

## **TECHNICAL SPECIFICATION**

### **AA PLUMBING AND DRAINAGE INSTALLATIONS**

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#### **AA 01 SCOPE**

This specification covers the general installation, repair and maintenance of plumbing and drainage installations, which include the following:

- (a) Rainwater disposal systems
- (b) Soil and wastewater drainage systems
- (c) Domestic water distribution and reticulation systems
- (d) Sanitary and brassware equipment
- (e) Fire water piped reticulation networks.

This specification shall form an integral part of the installation, repair and maintenance contract document, and shall be read in conjunction with the additional and particular specifications compiled as part of this document.

This specification shall act as a guideline to the Particular Specification and, in the event of any discrepancies between the Technical Specification and the Particular Specification, the latter shall take precedence.

#### **AA 02 STANDARD SPECIFICATIONS**

##### **AA 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES**

The latest edition, including all amendments up to date of tender, of the following specifications, publications and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof:

##### **AA 02.01.01 SABS Specifications and codes**

SABS 0254	-	The installation, maintenance, replacement and repair of fixed electric storage water heating systems
SABS 0400	-	The applications of building regulations
SABS 1200 DB	-	Earthworks (pipe trenches)
SABS 1200 LB	-	Bedding (pipes)
SABS 1200	-	Medium-pressure pipelines
SABS 1200 LD	-	Sewers
SABS 0252. Part 1	-	Water supply installations for buildings
SABS 0252. Part 2	-	Drainage installations for buildings

**AA 02.01.03    Occupational Health and Safety Act of 1993**

All regulations and statutory requirements as laid down in the latest edition of the Occupational Health and Safety Act, 1993 (Act no 85 of 1993) shall be adhered to.

**AA 02.01.04    Manufacturers' specifications, codes of practice and installation instructions**

All equipment and materials shall be installed, serviced and repaired strictly in accordance with the manufacturers' specifications, instructions and codes of practice.

**AA 02.01.05    Municipal regulations, laws and by-laws**

All municipal regulations, laws, by-laws and special requirements of the Local Authority shall be adhered to unless otherwise specified.

**AA 03                GENERAL REPAIRS AND MAINTENANCE**

The following specifications shall be adhered to unless otherwise specified in the Particular Specification.

**AA 03.01        GENERAL REPAIR AND INSTALLATION REQUIREMENTS**

- (a) All materials and equipment supplied and installed shall be new, high quality and designed and manufactured to the relevant specifications and suitable for providing efficient, reliable and trouble-free service.
- (b) All work shall be executed in a workman-like manner by qualified registered plumbers.
- (c) All equipment, component parts, fittings and materials supplied and/or installed, shall conform in respect of quality, manufacture, test and performance to the requirements of the applicable current SABS specifications and codes, except where otherwise specified or approved by the Engineer in writing.
- (d) All materials and workmanship which, in the opinion of the Engineer, are inferior to that specified for the work will be condemned. All condemned material and workmanship shall be replaced or rectified as directed and approved by the Engineer.
- (e) The Contractor shall submit a detailed list of the equipment and material to be used to the Engineer for approval before placing orders or commencing installation.
- (f) All new piping shall be installed and positioned so as not to impede on access routes, entrances and other services. The Contractor shall coordinate these new pipe routes taking other services and equipment into account.
- (g) All control equipment and serviceable items shall be installed and positioned so that they will be easily accessible and maintainable.
- (h) The Contractor shall make sure that all safety regulations and measures are applied and enforced during the repair and maintenance work to ensure the safety of the public and the User Client.
- (i) Repair and maintenance work shall be programmed in such a manner as to ensure the shortest possible downtime of any service and the least inconvenience to the User Client and the public. The Contractor shall make sure that the

necessary notifications and notices are timeously put into place for these activities.

