) 25 mm	b	b	1 × strainer 1 × meter (size 3) ^c	5,00 18,8	2,5 2,5	1,59 6,00	8,8	57,0	Nil	57,0 ^d 25 ^e
Service from pressure control valve to house	172	50 ^a	Above ground: Copper (class 3) 22 mm	b	b	2 × 90° elbows 2 × gate valve 1 × Tee	2,00 0,12 0,35	2,5 2,5 2,5	0,64 0,04 0,11	5,5	19,5	1,7	17,8
			Below ground: HDPE (class 10) 32 mm	13,5	0,35								

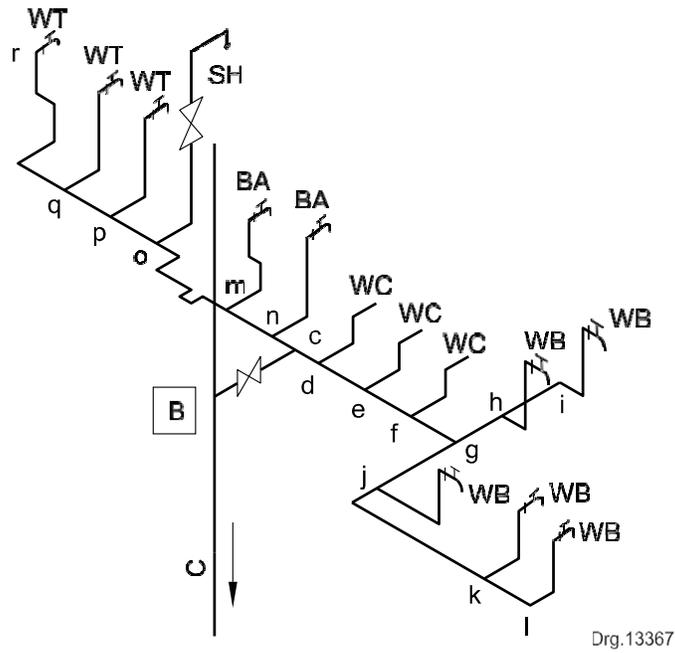
^a Although Q_p from table H.2 is 37 L/min, assume both bath mixers are operating together. (See note 2 in table H.2.)
^b Length and friction loss is negligible.
^c Obtain the value of k^* from the manufacturer.
^d Residual head upstream of the pressure control valve.
^e Residual head downstream of the pressure control valve, assuming a 400 kPa rated unit.



NOTE 1 See table H.7 for the sizing of the cold water dropper main.

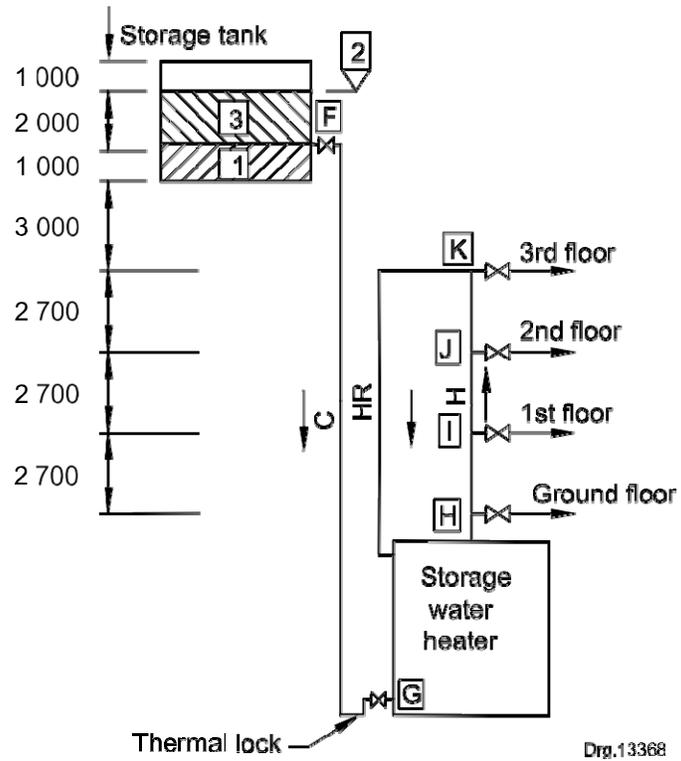
NOTE 2 For elements such as the numbering of nodes, see 7.6.1.4.

Figure H.4 — Schematic arrangement of cold water dropper main



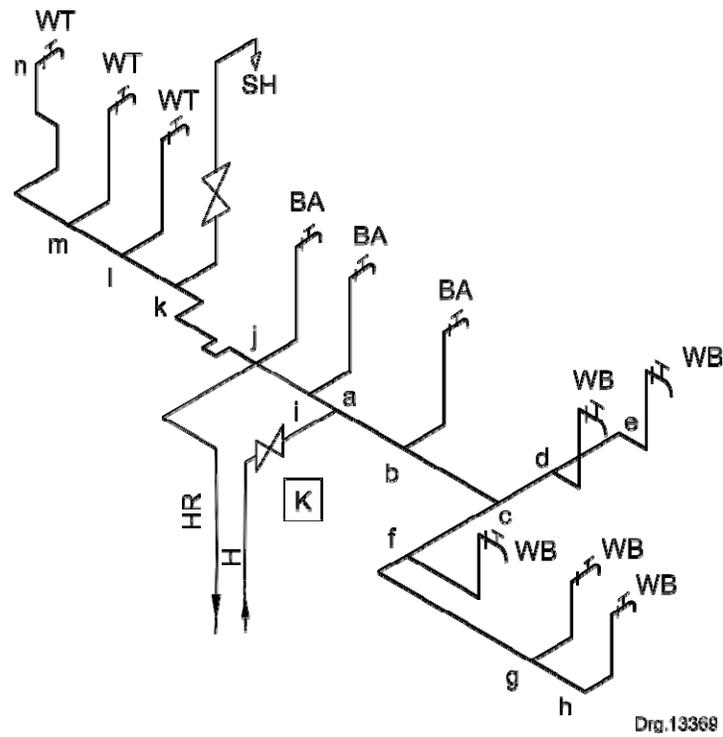
NOTE For elements such as the numbering of nodes, see 7.6.1.4.

Figure H.5 — Schematic arrangement of cold water supply system in third floor ablution facility



NOTE For elements such as the numbering of nodes, see 7.6.1.4.

Figure H.6 — Schematic arrangement of hot water mains



NOTE For elements such as the numbering of nodes, see 7.6.1.4.

Figure H.7 — Schematic arrangement of hot water installation in third floor ablution facility

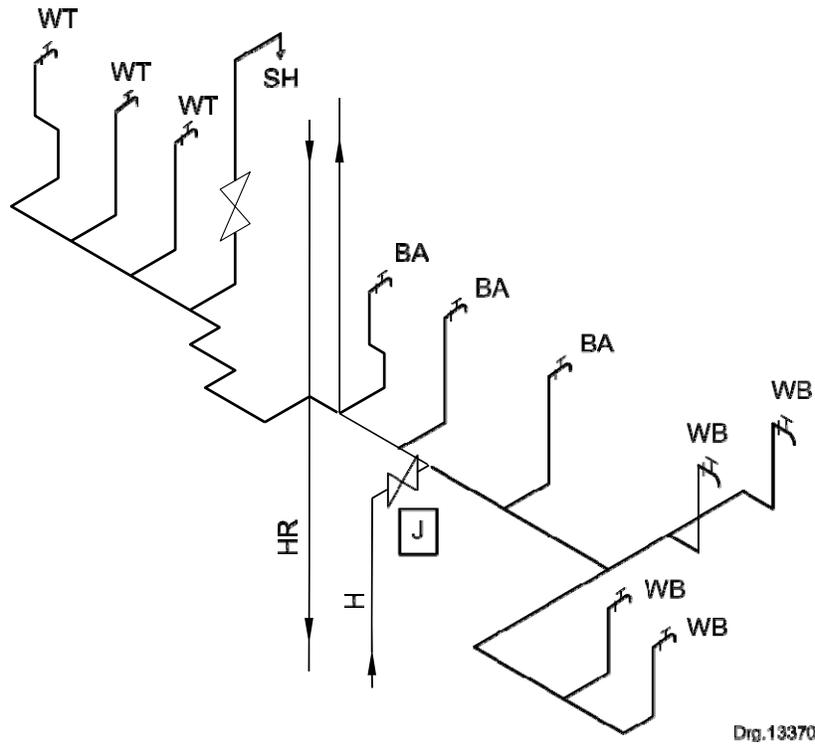


Figure H.8 — Schematic arrangement of hot water installation on second floor ablution facility

Table H.5 — Probable demand in branch pipe at each floor (cold water)

1	2	3	4
Fixture/Fitting	Number	Design flow rate per tap or fitting (see table 4)	Maximum demand Q
		L/min	L/min
Wash trough (20 mm taps – aerated outlet)	3	20	60
Showerhead (standard)	1	15	15
Bath (20 mm taps – plain outlet)	3	25	75
WC (float valve)	3	5	15
Wash-hand basin (15 mm taps – plain outlet)	5	10	50
			Total max. demand: $\Sigma Q = 215$
NOTE Probable maximum demand $Q_p = (\Sigma Q)0,8 = 73$ L/min.			

Table H.6 — Probable demand in branch pipe at each floor (hot water)

1	2	3	4
Fixture/Fitting	Number	Design flow rate per tap or fitting (see table 4)	Maximum demand Q
		L/min	L/min
Wash trough (20 mm taps – aerated outlet)	3	20	60
Showerhead (standard)	1	15	15
Bath (20 mm taps – plain outlet)	3	25	75
Wash-hand basin (15 mm taps – plain outlet)	5	10	50
			Total max. demand: $\Sigma Q = 200$
NOTE Probable maximum demand $Q_p = (\Sigma Q)0,8 = 69$ L/min.			

H.3.3 Sizing procedures

H.3.3.1 From table H.7, the residual head at B is 5,05 m. This appears to be sufficient to supply the cold water terminal fittings in the third floor ablution areas.

H.3.3.2 The next step is to size the cold water pipes on the third floor. Because the wash trough taps are large (20 mm) and the showerhead is elevated above the floor, these fittings are critical and should be investigated first. The pipes are sized as shown in table H.8.

H.3.3.3 From table H.8, the required residual head at B is 5,15 m, whereas the available residual head at B (table H.7) is 5,05 m. The actual residual head at the showerhead during peak demand is therefore 0,10 m less than the required 2,00 m, i.e. 1,90 m, which is within acceptable limits. The pipe sizes can be reduced for the lower floors where the available residual head is greater.

H.3.3.4 The sizing procedure for the cold water dropper main that supplies the water heater and the hot water riser main is given in table H.9.

H.3.3.5 From table H.9, the residual head at K (see figure H.7) is 5,21 m.

H.3.3.6 The next step is to size the hot water pipes on the third floor. Because of the restriction on the length of dead legs (see clause 7), a preliminary calculation of the pipe volume necessitated a portion of the piping (a to j) to be included in the circulating loop (see figure H.7).

The hot water pipes are sized as shown in table H.10, starting with the shower, which is a critical point, and working back to the riser (point K).

H.3.3.7 From table H.10, the required residual head at K is 5,41 m, whereas the available residual head at K (table H.9) is 5,21 m. The actual residual head at the showerhead during peak demand is therefore 0,20 m less than the required 2,00 m, i.e. 1,80 m, which is just acceptable. The actual available head at a (see table H.10) is 4,74 m.

The remaining pipes are sized as further shown in table H.10, using the 4,74 m residual head at a (see table H.10).

The residual heads at the other three critical points: n, e and h (see table H.10), are 3,66 m, 4,41 m and 4,32 m respectively, which are adequate.

H.3.3.8 The design should now be checked for compliance with 7.7.1.3 in respect of the internal volume of dead legs. The calculation of the volumes is shown in table H.11.

The volume of the most critical dead leg (j – n) is less than the required limit of 4 L. This could not have been achieved if pipes a – i (35 mm diameter) and i – j (28 mm diameter) had been included in the dead leg.

Figure H.8 shows the routing of the main riser pipe in order to ensure that the dead-leg volume on the second floor does not exceed the required limit.

Table H.7 — Sizing cold water dropper main (see figure H.4)

1	2	3	4	5	6	7	8	9	10	11	12	13
Pipe	ΣQ L/min	Q_p L/min	Pipe material nominal diameter	Pipe length m	Pipe friction loss h_f m/m	Secondary energy loss				Total head loss (5) × (6) + 10 m	Static head m	Residual head (12 – 11) m
						Fittings	k^* (see table 18)	V m/s	$\frac{k^* V^2}{2g}$ m			
A – B	4 × 215 = 860	223	GMS (med) 50 mm	5,0	0,070	1 × Tank outlet 1 × Sluice valve 2 × 90° elbows 1 × Tee	1,00 0,12 2,00 1,20	1,65	0,60	0,95	6,00	5,05
B – C	3 × 215 = 645	177	GMS (med) 50 mm	2,7	0,047	1 × Tee	0,35	1,35	0,03	0,13 + (0,03 + 0,95) = 1,11	8,70	7,59
C – D	2 × 215 = 430	128	GMS (med) 40 mm	2,7	0,090	1 × Tee	0,35	1,60	0,05	0,24 + (0,05 + 1,11) = 1,40	11,40	10,00
D – E	215	73	GMS (med) 32 mm	2,7	0,060	1 × 90° elbow	1,00	1,20	0,07	0,16 + (0,07 + 1,40) = 1,63	14,10	12,47

NOTE Obtain the value of k^* from the manufacturer.

Table H.8 — Sizing of piping in ablution area (cold water — 3rd floor) (see figure H.5)

1	2	3	4	5	6	7	8	9	10	11	12
Pipe	ΣQ L/min	Q_p L/min	Pipe material, pressure class and nominal diameter	Pipe length m	Pipe friction loss h_f m/m	Secondary energy loss				Total head loss (5) × (6) + 10 m	Residual head required m
						Fittings	k^* (see table 18)	V m/s	$\frac{k^* V^2}{2g}$ m		
r – q	20	20	GMS (med) 20	b	b						
q – p	40	40	GMS (med) 20	b	b						
p – o	60	40 ^a	GMS (med) 20	b	b						
o – SH	15	15	GMS (med) 20	3,0	0,057	1 × Tee 2 × 90° elbows 1 × Stopcock	1,20 2,00 10,0	0,75	0,38	0,55	2,00 ^c (at SH) 4,55 ^d (at O)
n – o	75	40 ^a	GMS (med) 32	2,5	0,022	1 × Tee 6 × 90° elbows	0,35 6,00	0,70	0,16	0,22	4,77
m – n	100	40	GMS (med) 32	1,8	0,022	1 × Tee	0,35	0,70	0,01	0,05	4,82
b – m	125	48	GMS (med) 32	1,0	0,029	1 × Tee	0,35	0,80	0,01	0,04	4,86
B – b	215	73	GMS (med) 32	1,0	0,070	2 × Tees 1 × Gate valve	2,40 0,12	1,30	0,22	0,29	5,15 (at B)

NOTE Obtain the value of k^* from the manufacturer.

^a Q_p maintained at 40 L/min until $Q_p = 0,8$ exceeds 40 L/min.
^b Length and friction loss is negligible.
^c Requires 2,00 m residual head at showerhead which is the most critical fitting.
^d Required residual head at o (see figure H.5), is the height of showerhead above 0 (= 2,00 m) plus required residual head at SH (= 2,00 m), plus head loss in pipe o-SH.

Table H.9 — Sizing cold water supply main (see F to G in figure H.6) and hot water riser main (see H to K in figure H.6)

1	2	3	4	5	6	7	8	9	10	11	12	13
Pipe	ΣQ L/min	Q_p L/min	Pipe material nominal diameter	Pipe length m	Pipe friction loss h_f m/m	Secondary energy loss				Total head loss (5) × (6) + 10 m	Static head m	Residual head (12 – 11) m
						Fittings	k^* (see table 18)	V m/s	$\frac{k^* V^2}{2g}$ m			
F – G	4 × 200 = 800	210	GMS (med) 65 mm	18,3	0,018	1 × Tank outlet 1 × Sluice valve 4 × 90° elbows 1 × Sudden enlargement	1,00 0,12 4,00 1,00	0,95	0,20	(0,33 + 0,28 = 0,61)		
H – K	4 × 200 = 800	210	Copper (class 0) 76 mm	8,6	0,01	1 × Sudden contraction 3 × Tees (inline) 1 × Tee (line to branch)	1,05 0,80	0,80	0,08	(0,09 + 0,09 + 0,61) = 0,79	6,00	5,21

NOTE Obtain the value of k^* from the manufacturer.

Table H.10 — Sizing of piping in ablution (hot water – 3rd floor) (figure H.7)

1	2	3	4	5	6	7	8	9	10	11	12
Pipe	ΣQ L/min	Q_p L/min	Nominal pipe diameter mm	Pipe length m	Pipe friction loss h_f m/m	Secondary energy loss				Total head loss (5) × (6) + 10 m	Residual head required m
						Fittings	k^* (see table 18)	V m/s	$\frac{k^* V^2}{2g}$ m		
m – n	20	20	22	2,5	0,075	5 × 90° elbows	5,00	1,05	0,28	0,47	3,66 (at n)
l – m	40	40	28	1,0	0,073	1 × Tee	0,35	1,2	0,03	0,10	4,13
k – l	60	40 ^a	28	1,2	0,073	1 × Tee	0,35	1,2	0,03	0,11	4,23
k – SH	15	15	22	3,0	0,043	1 × Tee ^b 2 × 90° elbows 1 × Stopcock	1,20 2,00 10,0	0,75	0,38	0,51	2,00 ^c (at SH) 4,51 ^d (at k) Actual 4,74
j – k	75	40 ^a	28	2,5	0,07	1 × Tee 6 × 90° elbows	0,35 6,00	1,2	0,47	0,64	5,15 (at j)
i – j	100	40	28	1,8	0,07	1 × Tee	0,35	1,2	0,02	0,15	5,30 (at i)
a – l	125	48	35	1,0	0,034	1 × Tee ^b	1,20	0,9	0,05	0,08	5,38 (at a) Actual 7,74
K – a	200	69	42	1,0	0,028	1 × Gate valve	0,12	0,95	0,01	0,03	5,41 (at K) Actual 5,22
a – b	75	32	22	0,3	0,17	1 × Tee	0,35	1,65	0,05	0,10	5,28
b – c	50	23	22	1,1	0,095	1 × Tee	0,35	1,18	0,02	0,13	5,15 (at c)
c – d	20	20	22	0,3	0,075	1 × Tee ^b	1,20	1,05	0,07	0,09	5,06
d – e	10	10	15 15	3,0	0,14	1 × Tee 3 × 90° elbows	0,35 3,00	1,15	0,23	0,65	4,41 (at e)
c – f	30	20	22	0,5	0,075	1 × Tee	1,35	1,05	0,02	0,06	5,00
f – g	20	20	22	1,8	0,075	1 × 90° elbow	0,35	1,05	0,08	0,21	4,79
g – h	10	10	15	1,9	0,14	3 × 90° elbows	3,00	1,15	0,20	0,47	4,32 (at h)

^a Q_p maintained at 40 L/min until Q_p 0,8 exceeds 40 L/min.
^b Line to branch to line sharp-edge tee.
^c Requires 2 m residual head at showerhead which is the most critical fitting.
^d Required residual head at k^* is the height of showerhead above k^* (= 2 m) plus required residual head at SH (= 2 m) plus head loss in pipe K-SH.

Table H.11 — Internal volume of dead legs in pipes
(see figure H.7 and table H.10)

Amdt 2

1	2	3	4
Pipe	Length m	Diameter and type of pipe mm	Internal volume L
j – m m – n	4,7 2,5	28 Cu 22 Cu	2,6 0,8
Total for j – n			3,4
a – g g – h	3,7 1,9	22 Cu 15 Cu	1,2 0,3
Total for a – h			1,5

H.4 Determining hot water replenishment/storage capacities, using graphs

H.4.1 Design criteria

Determine the required water heater size for a 300-bed women students' hostel using the following criteria:

- storage system to have a minimum replenishment rate;
- storage system to have a replenishment rate of 2,6 mL/s per student; and
- an additional requirement of a cafeteria, to serve a maximum of 300 meals/h with a minimum replenishment rate combined with the information given in (a), and a replenishment rate of 1,1 mL/s/max. meals/h, combined with the information given in (b).

H.4.2 Solution

The minimum replenishment rate from figure E.15 for women's hostels is approximately 1,2 mL/s/student, giving a total of 360 mL/s. The storage required is 45 L/student or 13 500 L of storage. The necessary tank size on a 70 % net usable basis is 19 300 L.

NOTE Example based on ASHRAE Handbook (see note 1 to E.5).

The same curve shows storage of approximately 20 L/student at a replenishment of 2,6 mL/s/student or approximately 8 600 L of storage on a 70 % net usable basis, with a replenishment rate of 780 mL/s.

The additional requirement for a cafeteria with the storage replenishment capacities added to that for the hostel, can be determined from figure E.19.

In the case of the minimum replenishment rate, the cafeteria requires $0,47 \times 300 = 141$ mL/s replenishment rate and $28 \times 300 \times 1/0,7 = 12\,000$ L, additional storage. The entire building therefore requires 501 mL/s replenishment capacity and 31 300 L storage capacity.

With 1,1 mL/s replenishment rate per maximum meals per hour, the additional replenishment capacity required is 330 mL/s and the additional storage capacity required is $7,5 \times 300 \times 1/0,7 = 3\,214$ L.

Therefore, by combining 330 mL/s with the information given in H.4.1(b), the entire building requires 1 110 mL/s replenishment capacity and 11 800 L storage capacity.

H.5 Example schedule of information

The position and size of every pipe and the location of every water fitting, storage tank, pump, overflow and item of equipment or plant that uses water as a heat exchange medium and is connected to the water installation should be shown on the drawings.