**AA 03.02      GENERAL REQUIREMENTS FOR REPAIR AND INSTALLATION OF DOMESTIC WATER INSTALLATIONS**

- (a) All pipes are to be carefully examined for defects and flaws before installation and shall be neatly fitted. They shall be installed in such manner as to prevent the formation of air locks. Automatic air vents shall be installed on all high points of the installation.
- (b) The ends of all the pipes are to be clean, free from burrs, and rough edges, and joined together tightly. Where applicable such as with galvanised piping, an approved pipe jointing compound may be sparingly used with best quality hemp. All surplus or exposed hemp is to be thoroughly cleaned off joints before the painting of pipes. Pipes to be installed underground shall comply with the requirements of SABS 1200L and SABS 1200LB as far as bedding, excavation and backfilling are concerned.
- (c) All vertical pipes must be securely fixed with brackets and supports of approved type, into the wall and not more than 40 mm from the wall. These fixings must be strictly adhered to.
- (d) Pipes installed in service ducts and ceiling voids are to be perfectly plumbed and secured with approved brackets, fixed securely at distances not exceeding the specified distances and not more than 40 mm away from the face of the walls or soffits. Pipes must be free to move in the brackets. Pipes inside buildings and where specified shall be chased into walls, wrapped with building paper and properly secured and covered.
- (e) Pipes passing through walls and concrete floors are to be provided with suitable pipe sleeves extending 10 mm beyond finished floor or wall surfaces. All pipe fixings and throughways shall be free to allow movement for expansion and contraction. Any pipe fitting used to join a pipe which is rigidly secured by a structural element shall be securely anchored to prevent any stress developing between the fitting and the structural element.
- (f) Chromium or nickel-plated metal covering plates are to be provided and fixed securely to pipes passing through the ceilings and walls. This requirement is not applicable to concrete floors and ceilings.
- (g) Pipes passing through the ceilings or floors shall be offset from the wall to the front of the cornice with sufficient clearance to allow for the clear fixing of a ceiling plate. Pipes shall not be installed directly through the cornice. In multi-storey buildings where wall thickness varies, the same shall apply.
- (h) All offsets are to be evenly and symmetrically set, the offsets being as near to the ceiling as possible.
- (i) Pipes shall be installed in such a manner to allow for contraction and expansion.
- (j) During construction all pipe ends shall be kept plugged to prevent any ingress of dirt, rubble, etc.
- (k) Damages, chases, holes, etc, in brickwork, concrete and other finishes resulting from repair, replacement and service work shall be made good to match the existing and shall include plaster, concrete work, brickwork, paint, tiling, ceilings and all required materials for the remedial action.

- (l) The work shall be of a high quality and executed by qualified tradesmen in accordance with the relevant specifications.

**AA 03.03      GENERAL REQUIREMENTS FOR REPAIR AND INSTALLATION OF SOIL AND WASTEWATER INSTALLATIONS**

The following requirements shall apply to this installation unless otherwise specified.

**AA 03.03.01      Underground sanitary drainage installations**

- (a) All manhole covers and frames shall be cast into the concrete cover slabs.
- (b) Manholes in trafficable areas shall be provided with type 1A heavy-duty cover and frame and surrounded by concrete slabs.
- (c) Fittings in the ground and below floor slabs shall be without access eyes.
- (d) Sewer pipes in the ground with a slope steeper than 1:5 and/or under surface beds shall be encased in concrete as detailed.
- (e) The sewer outside the boundary of a building complex shall be constructed strictly in accordance with the details and specifications of the local authorities.
- (f) Existing drainage invert levels and positions are to be checked against invert levels given on the drawings before commencing the work. The Contractor shall inform the Engineer immediately of any discrepancy.
- (g) All affected existing services are to be located and exposed before commencing the proposed repair work.
- (h) The drainage system shall be tested according to the specifications laid down by the NBRI. This shall be carried out in the presence and to the satisfaction and approval of the Engineer.
- (i) During construction all pipe ends are to be suitably plugged to prevent any ingress of dirt, rubble, etc.
- (j) Modern technology video surveying equipment and detection equipment shall be utilised if so approved by the Engineer to establish blockage problems and indicate the positions of such problems. The Engineer's Representatives has no authority to approve the use of such surveying equipment.
- (k) Any drainage pipe within the 45° range below building foundations shall be encased in concrete or soilcrete as specified.

**AA 03.03.02      Above ground sanitary drainage installations**

- (a) All accessible waste and soil fittings above ground level shall have inspection eyes. Inspection eyes shall not be underneath any fittings.
- (b) All single wash hand basins shall be connected to a 40 mm internal diameter waste pipe.
- (c) All groups of wash hand basins and sinks shall be connected to a 50 mm internal diameter waste pipe, unless otherwise indicated.

- (d) All traps up to and including 50 mm diameter shall be of the "deep reseal" (75 mm) type.
- (e) The maximum bend on any single fitting shall be 45°, with the exception of ventilation pipes where bends of up to 90° may be used.
- (f) Drainage pipes and fittings running below concrete slabs and along walls and columns shall be suspended by means of approved type hangers, holderbats, etc, placed at appropriate intervals, to provide a rigid, proper suspended system as required by the manufacturer.
- (g) All ventilation pipes shall be finished off with a suitable durable grating.
- (h) All S-trap WC pans shall have plugged anti-siphon horns fitted to provide for cleaning access.

#### **AA 03.04      PRESSURE TESTING OF WATER PIPES**

- (a) All new pipe installations under the repair Contract shall be pressure tested before being taken into use. The Engineer shall witness this pressure test. Tests shall be carried out both on surface-mounted and buried pipework. Buried pipes shall be backfilled except at fittings and joints before being tested.
- (b) Completed sections of the pipe installation shall be filled with water after all branches have been plugged, sealed or closed.
- (c) The section of pipe shall be hydraulically pressure tested by means of a suitable manually-operated or mechanically-driven pressure pump.
- (d) A pressure of at least 1,5 times the working pressure of the class rating of pipes or fittings shall be applied for a period of time specified in the specifications or as recommended by the manufacturers. (Refer to SABS 1200 L for minimum and maximum test pressures.)
- (e) Tests shall not be performed against closed valves.
- (f) Leakage which occurs shall be measured and calculated and checked against the allowable losses, as specified in SABS 1200 L.
- (g) If the completed section of pipe complies with all specifications and passes the tests and inspection, to the approval of the Engineer, and the Contractor shall backfill the open sections of trench at the joints and connections, where applicable.
- (h) The Contractor shall then proceed to build all the valve chambers, inspection chambers, etc, for underground installations and shall close-off around pipes in walls, voids and ducts for above ground installations.

#### **AA 03.05      STERILISING OF WATER PIPES**

- (a) Before any repaired and new pipeline is taken into use, the pipeline shall be sterilised over its complete length, including the fittings. The pipe shall be filled with potable water chlorinated to a concentration of 15 mg of chlorine per litre of water, which shall remain in contact with the inner surface of the pipeline for a period of not less than 24 hours. The pipeline shall be filled for sterilising in such a manner that no water-hammer shock is created or air is trapped in the pipeline.

- (b) The Contractor shall submit full details of the proposed method of sterilising the pipeline to the Engineer for approval at least fourteen days prior to the commencement of sterilising.
- (c) The cost of water for filling the pipeline for sterilising shall be borne by the Contractor.
- (d) The Contractor shall provide all necessary materials, tools, equipment and labour required for sterilising the pipeline. After sterilising the pipeline the Contractor shall, at no extra cost, empty the pipeline and dispose of the water in a manner approved by the Engineer.

The Contractor may use the following products as a source of chlorine:

- chloride of lime to SABS 295 yielding 33 % free chlorine by mass;
- calcium hypochlorite to SABS 295 yielding 70 % free chlorine by mass;
- chlorine gas applied by chlorinator.

After sterilisation, an approved water quality test shall be carried out to a minimum number of 10 % of the total water points, randomly selected, evenly spread and marked on drawings. These tests shall include a full bacteriological test as per SABS 241 and the results shall be submitted to the Engineer for approval. All tests shall be for the Contractor's account.

#### **AA 03.05.01 Bacteriological requirements**

When tested the water shall comply with the limits given in table AA 03.05.01/1.

TABLE AA 03.05.01/1

PROPERTY	RECOMMENDED MAXIMUM LIMIT	MAXIMUM ALLOWABLE LIMIT
Total coliform bacteria count per 100 millilitre	Nil*	5
Faecal coliform bacteria count per 100 millilitre	Nil	Nil
Standard plate count per millilitre	100	Not specified

- \*(a) If any coliform bacteria are found in a sample, a second sample must be taken immediately after the tests on the first sample have been completed. This sample shall be free from coliform bacteria.
- (b) Not more than 5 % of the total number of water samples (from any one reticulation system) tested per year may contain coliform bacteria.

The Engineer shall witness the sterilising of the pipes.

The Contractor shall ensure that during the sterilising procedure the necessary safety precautions are instituted to prevent the intake of water by the user and/or public from the system. On completion the system shall be properly flushed out.

#### **AA 03.06 AIR TEST FOR SEWER AND DRAINS**

The following air test requirements are specified in the NBRI information sheet X/BOU 2-34 and are reproduced here. They shall be applicable to all air tests on new sewers and

drains installed under the repair work phase, and shall be executed by the Contractor and witnessed by the Engineer.

#### **AA 03.06.01 Method of air testing**

All openings in the pipeline are plugged by means of sewer testing plugs. The sewer plug at the lowest end of the pipeline is connected to an air supply hose, which is attached to a mechanically driven air blower, compressor or hand pump. Air is pumped into the pipeline at a pressure of approximately 375 mm water gauge. The pressure is held at this level for a period of two minutes to allow the air temperature to become constant. Subsequently the air supply is closed off and the time recorded for the air pressure to drop from 250 to 125 mm water gauge. If the recorded time is less than the value given in table AA 03.06.01/1 below, it means that the pipeline leaks and does not comply with the required standards of tightness. The apparatus required for the air test is commercially available.

The following requirements have to be taken into account when performing the air test:

- (a) Air-permeable pipelines such as vitrified clay or asbestos cement should preferably be tested when moist or wet.
- (b) The trench should be partially backfilled before the test is carried out. This is to stop possible temperature variations and to prevent damage to the pipeline during subsequent backfilling operations.
- (c) The testing equipment should be shielded from the direct rays of the sun.
- (d) Flexible joints are recommended for sewer and drain pipelines. Good quality flexible joints are superior to cement caulked joints and they also provide the pipeline with flexibility to prevent cracking due to subsequent soil movement.
- (e) The test method is very sensitive to flaws in the pipeline, such as cracks or leaking joints. The actual positions of flaws along the pipeline can be determined by using special equipment.
- (f) If the pipeline is below the water table and subjected to external water pressure, the test method should be modified so that the final pressure value are higher than that of the external water pressure acting on the lowest part of the pipeline.