Further information required can be provided in the form of schedules on the drawings. Examples of such schedules are given in tables H.12 and H.13.

Table H.12 — Schedule of water pressures (to be shown on the drawing)

1	2
Type of installation	Working pressure kPa
General installation	800
Fire installation	900

Table H.13 — Schedule of elements such as pipes and fittings
(to be shown on the drawing)

1	2	3
Item	Reference No. ^a	Details
Pipes underground: Diameter < 75 mm Diameter < 75 mm		HDPE class 10 FC class 18
Pipes above ground: All diameters		Cu class 0
Water fittings (terminal): Wash-hand basin taps Bath taps Showers Water closets Bidets Urinals Sink taps Wash trough taps Float valves External taps	HB/1-6 BA/1-4 BA/4,5 SH/1-3 SH/4 WC/1-6 BT/1 UR/1-3 SK/1-4 WT/1-4 FV/1 ET/1,2	15 mm pillar tap (plain outlet) 20 mm pillar tap (aerated outlet) 15 mm pillar tap (plain outlet) 15 mm mixer taps and standard showerhead set 15 mm thermostatically controlled mixing valve and water-saving showerhead set Cistern 15 mm mixing valve Automatic shut-off flush valve for washdown type 15 mm bib tap (plain outlet) 20 mm bib tap (plain outlet) 15 mm (5 mm seat bore) 15 mm hose bib cock
Water fittings (in-line): Water heaters Pressure reducing valves Pressure control valves Level control valves	WH/1,2 PR/1-3 PC/1,2 LCV/1 ST/1	200 L SANS 151 type 3 fixed electric storage heater 400 kPa rated 3 kW element 30 kPa to 500 kPa rated adjustable. Set at 300 kPa outlet pressure 400 kPa rated 50 mm inlet diameter
Storage tanks	ST/2	6 000 L capacity 13 000 L capacity
Pumps	PU/1	Booster pump for fire installation
^a Reference number shown next to the item on a drawing.		

Annex I
(informative)

Friction loss curves and general tables

I.1 Properties of various substances and materials

I.1.1 Table I.1 gives certain properties of water.

Table I.1 — Properties of water

1	2	3	4	5	6
Temp. °C	Density kg/m ³	Specific weight ^a kN/m ³	Bulk modulus kN/mm ²	Kinematic viscosity mm ² /s	Vapour pressure kPa
0	1 000	9,81	2,00	1,79	0,62
15	1 000	9,81	2,15	1,14	1,72
20	999	9,80			
30	997	9,78			
50	990	9,71	2,29	0,56	11,7
100	960	9,42	2,07	0,30	101,2

^a Assuming $g = 9,81 \text{ m/s}^2$.

I.1.2 Table I.2 gives the heat properties of substances that are suitable for use as heat transferring mediums.

Table I.2 — Heat properties

1	2	3
Material	Specific heat kJ/kg °C	Volumetric specific heat kJ/m ³ °C
Water	4,2	415
Mercury	0,13	188
Alcohol	2,93	262
Petroleum	2,10	174
Glycol	3,24	355
Air	1,01	1,2
Iron ^a	0,46	355

^a Given for comparison purposes.

I.1.3 Table I.3 gives the calorific values of various fuels.

Table I.3 — Calorific values of various fuels

1	2	3	4
Type of fuel	Calorific value		Density kg/m ³
	MJ/kg	GJ/m ³	
Solid fuel:			
Anthracite	35	29	33
Bituminous coal	30	24	800
Bituminous coke	28	11	400
Oil:			
Domestic (35 s)	45	37	83
Light (200 s)	42,6	40	940
Town gas	–	0,02 ^a	–
Natural gas	–	0,04 ^a	–
Electricity	3,5 MJ/kWh		–

^a At standard temperature and pressure.

I.1.4 Table I.4 gives the expansion coefficients of various materials.

Table I.4 — Expansion coefficients of materials

1	2
Material	Coefficient of expansion °C
Mild steel	11,9.10-6
Copper	166,0.10-6
Water at 0 °C	-67,0.10-6
Water at 20 °C	206,0.10-6
Water at 40 °C	308,0.10-6
(Mean 0 °C to 40 °C)	192,0.10-6

I.2 Climatic data

I.2.1 Table I.5 gives the climatic data for selected cities in the Republic of South Africa.

NOTE Taken from the paper on *Heat-pump hot water systems at educational institutions* (see bibliography).

I.2.2 Table I.6 gives the mean daily hours of sunshine for selected cities for the months of January to December.

Table I.5 — Climatic data for selected cities

1	2	3	4	5	6	7	8
City	Average annual wet bulb temp. ^a °C	Equivalent low wet bulb ambient temperature at stated probabilities between stated hours °C				Expected temperature of water in mains ^b °C	
		1 % 0:00 – 24:00	1 % 09:00 – 21:00	2,5 % 0:00 – 24:00	2,5 % 09:00 – 21:00	Low	High
Alexander Bay	15,5	7,6	9,3	8,1	9,6	c	c
Beaufort West	13,5	1,3	4,0	2,3	5,0	13,0	32,5
Bloemfontein	12,0	-0,8	1,9	0,2	2,8	8,5	24,0
Cape Town	15,0	6,1	8,7	7,0	9,5	13,0	28,0
Durban	19,0	9,8	12,7	10,8	13,8	c	c
East London	16,5	c	c	c	c	15,0	24,0
George	c	7,4	9,8	7,6	9,9	c	c
Johannesburg	12,0	1,1	2,9	1,7	3,1	11,0	21,5
Kimberley	13,0	0,3	3,2	1,4	4,2	c	c
Port Elizabeth	15,5	8,4	10,8	9,2	11,6	15,0	24,5
Polokwane	14,0	4,3	6,7	5,1	7,6	c	c
Pretoria	14,0	2,7	5,5	3,6	6,3	12,0	24,5
Richards Bay	20,0	c	c	c	c	18,0	27,0
Upington	14,5	0,5	4,3	2,0	5,4	13,5	33,5
Windhoek	12,0	1,4	3,2	1,6	3,6	13,5	26,0

^a Based on weather data between the hours of 09:00 and 21:00 (13 h); information accuracy of ± 0,5 °C.
^b From the city mains supply at ± 0,5 °C.
^c Information not available.

Amdt 1

Table I.6 — Mean daily hours of sunshine for selected cities for the months of January to December

1	2	3	4	5	6	7	8	9	10	11	12	13
City	Mean daily sunshine h											
	Month											
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Alexander Bay	10,24	9,72	9,09	8,94	6,12	8,50	7,51	8,28	9,11	9,55	10,16	10,28
Bloemfontein ^a	9,79	9,24	8,52	8,80	8,77	8,74	5,72	6,42	7,16	8,87	9,85	11,10
Cape Town ^a	10,94	10,47	9,10	6,92	5,92	5,96	5,72	6,42	7,16	8,87	9,85	11,10
Durban ^a	6,49	6,74	6,17	6,83	7,40	6,94	6,87	6,91	5,83	5,24	5,75	5,97
Keetmanshoop	11,44	10,34	9,92	10,15	9,94	9,65	9,84	10,51	10,92	11,32	11,97	11,95
Kimberleya	9,69	9,48	8,87	8,96	8,64	8,82	9,05	9,71	9,67	9,70	10,20	10,54
Polokwane ^a	7,99	7,55	7,55	8,06	8,61	8,91	8,63	8,64	8,72	8,73	8,23	8,13
Port Elizabeth	8,55	8,23	7,51	7,57	6,91	6,85	7,15	7,61	7,44	7,67	8,29	8,93
Pretoria	8,35	8,08	7,68	8,69	9,27	9,23	9,36	9,91	9,26	8,90	9,02	9,05
Upington	11,52	10,51	9,53	9,67	9,18	8,97	9,10	10,00	10,61	10,92	11,63	11,65
Windhoek	9,26	8,98	9,05	9,09	10,04	10,25	10,50	11,01	10,75	10,30	9,85	9,21

^a Airport.

Amdt 1

I.2.3 Table I.7 gives the mean daily total available solar radiation on a horizontal surface.

Table I.7 — Mean daily total available solar irradiation on horizontal surfaces

1	2	3	4	5	6	7	8	9	10	11	12	13
Station	Mean daily total available solar radiation on horizontal surfaces MJ/m ²											
	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Alexander Bay	30,2	27,4	23,2	18,6	15,1	13,0	13,2	16,7	21,4	25,8	29,6	30,4
Bloemfontein	26,9	24,7	21,1	17,7	14,7	13,4	14,4	17,8	21,9	24,7	27,4	28,6
Cape Town	29,0	25,7	21,5	15,2	10,8	9,1	9,7	12,5	17,5	22,4	27,3	29,1
Durban	20,6	19,8	17,9	14,6	11,9	11,1	11,6	13,6	15,4	17,4	18,8	20,9
Grootfontein – Cape	28,3	23,3	20,6	16,8	13,6	12,2	13,4	16,4	21,0	25,0	27,7	30,0
Keetmanshoop	30,0	27,6	23,7	20,7	17,2	15,4	16,3	19,3	23,7	27,3	30,5	31,3
Kimberley	26,5	25,5	20,9	17,7	14,2	12,6	13,7	17,7	21,6	25,7	27,8	28,9
Maun	23,1	21,2	20,1	18,7	17,3	16,0	17,0	20,0	22,6	23,0	23,7	22,6
Nelspruit	20,6	22,2	20,6	16,4	15,0	14,4	14,7	16,7	18,6	19,7	19,0	20,8
Polokwane	25,6	23,3	21,9	18,8	16,8	15,4	16,4	18,6	21,5	25,5	25,4	25,7
Port Elizabeth	25,0	22,9	18,5	14,2	11,1	9,7	10,5	13,1	16,8	20,9	24,7	25,9
Pretoria – Forum	24,2	22,8	20,3	16,7	15,2	13,9	14,9	18,0	21,7	22,9	23,9	25,2
Pretoria – Lynnwood	23,7	22,0	20,1	17,6	15,1	14,2	15,0	18,1	20,7	22,1	23,7	23,9
Roodeplaat	24,7	23,1	20,8	16,8	15,2	13,8	14,9	17,8	21,3	23,1	24,1	25,2
Upington	25,9	26,2	22,1	18,3	15,2	13,7	14,4	17,8	21,7	25,5	29,0	27,1
Windhoek	25,7	24,1	21,8	20,7	13,9	17,3	18,5	21,2	24,3	26,1	27,3	27,8

Amdt 1

I.3 Friction loss curves

Friction loss (hydraulic gradient) versus flow rate (flow velocity) graphs are given for pipes of the following materials:

- a) figure I.1: hard-drawn copper pipes, class 0 (SANS 460);
- b) figure I.2: heavy-wall copper pipes, class 3 (SANS 460);
- c) figure I.3: galvanized steel pipes, medium class (SANS 62-1);
- d) figure I.4: PVC-U pipes, class 4 (SANS 966-1);
- e) figure I.5: PVC-U pipes, class 6 (SANS 966-1);
- f) figure I.6: PVC-U pipes, class 9 (SANS 966-1);
- g) figure I.7: PVC-U pipes, class 12 (SANS 966-1);
- h) figure I.8: PVC-U pipes, class 16 (SANS 966-1);
- i) figure I.9: PE pipes, 6,5 MPa PN 4 (SANS 4427-1, SANS 4427-2, SANS 4427-3 and SANS 4427-5);
- j) figure I.10: PE pipes, 6,5 MPa PN 6 (SANS 4427-1, SANS 4427-2, SANS 4427-3 and SANS 4427-5);
- k) figure I.11: PE pipes, 6,5 MPa PN 10 (SANS 4427-1, SANS 4427-2, SANS 4427-3 and SANS 4427-5);

l) figure I.12: PE pipes, 6,5 MPa PN 12.5 (SANS 4427-1, SANS 4427-2, SANS 4427-3 and SANS 4427-5); and

m) figure I.13: PE pipes, 6,5 MPa PN 16 (SANS 4427-1, SANS 4427-2, SANS 4427-3 and SANS 4427-5).