TABLE AA 03.06.01/1: MINIMUM TIMES FOR PRESSURE DROP OF 250 mm TO 125 mm WATER GAUGE

PIPE (DIAMETER (mm))	MINIMUM TIME (min - s)	CRITICAL LENGTH OF PIPELINE (m) (58 m <sup>2</sup> INTERNAL SURFACE AREA)	MINIMUM TIME (S) FOR LONGER LENGTH (L) OF PIPELINE
100	1 - 58	184,6	0,640 L
150	2 - 57	123,1	1,439 L
200	3 - 56	92,3	2,559 L
225	4 - 26	82,1	3,239 L
250	4 - 55	73,8	3,998 L
300	5 - 54	61,5	5,757 L
375	7 - 23	49,2	8,996 L
450	8 - 51	41,0	12,954 L
525	10 - 20	35,2	17,632 L
600	11 - 49	30,8	23,030 L

#### **AA 04 OPERATING AND MAINTENANCE MANUALS**

The Contractor shall be responsible for the compilation of an inventory list and operating and maintenance manuals.

This shall be done in accordance with Additional Specification SB: Operating and Maintenance manuals.

All information shall be recorded and captured in electronic format and the Department shall be provided with three sets of hard copies.

#### **AA 05 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK**

Except where otherwise provided in the Contract, the Contractor shall provide all labour, materials, power, fuel, accessories and properly calibrated and certified instruments necessary for carrying out such tests. The Contractor shall make arrangements for such tests and he shall give at least 72 hours notice to the Engineer, in writing, prior to commencing test.

In the event of the installation not passing the test, the Engineer shall be at liberty to deduct from the Contract price all reasonable expenses incurred by the Engineer attending the repeated test.

Whenever any installation or equipment is to be operated for testing or adjusting as provided for above, the Contractor shall operate the entire system for as long a period as may be required to prove satisfactory performance at all times in the occupied space served by that system for up to twenty-four hours a day continuously until the system is handed over.

The Contractor shall provide all labour and supervision required for such operation and the Department may assign operating personnel as observers, but such observation time shall not be counted as instruction time.

After completing the installation or system, all equipment shall be tested, adjusted and readjusted until it operates to the satisfaction and approval of the Engineer.

The Contractor shall submit certificates of tests carried out to prove the soundness of all installations.

#### **AA 06 QUALITY ASSURANCE SYSTEM**

The Contractor shall institute an approved quality assurance (QA) system which shall be submitted to the Engineer for approval. The records of this QA system shall be kept throughout the duration of the Contract and be submitted to the Engineer at regular intervals as required.

#### **AA 07 OPERATING AND COMMISSIONING OF PLANT AND INSTALLATION**

On completion of the repair work and/or the installation of new pipe systems and items of equipment the system and equipment shall be put into operation after all tests have been carried out to the satisfaction of the Engineer. The Contractor shall operate the system for a period of time as specified by the Engineer and train the staff of the User Client to maintain the system. This period of time shall not exceed one month.



Logging of the operation of the installations shall commence immediately upon commencement of their use.

The Contractor shall submit a full commissioning report.

**AA 08**      **GUARANTEE OF EQUIPMENT AND MATERIAL**

The Contractor shall provide and obtain guarantees from the manufacturer(s) and/or supplier(s) to the effect that each new fitting, pipe or other item of material and equipment supplied and installed under the repair contract, shall comply with the application.

**AA 09      DETAILS OF REPAIR WORK****AA 09.01      GENERAL**

During the repair and maintenance Contract all the systems, installations and equipment shall be repaired as specified in the Particular Specification. This repair work shall include but not be limited to the specified Particular Specification details.

All repair work shall be executed using approved materials and equipment suitable to the systems and/or installations they serve.

All materials and equipment shall comply fully with the requirements as specified for each installation.

The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws, manufacturer's specifications and codes of practice and all additional and particular specifications included in this document.

The repair work items shall be listed in tabular form in the Particular Specification with all relevant details, such as capacity, size, manufacturer, model number, etc.

All repair work shall be executed within the specified durations listed in the Appendix to Tender. All new equipment, materials and systems shall be furnished with a written guarantee with a defects liability period of 12 months from date of issue of a certificate of completion for the repair work. These guarantees shall be furnished in favour of the Department of Public Works. On completion of the required and specified repair work the systems, installations and equipment shall be commissioned and handed over to the satisfaction of the Engineer.

Repair work items for the plumbing and drainage installations shall be categorised under the following headings:

- (a) Rainwater disposal systems
- (b) Soil and wastewater drainage systems
- (c) Domestic water distribution and reticulation networks
- (d) Sanitary and brassware equipment
- (e) Fire water piped reticulation networks.

**AA 09.02      RAINWATER DISPOSAL SYSTEMS****AA 09.02.01      General**

Repair work to the rainwater disposal system shall be detailed in the Particular Specification and shall include but not be limited to the following:

- (a) Replacement of damaged, broken, leaking and corroded pipework and fittings;
- (b) Replacement of damaged, broken and missing rainwater outlets, stormwater catch pit gratings, manhole covers and frames and floor drains;
- (c) Repair work to damaged manholes, catch pits, curb inlets, channel drains and drain points including builder's work and benching;
- (d) Initial unblocking and clearing of all rainwater drainage pipes, manholes, catch pits, drain points, channel drains and gutters;
- (e) Repair and upgrading of drainage system where necessary;

- (f) Provision of additional rainwater drainage points where outlets are insufficient and ponding occurs;
- (g) Prevention of the ingress of any unauthorised effluent into this drainage system;
- (h) Realign and fix gutters to correct falls where necessary, including additional brackets where required.
- (i) Reinstatement and making good of walls, tiling, floors, concrete, road surfaces, etc, to approved acceptable levels where any repair, upgrading and/or service work has been executed;

**AA 09.02.02    Material and equipment specification for rainwater disposal systems**

Materials and equipment to be used for repair items shall be suitable and/or adaptable to the existing installation and shall comply with the following:

(a)    Vitrified clay pipe and fittings

Vitrified clay pipes shall only be used for underground installations. The pipes and fitting shall strictly conform to SABS 559. The pipes and fittings shall have a minimum crushing strength of 45 kN/m.

The joining method to be used shall be polypropylene couplings with integral rubber seal similar or equal to Vitrosleeve in accordance with SABS 974 allowing up to 2,5° angular movement per joint and 5 mm line displacement per joint. The joint shall retain an effective water seal with regard to above conditions with a 6 m water head.

Pipes shall be cut using an approved pipe cutter and the ends shall then be trimmed by means of a pipe trimmer to remove any sharp edges.

The piping system shall be tested as indicated in this specification under subclause AA 03.06 above.

(b)    Supercast cast-iron pipe and fittings

Supercast cast-iron pipes can be used for underground and above ground installations. Plain-ended cast-iron pipes and fittings, manufactured from 150, grade A grey iron in accordance with SABS 1034 shall be used. Fittings and pipes shall be free of pinholes, blowholes, blemishes, flash and foundry sand and have a smooth bore. All pipes and fittings shall be sand-blasted and coated on the inside and outside by submersion in a corrosion inhibiting oxide primer or bitumen paint.

The pipes and fittings shall be joined by means of stainless steel neoprene couplings as supplied by the manufacturer of the pipe system. The coupling shall be installed according to the manufacturer's specification and tightened with a torque wrench to a torque of 6,8 Nm.

(c)    uPVC pipe and fittings above ground

uPVC pipes and fittings shall be used for above ground installations. For pipe sizes larger than 160 mm diameter uPVC class 6 pressure pipe to SABS 966 shall be used with prefabricated uPVC bends and junctions. Prefabrication shall be done by means of hot-air welding of fittings to be covered with three layers of fibreglass reinforced lining over welded sections. The resin to be used shall be

as specified by the manufacturer for usage with PVC. Bends shall be manufactured out of 3 to 4 sections per bend. Pipe jointing shall be done by means of couplings fixed with solvent cement for PVC piping. This joint shall be reinforced with a fibreglass lining of three layers.

Piping has to be supported and bracketed with properly sized and designed brackets consisting of two half sections clamped over the pipe and shall with two hanger rods.

Pipes be pressure tested in sections as specified in this specification.

(d) Galvanized steel piping and fittings above ground

Galvanized steel piping shall be used for above ground rainwater drainage systems. The pipe to be used shall be plain ended medium gauge uncoated pipe to SABS 62 galvanized to SABS 763. All fittings are to be manufactured from the same material welded with flanged ends or rolled ends to fit clambon fittings. Fittings are only to be galvanized after manufacturing. All joints to be either flanged or equipped with clambon couplings. All fittings and junction to be 45° sections.

The pipe system shall be properly secured and bracketed at regular intervals with correctly sized and designed galvanized brackets.

Pipes are to be pressure tested in sections as specified in this specification under subclause AA 03.06 above.

(e) Geberit HDPE pipe and fittings

Geberit HDPE pipes and fittings can be used for underground and above ground installations where specified. Pipes shall be plain ended and only Geberit HDPE bends and fittings shall be used. Jointing of pipes and fittings shall be done by butt welding, electro-sleeve couplings and/or flanged joints. Pipes and fittings shall only be installed by Geberit approved installers and the Contractor shall furnish a certificate to this effect. Pipes and fittings shall be installed strictly according to the Geberit application technique.

Pipes to be pressure tested in sections as specified in this specification.

(f) Roof outlets

Where waterproofing is installed, as for roof slabs, an adjustable roof outlet/drainage point to be used consisting of a cast-iron unit with cast-iron ring clamp to fit over waterproofing edge and an adjustable height outlet to fit in with the screed level. For surfaces such as paving and walkways a flat grating of brass or cast iron shall be used with a catch basket. Within paving blocks a square top frame shall be used. For roof outlets a domed grating is to be used. Where roofs are to be covered with stones, a mesh shall be installed to prevent any stones from entering the rainwater system.