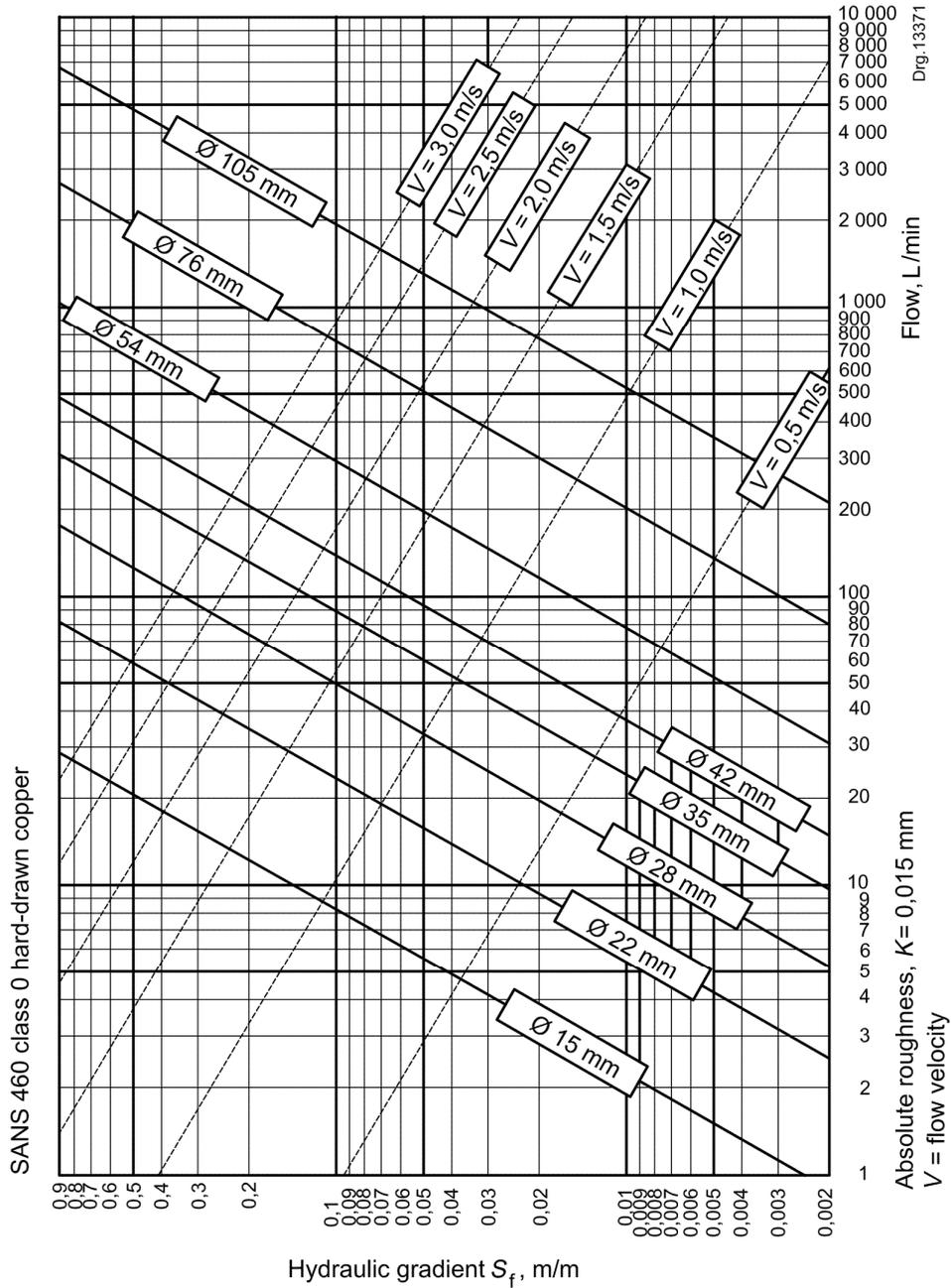


Figure I.1 — Friction losses for hard-drawn copper pipes that comply with SANS 460 class 0

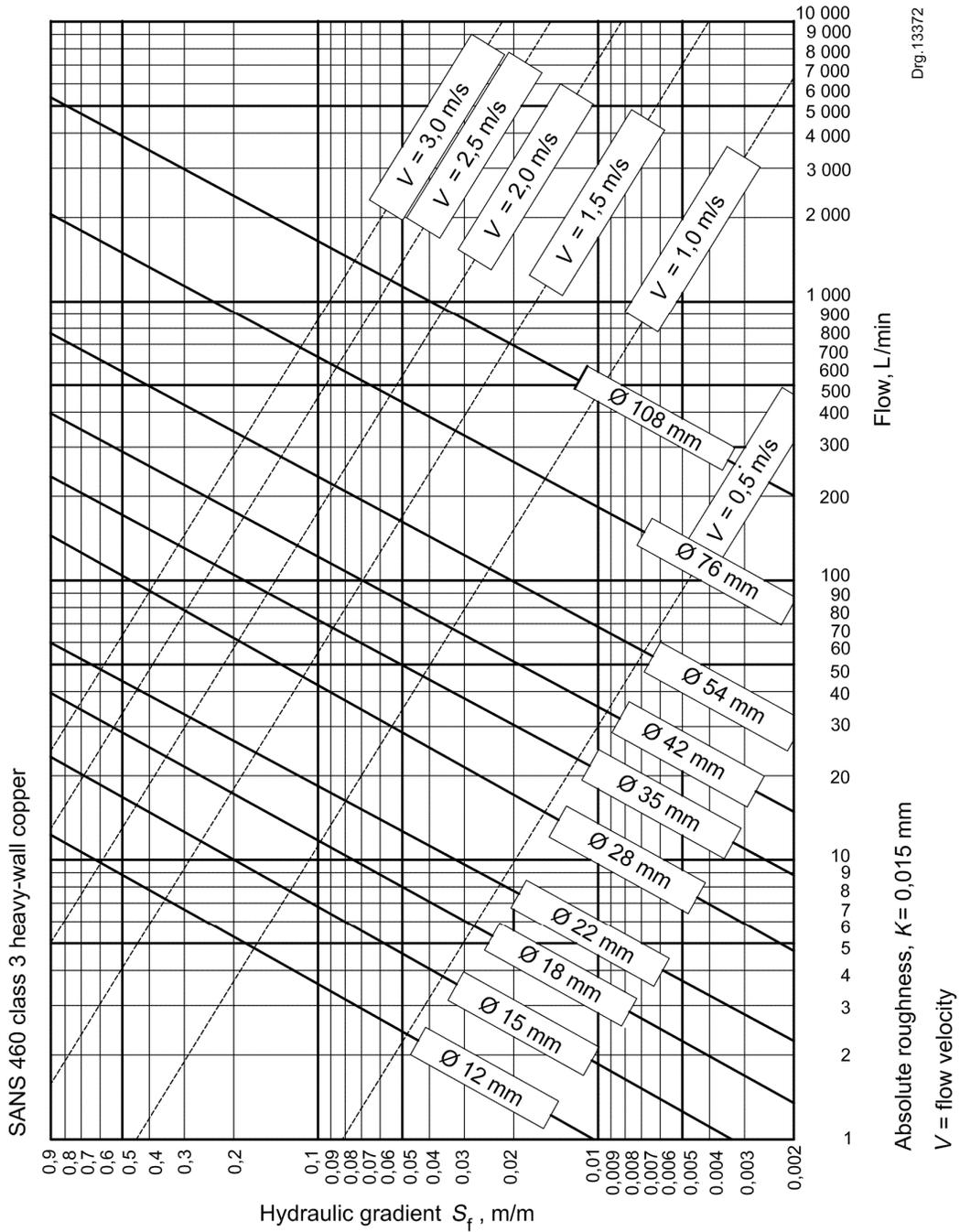


Figure I.2 — Friction losses for heavy-wall copper pipes that comply with SANS 460 class 3

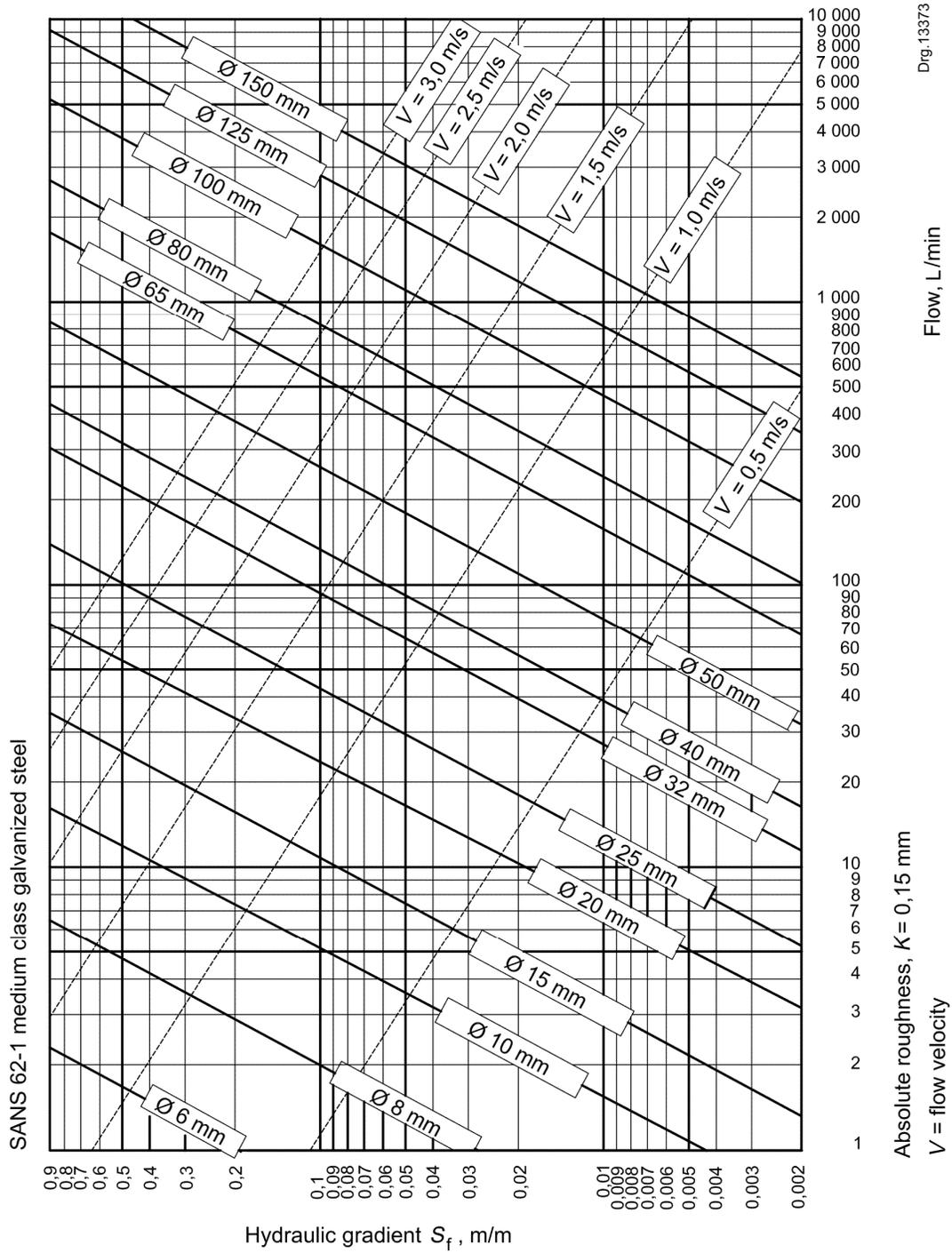


Figure I.3 — Friction losses for galvanized steel pipes that comply with SANS 62-1 medium class