Two-way side outlets shall be used in cases where required.

Floor and roof outlets to be fitted to cast-iron pipe by means of SSN couplings.

**AA 09.03      SOIL AND WASTEWATER DRAINAGE SYSTEM**

**AA 09.03.01      General**

Repair work to the soil and wastewater drainage system shall be detailed in the Particular Specification and shall include but not be limited to the following:

- (a) Replacement of damaged, broken, leaking, corroded above and underground pipework and fittings;
- (b) Replacement of damaged, broken and missing gully gratings, manhole covers and frames, cleaning eye covers, screws and bolts, inspection eye covers, end caps and vent cowls;
- (c) Repair work to damaged manholes, gullies, cleaning eyes, floor drains, etc, including builder's work and benching;
- (d) Initial unblocking only of all blocked drainage pipework, traps, floor drains, gullies and the cleaning of sanitary ware equipment;
- (e) Video surveying of all underground drainage pipework when so authorised by the Engineer (but not by the Engineer's Representative) to establish root ingress, damaged pipework, fat build-up, blockages, incorrect falls, sagging and as-built information. This survey shall be utilised to establish the extent of repair and upgrade work to be executed;
- (f) Repair and upgrading of soil and wastewater drainage systems where necessary;
- (g) Repair work to bracketing systems including fixing and repair of existing brackets and the introduction of additional brackets where required;
- (h) Repair, re-fix and bracket sanitary ware equipment to walls, floors, etc, where required;
- (i) Repair, replace and clean out sanitary ware and equipment traps;
- (j) Test pipe system, traps and equipment for leakage;
- (k) Empty, clean out separators, clean out strainers, and test for leak tightness, repair and recommission oil and grease separators. Check the conformance of the capacities of the oil and grease separators in relation to the facilities they serve; where necessary these shall be upgraded and where no separators have been provided, new separators shall be provided;
- (l) Reinstatement of walls, tiling, floors, concrete finishes, holes, chases, surfaces, etc, to an approved acceptable level where any repair, upgrade and/or service work has been executed;
- (m) Prepare, paint and repaint pipework and equipment where necessary, in accordance with Technical Specification BH: Fittings.

#### **AA 09.03.02    Material and equipment specification for soil and wastewater drainage systems**

Materials and equipment to be used for repair items shall be suitable and/or adaptable to the existing installation and shall comply with the following:

- (a)    Vitrified clay pipe and fittings  
As specified in subclause AA 09.02.02(a) above.
- (b)    Supercast cast-iron pipe and fittings  
As specified in subclause AA 09.02.02(b) above.

Where cast-iron stub stack overflow gullies are used with pipe materials such as PVC a rubber O-ring shall be used to fit over the PVC pipe into the cast-iron fitting. The joint shall be grouted up afterwards.

Above ground piping shall be bracketed with properly sized and designed brackets according to the manufacturer's specification at correct intervals.

The piping system shall be tested in accordance with the NBRI information sheet X/BOU 2-34 as specified in subclause AA 03.06 above.

(c) uPVC soil and waste pipe and fittings

UPVC soil, vent and waste pipe systems can be used for underground and above ground drainage installations. This piping shall conform in all respects to SABS 971 for underground systems and to SABS 967 for above ground systems.

All underground pipes, as well as soil pipes above ground, shall be joined by means of rubber ring seal couplings and fittings in accordance with the manufacturer's specification. All waste and vent pipes shall be joined by means of solvent weld fittings and couplings. The solvent weld glue to be used shall be as specified by the pipe manufacturer, allowing for thermal contraction and expansion.

The piping system shall be pressure tested in accordance with the NBRI information sheet X/BOU 2-34 as specified in subclause AA 03.06 above

(d) Structural wall uPVC pipes and fittings

Structural wall uPVC drainage pipe shall be used for underground drainage systems. This piping system shall be used with standard underground uPVC pipe fittings, equipped with rubber ring joints. The pipe shall be equipped with z-lock type rubber ring joints.

The piping system shall be pressure tested in accordance with the NBRI information sheet X/BOU 2-34 as specified in subclause AA 03.06 above.

(e) Geberit HDPE pipes and fittings

As specified in subclause AA 09.02.02(e) above.

(f) Stainless steel floor traps and floor channels

Stainless steel floor traps and channels shall be manufactured from 304 stainless steel with a load capacity of 1 500 kg. The floor traps shall have a flow capacity of 3 litre/second.

The units shall be fitted with a double water seal, large sludge box and shall be easily dismantlable for cleaning purposes. Tiling keys and waterproofing flanges shall be provided where required. Side inlets with diameter of 50 mm shall be provided for waste connections to other equipment where required.

(g) Cast-iron floor traps

Cast-iron floor traps shall be manufactured from cast iron and shall be fitted with a water seal and a large sludge box and lid to be easy removable for maintenance purposes. The unit shall be designed such as to provide access to the drainage system and to be used as a cleaning point.