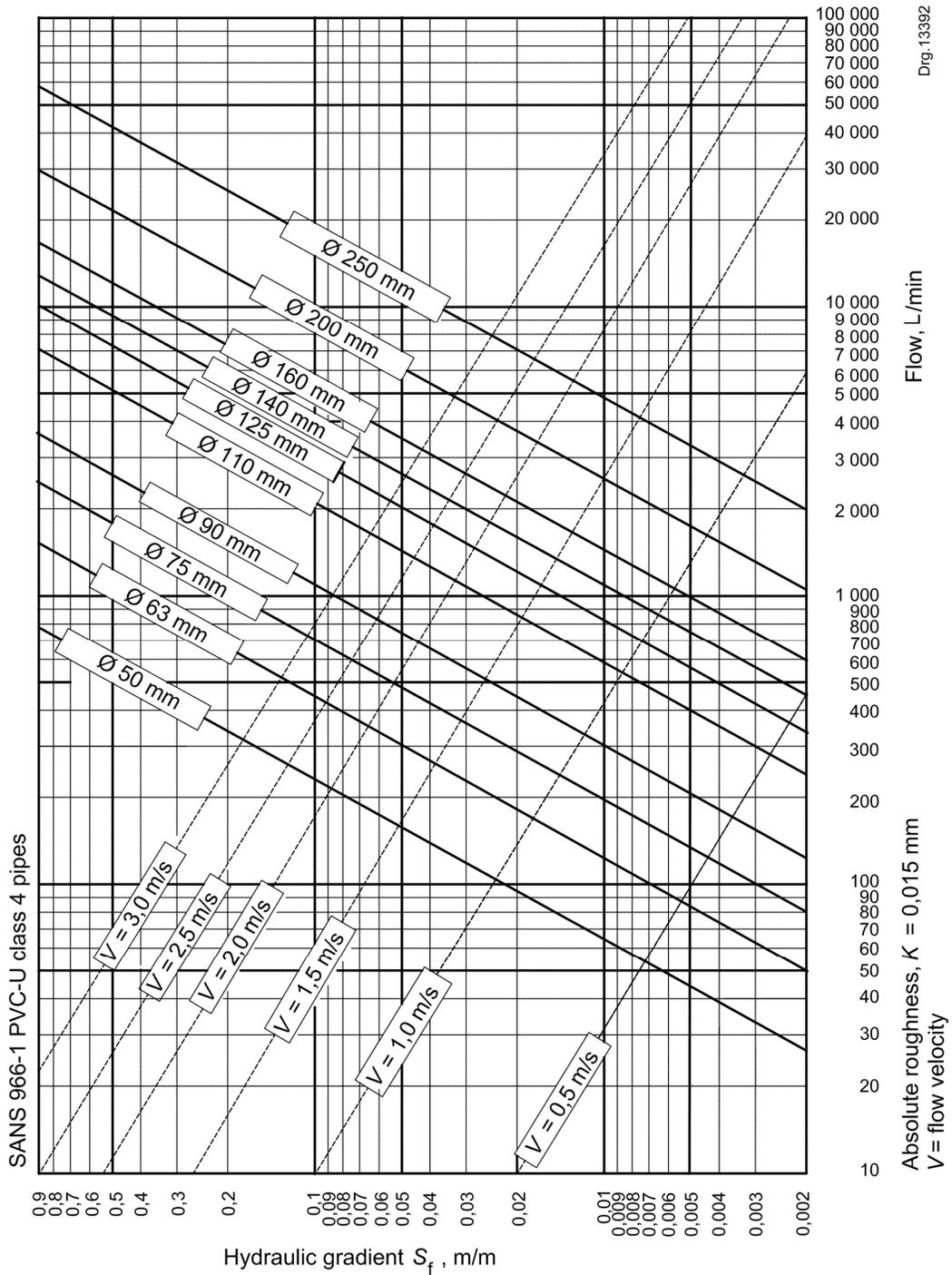


Figure I.4 — Friction losses for PVC-U class 4 pipes that comply with SANS 966-1

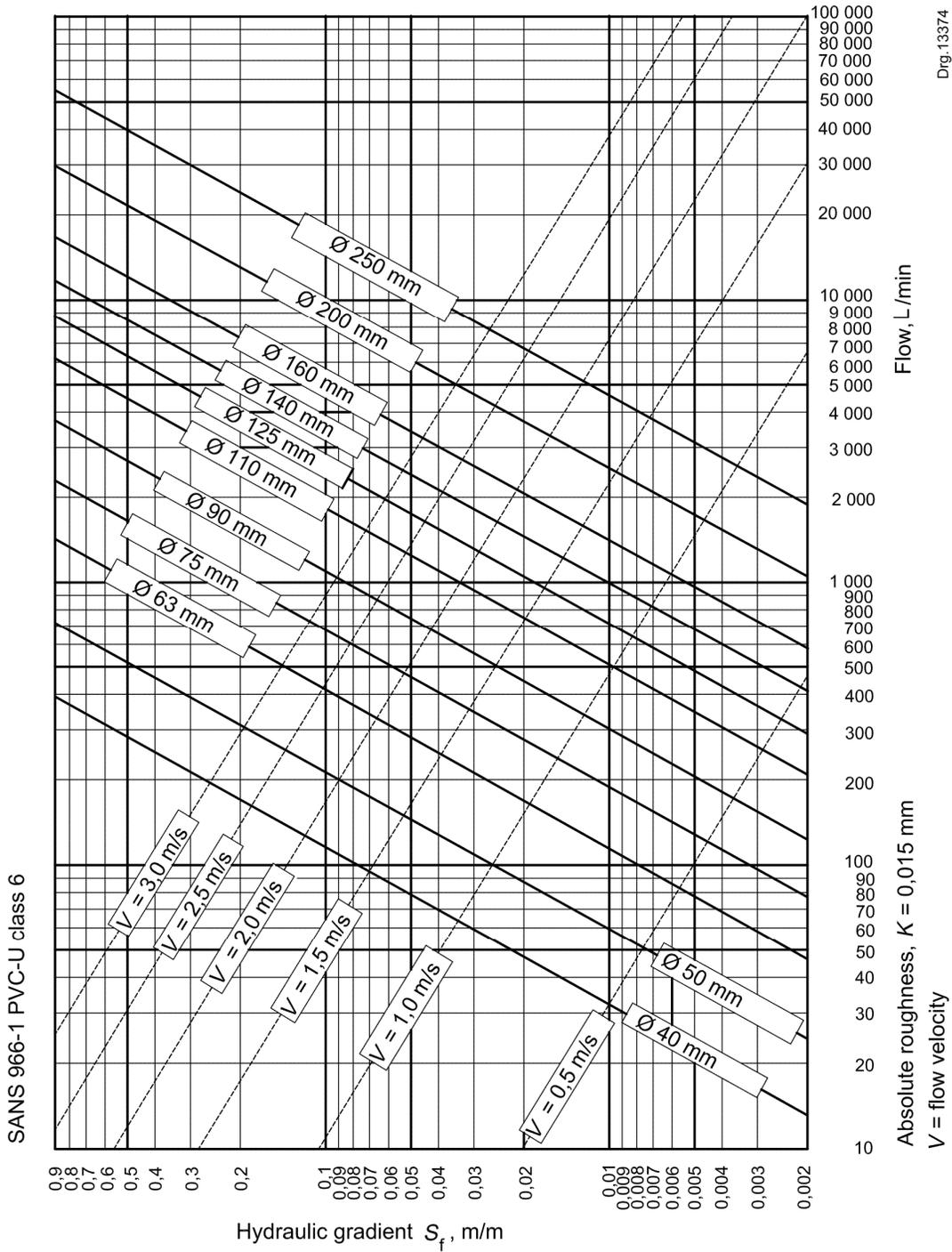


Figure I.5 — Friction losses for PVC-U class 6 pipes that comply with SANS 966-1

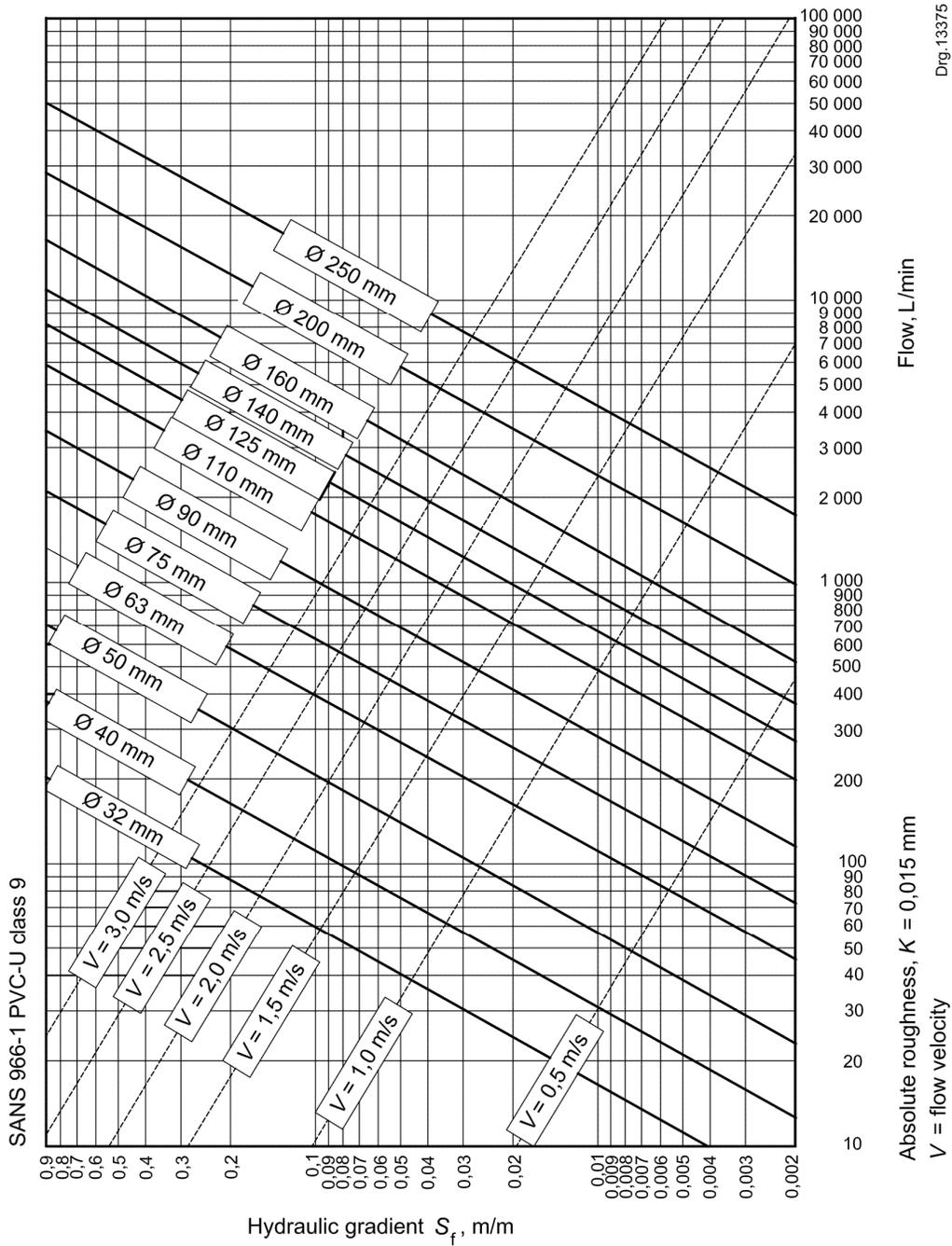


Figure I.6 — Friction losses for PVC-U class 9 pipes that comply with SANS 966-1

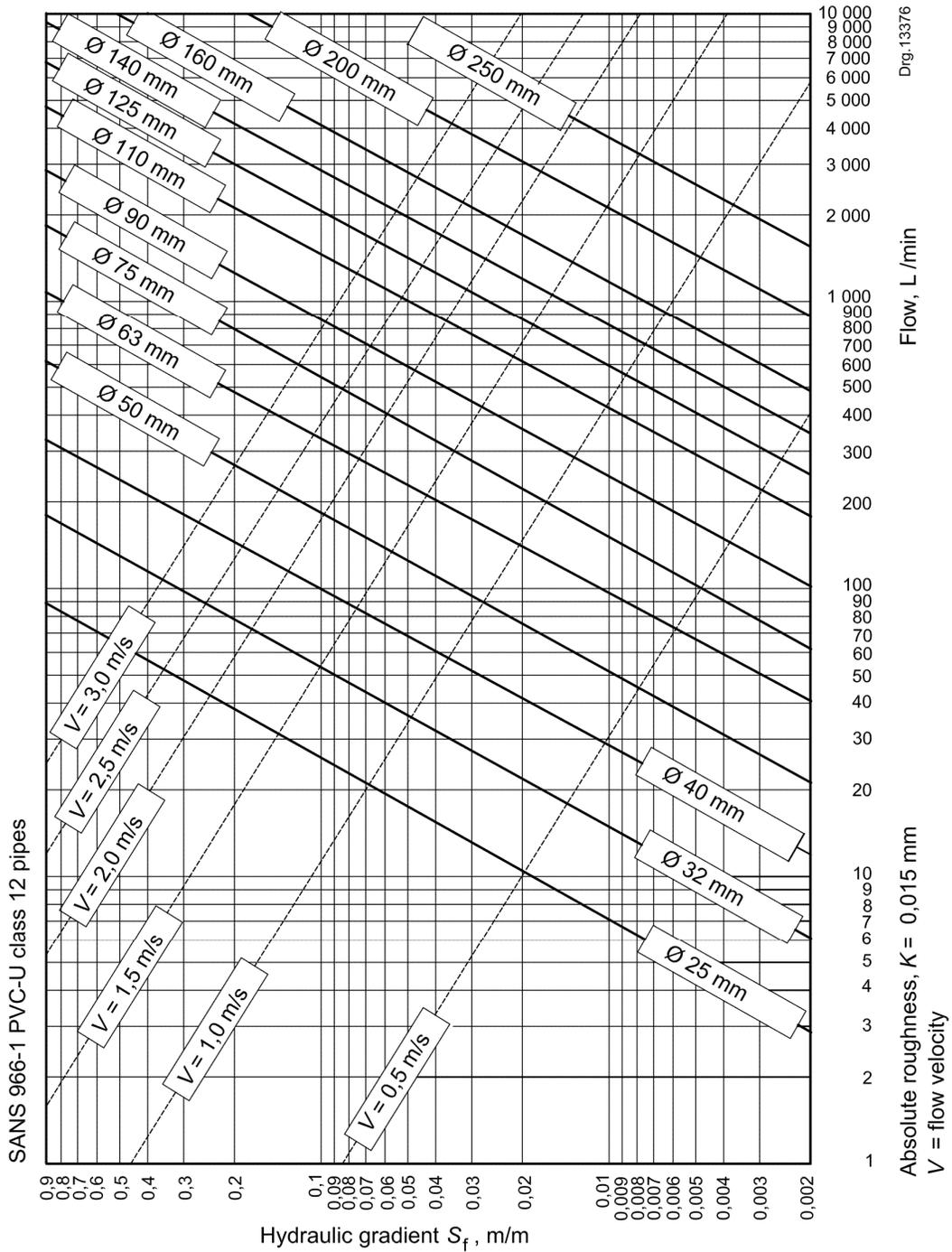


Figure I.7 — Friction losses for PVC-U class 12 pipes that comply with SANS 966-1

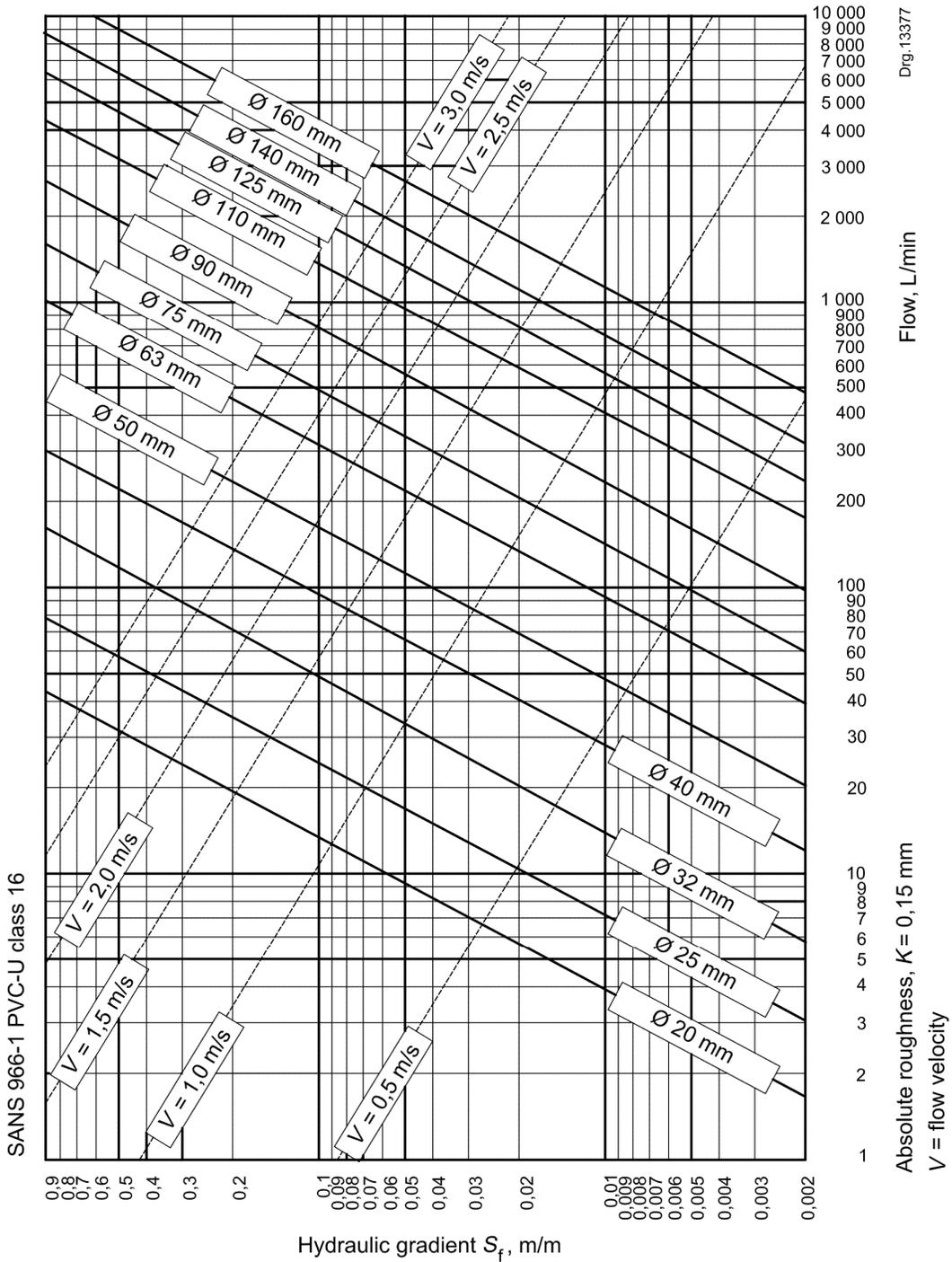


Figure I.8 — Friction losses for PVC-U class 16 pipes that comply with SANS 966-1

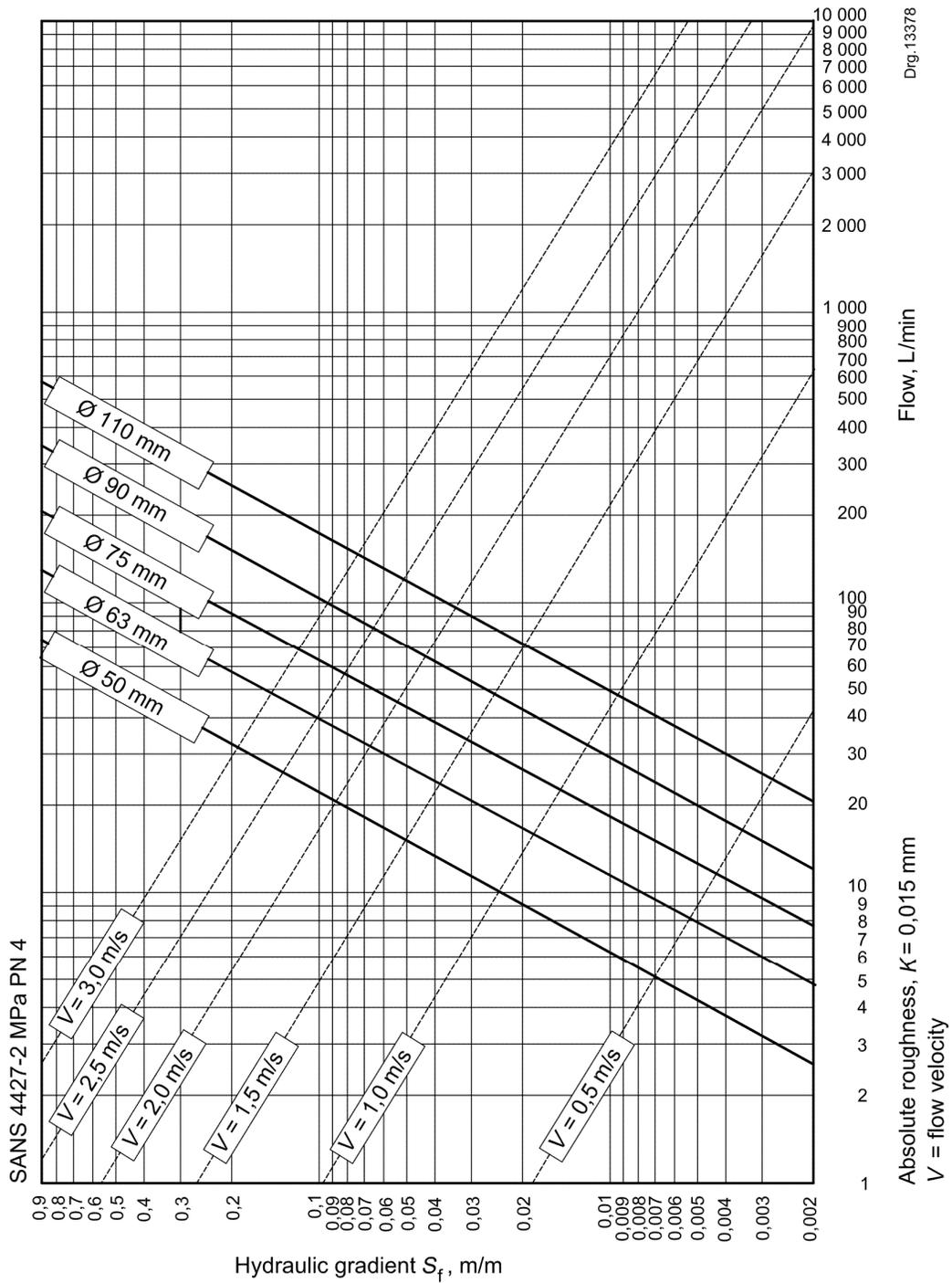


Figure I.9 — Friction losses for PN 4 polyethylene pipes that comply with SANS 4427-2

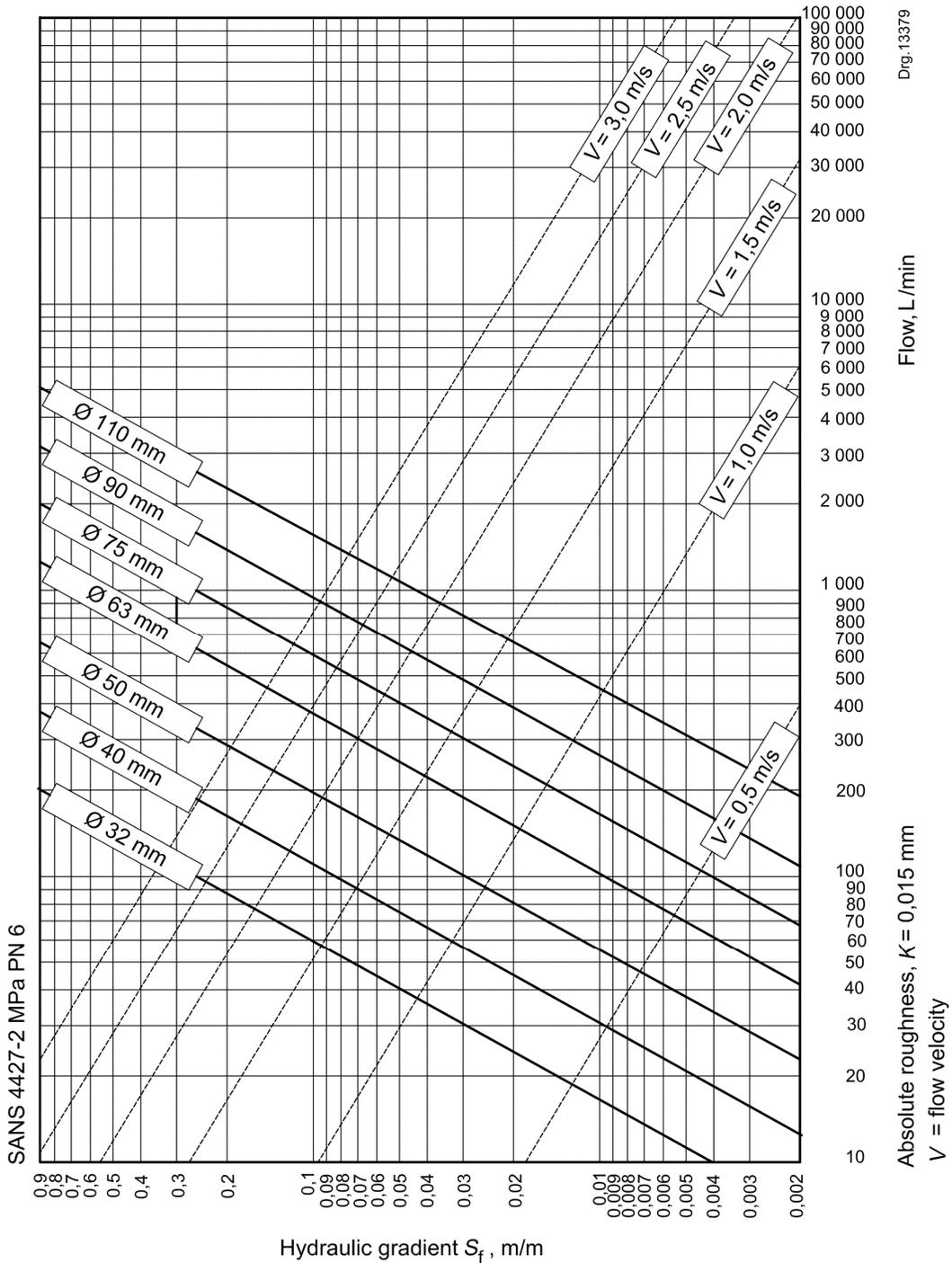


Figure I.10 — Friction losses for PN 6 polyethylene pipes that comply with SANS 4427-2

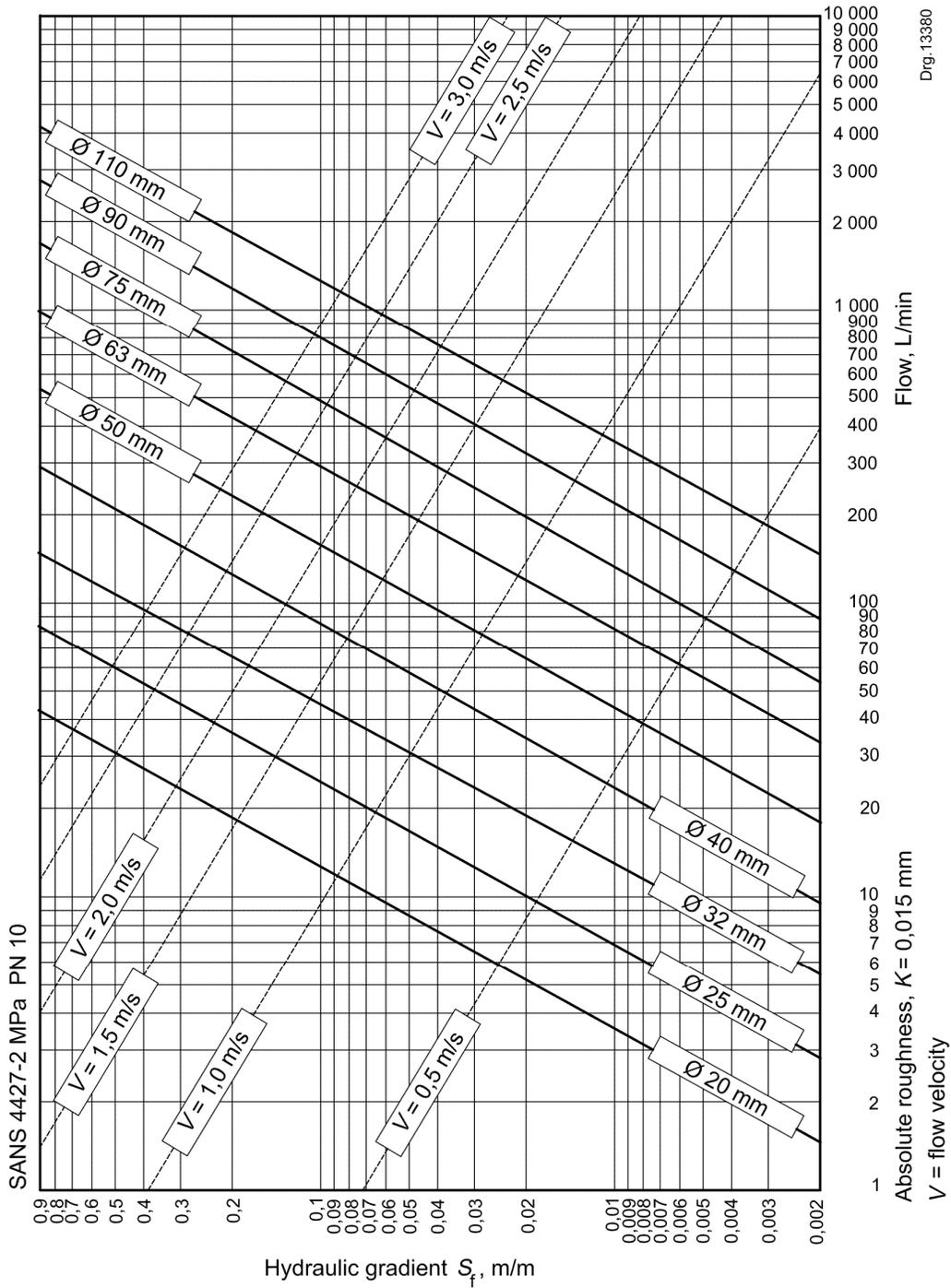


Figure I.11 — Friction losses for PN 10 polyethylene pipes that comply with SANS 4427-2

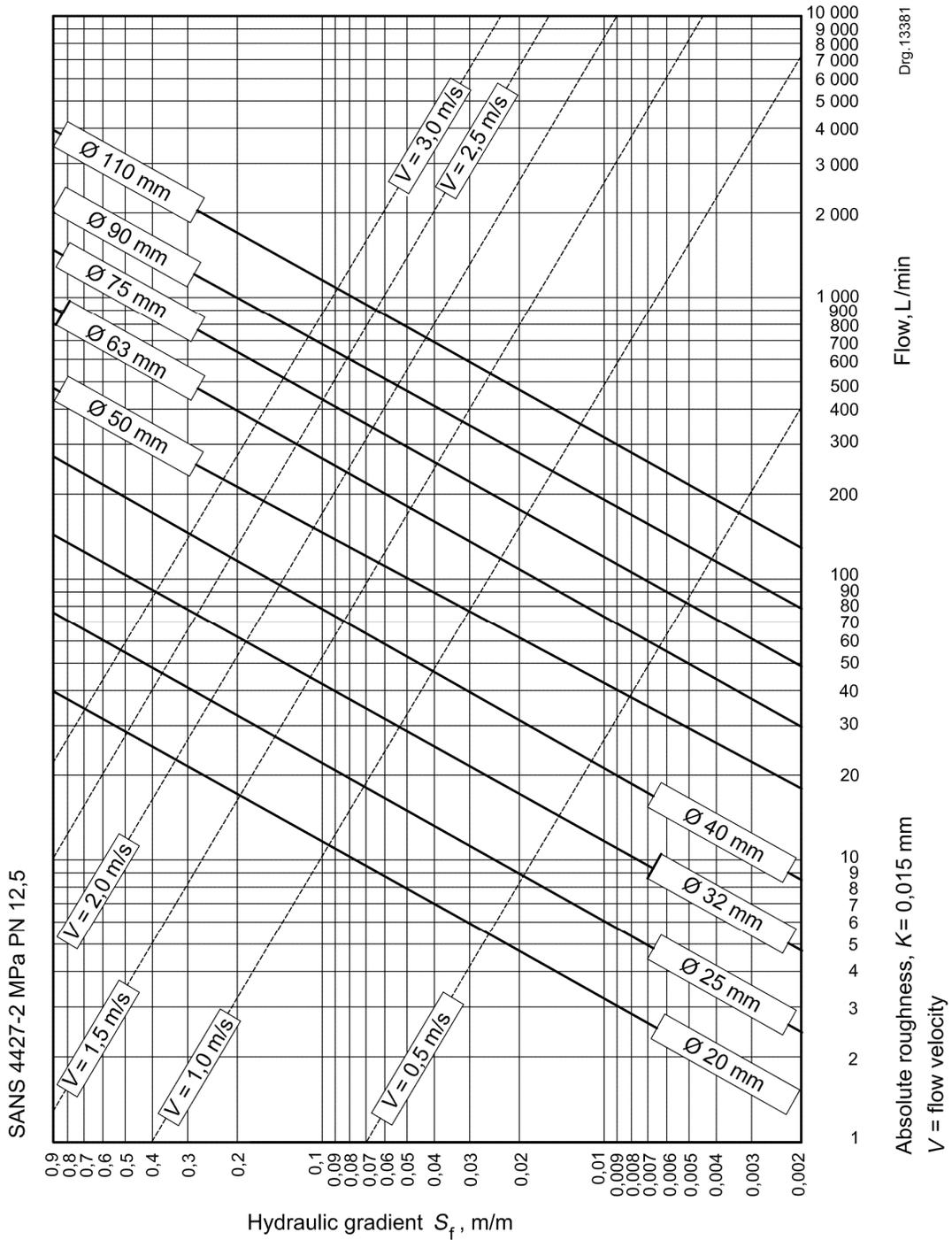


Figure I.12 — Friction losses for PN 12,5 polyethylene pipes that comply with SANS 4427-2

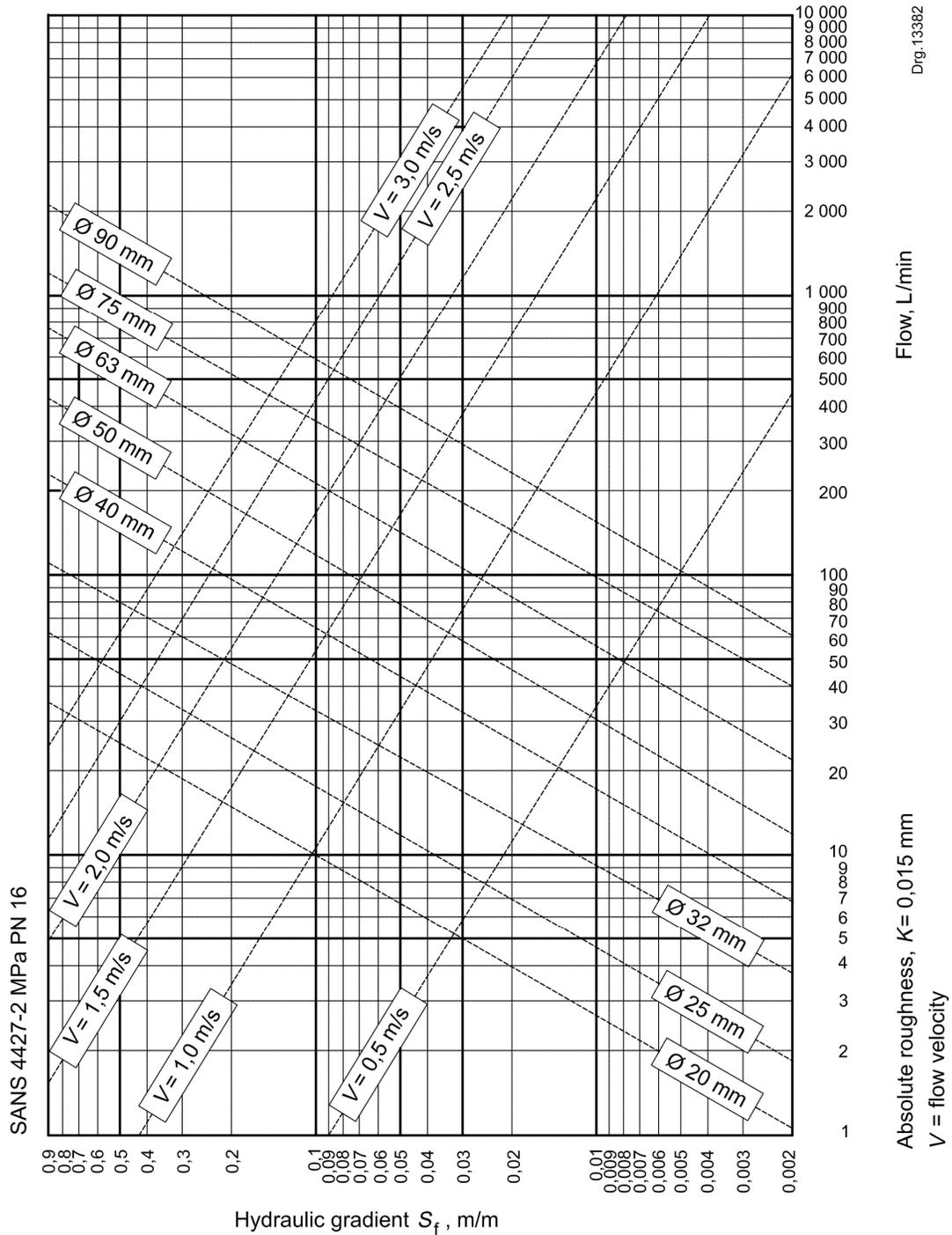


Figure I.13 — Friction losses for PN 16 polyethylene pipes that comply with SANS 4427-2

Annex J

Deleted by amendment No. 1.

Bibliography

Standards

~~ASTM E 96, Standard test methods for water vapour transmission of materials.~~

Amdt 2 |

ASTM C 692, *Standard test method for evaluating the influence of thermal insulations on external stress corrosion cracking tendency of austenitic stainless steel.*

BS 5422, *Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40 °C to +700 °C.*

BS 5970, *Code of practice for thermal insulation of pipework and equipment in the temperature range of -100 °C to +870 °C.*

BS 417-2, *Specification for galvanized low carbon steel cisterns, cistern lids, tanks and cylinders – Metric units.*

BS 1564, *Specification for pressed steel sectional rectangular tanks.*

SANS 24, *Soft solders.*

SANS 121/ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods.*

SANS 185, *Immersion-type heating units for electric appliances.*

SANS 191, *Cast steel gate valves.*

SANS 558, *Cast iron surface boxes and manhole and inspection covers and frames.*

SANS 676, *Reinforced concrete pressure pipes.*

SANS 710, *Acid-cored solders.*

SANS 975, *Prestressed concrete pipes.*

SANS 1117, *Plastics wrappings for the protection of steel pipelines.*

SANS 1130, *Fibre reinforcing material for pipe wrapping.*

SANS 1178, *The production of coated steel pipes using fibre reinforced bitumous materials.*

SANS 1190, *Malleable iron castings.*

SANS 1303-1, *Wrought copper alloys – Part 1: Chemical composition of copper-zinc alloys (non-leaded and leaded).*

SANS 1804-1, *Induction motors – Part 1: IEC requirements.*

SANS 1804-2, *Induction motors – Part 2: Low-voltage three-phase standard motors.*

SANS 10252-1:2018

Edition 3.2

SANS 1804-3, *Induction motors – Part 3: Low-voltage three-phase intermittently-rated wound-rotor motors.*

SANS 1804-4, *Induction motors – Part 4: Single-phase induction motors.*

SANS 10102-1, *The selection of pipes for buried pipelines – Part 1: General provisions.*

SANS 10102-2, *The selection of pipes for buried pipelines – Part 2: Rigid pipes.*

SANS 10177-5, *Fire testing of materials, components and elements used in buildings – Part 5: Non-combustibility at 750 °C of building materials.*

SANS 10243, *The manufacture and erection of timber trusses.*

Other publications

Ackers, P. *Charts for the hydraulic design of channels and pipes.* 1963. Hydraulics research paper No. 2, Hydraulics Research Station, Department of Scientific and Industrial Research, H.M.S.O. London: UK.

ASHRAE Handbook, published by the American Society of Heating, Refrigerating and Air-conditioning Engineers Inc.

Chartered Institution of Building Services Engineers (CIBSE). 1985. *The selection and application of heat pumps.* London: UK.

Colebrook, C.F. and White C.M. *The reduction of carrying capacity of pipes with age.* Journal of the Institution of Civil Engineers (UK), Volume 99. 1937/1938.

Gebhardt, D.S. 1973. *Plastics pipes for urban water supplies.* Municipal Engineer, July/August 1973.

Joint Acceptance Scheme for Water Installation Components (JASWIC) acceptance list.

Manual of British Water Engineering Practice. 1963, Vol. 11, W Heffer & Sons Limited. Cambridge: United Kingdom.

Nel, Van Wyk & Louw Inc. September 1986. Paper on *Heat-pump hot water systems at educational institutions.*

Plumbing services design guide. Published by the Institute of Plumbing: UK.

Williams, P.G. *Chlorination of small-scale water supplies.* Publication RW 924. Division for Water Research. CSIR: Pretoria.