**AA 09.04      DOMESTIC WATER DISTRIBUTION AND RETICULATION NETWORKS****AA 09.04.01      General**

Repair work to the domestic water distribution and reticulation networks shall be detailed in the Particular Specification and shall include, but not be limited to the following:

- (a) Replacement of damaged, broken, leaking, corroded above and underground pipe work, fittings and equipment;
- (b) Repair, replace and service valves, which shall include new gaskets, gland packings, seals, bolt and nuts, etc;
- (c) Where valves do not close properly, all these valves shall be refurbished, descaled or replaced where necessary;
- (d) Repair, clean and service all strainers, including the replacement of strainer elements where corroded and installation of new gaskets;
- (e) Repair, service, test and readjust pressure-reducing valves. Pressure gauges are to be recalibrated and checked. Up and downstream pressures are to be logged. Downstream pressure has to be adjusted to an acceptable level, taking into account the allowable working pressure of the system and its components;
- (f) Repair, service and check the proper functioning of all non-return valves;
- (g) Repair, service, readjust and calibrate all safety and expansion relief valves;
- (h) Repair, service and clean out all air release valves and vacuum breakers;
- (i) Repair work to bracketing systems including fixing and repair of existing brackets and provision of additional brackets where required;
- (j) Hot-water pipe lagging and cladding shall be inspected, repaired, sealed and replaced where required;
- (k) Repair, service and log readings of water meters including cleaning of integral strainers;
- (l) Water storage tanks are to be emptied, cleaned out, repaired, sealed and put back into operation. Ball float and/or filling valves to these tanks are to be serviced and repaired where required;
- (m) Water pipes are to be sampled for corrosion and scaling. The Engineer will evaluate the actions to be taken if the results of this sampling indicate that attention is required;
- (n) Water supply has to be sampled and chemically analysed for the suitability to the systems and materials it serves;
- (o) Domestic geysers are to be repaired and serviced in accordance with the manufacturer's specification and SABS 0254 shall include descaling, replacement of elements, testing for any leaks, checking of safety valve operation (replace if required), testing of the thermostat operation and set point (replace if necessary);
- (p) Pressure test and sterilise repaired new installation and equipment;

- (q) Reinstatement and making good of walls, tiling, floors, concrete, finishes, holes, chases, surfaces, etc, to an acceptable level where repair, upgrade and/or service work has been executed.

**AA 09.04.02 Material and equipment specification for domestic water distribution and reticulation networks**

Materials and equipment to be used for repair items shall be suitable and/or adaptable to the existing installation and shall comply with the following requirements:

- (a) Copper pipe installation
- (i) The installation of copper piping systems shall be done in accordance with the manufacturer's instructions and all relevant codes, standards and regulations.
  - (ii) Copper pipes shall only be installed downstream of galvanized mild steel pipes when applicable.
  - (iii) Where dissimilar metals are joined, dielectric or isolating couplings shall be used. This is not required where copper and brass dezincified alloys join.
  - (iv) Copper pipes shall be of the hard drawn type Class 0 in accordance with SABS 460 and shall be joined by means of capillary soldered type fittings. No compression type fittings shall be allowed unless otherwise specified.
  - (v) Copper capillary soldered type fittings shall be used in accordance with ISO 2016, SABS 1067, DIN 2856 or BSS 864.
  - (vi) The soldering flux to be used shall be water based and easily flushed out, withstand temperatures above 240 °C and shall contain no ammonia. The flux shall be non-toxic when dissolved in water.
  - (vii) The solder to be used shall be in accordance with SABS 24 and shall consist of a material containing 97 % tin and 3 % copper. Solders containing lead, resin core and acid core shall not be used.
  - (viii) The heat source to be used shall be propane gas with induction air, at a temperature not higher than 240 °C. The pipe ends and fittings shall be cleaned and waxed with an approved solder flux, before soldering. The pipe and fittings shall then be fitted together and heated to the correct temperature before the solder is applied. Care must be taken not to add too much or too little solder to the joint. Immediately after setting of the solder the joint shall be wiped clean with a wet cloth. Pipes shall be washed out as soon as possible after jointing and all traces of flux shall be removed.
  - (ix) All bronze or brass equipment and fittings shall be of the dezincification resistant (DZR) type.
  - (x) Copper pipes and fitting shall be installed strictly to the manufacturer's specification which shall include the following:
    - (1) No labour bends;
    - (2) Provision for thermal contraction and expansion of pipes;



- (3) Pipe brackets shall be installed at appropriate positions where pipes are installed on surface level;
- (4) Pipes chased or built into walls or floors shall be wrapped with two layers of building paper or similar approved material. Hot and cold water pipes running next to each other shall be at least 50 mm apart;
- (5) Equipment fixed to copper pipe outlets, where the pipes are surface mounted or built into walls, shall be done by means of copper wall plate fittings on the copper pipes, properly secured to the structure to prevent structural damage to soldered joints.
- (xi) Pipe hangers and brackets shall be of copper, copper alloy or non-conductive materials. No piece of copper pipe shall touch any other conductive surface. Brackets shall be designed to structurally support and fix the pipe system, and shall allow enough clearance from walls, soffits, etc, to insulate hot-water pipes and maintain equipment.
- (xii) Pipe hangers and brackets shall be installed according to the manufacturer's specification on the following maximum spacings:

PIPE DIAMETER (mm)	HORIZONTAL (metre)	VERTICAL (metre)
15	1,3	1,9
22 and 28	1,9	2,5
35 and 42	2,5	2,8
54	2,5	3,9
67 – 108	2,8	3,9

- (xiii) All copper pipes open to structural damage, shall be protected by steel sleeves or a structurally designed cover.
- (xiv) All pipework shall be pressure tested and sterilised as specified.
- (xv) Where flanged fittings are used, cadmium-plated bolts, nuts and spring washer shall be used to join these flanges.
- (xvi) All hot-water pipes shall be lagged as specified.
- (xvii) Shut-off valves shall be installed on all branch pipes and ball-o-stop valves shall be installed on all connectors to basin pillar cocks, sink mixers, cistern type WCs and other fittings.
- (xviii) All pipes shall be marked in accordance with SABS 0140 or as specified by the Engineer.
- (xix) Approved type expansion bellows shall be installed where required for expansion and contraction to prevent excessive strain on fittings and soldered joints.

(b) Galvanized steel pipe installations

- (i) All galvanized steel pipes shall be medium gauge mild steel screwed and socketed pipes to SABS 62 and shall be normalised and marked as such by the manufacturer. Pipes shall be hot-dip galvanized to SABS 763.
- (ii) All fittings shall be malleable cast-iron fittings to SABS 509 and galvanized to SABS 763.
- (iii) All 80 mm diameter and larger pipes shall be joined with Class 16 flanged couplings to SABS 1123/1600. The bolts, nuts and spring washers to be used on these joints shall be cadmium-plated.
- (iv) In pipe ducts and elsewhere pipes shall be fixed onto walls, soffits, etc, with approved type of supports, holderbats, clamps, etc. Brackets shall be designed to structurally support and fix the pipe system and shall have enough clearance from walls, soffits, etc, to insulate hot-water pipes and maintain equipment.
- (v) Pipes shall be supported according to the manufacturer's specifications with approved brackets at the following maximum intervals:

PIPE DIAMETER (mm)	HORIZONTAL (metre)	VERTICAL (metre)
15 dia to 20 dia	1 200	1 830
32 dia to 40 dia	1 830	2 450
50 dia to 150 dia	2 450	3 050

- (vi) Pipes shall be installed in such a manner as to prevent air locks. A minimum rise of 1:250 shall be maintained to high points, which shall be fitted with suitable air release valves.
- (vii) All pipes shall be marked according to SABS 0140 or as specified by the Engineer. All surface pipes shall be painted.
- (viii) Pipes shall be installed flush with brick walls before plastering unless otherwise instructed by the Engineer.
- (ix) Provision shall be made for thermal contraction and expansion.
- (x) The type of pipe joint compound shall be approved by the Engineer and used sparingly with good quality hemp. For pipes larger than 80 mm diameter a jointing compound such as Epidermix 32 shall be used.
- (xi) Any pipe buried shall have at least 900 mm cover and be coated and wrapped to SABS 1117 and tested in the presence of the Engineer.
- (xii) All exposed hot-water pipes shall be lagged as specified.
- (xiii) All pipework and fittings shall be pressure tested and sterilised as specified
- (xiv) Valves shall be installed on all branch pipes and ball-o-stop valves on all connectors to basin pillar cocks, sink mixers, cistern type WCs and other fittings.

- (xv) Approved type expansion bellows shall be installed where required for expansion and contraction to prevent excessive strain on fittings and pipe joints.

(c) uPVC underground pipe installations

- (i) uPVC piping shall conform to SABS 966 with rubber ring type joints.
- (ii) All bends shall be uPVC type fittings with rubber ring joints.
- (iii) All other fittings such as T-pieces, reducers, flanges, etc, shall be bitumen-dipped cast-iron rubber ring jointed fittings to SABS 546.
- (iv) No solvent weld type fittings will be allowed.
- (v) All cast-iron fittings shall be coated and wrapped to SABS 1117.
- (vi) All pipes shall be laid on a 100 mm sand-bedding cradle and covered with 300 mm sand before backfilling.
- (vii) All backfilling shall be in accordance with SABS 1200 DB and to the Engineer's approval.
- (viii) Pipe trenching and bedding:

AREA	MINIMUM COVER	BEDDING TYPE	MAIN FILL
Vehicle traffic	1 100	Flexible pipe bedding as per SABS 1200 LB	Soilcrete
Under surface bed	600		Soilcrete
Other areas	900		90 % of modified AASHTO density

- (ix) All thrust blocks shall be cast between the pipe and the undisturbed trench material.
- (x) No concrete shall come into direct contact with the UPVC pipe. At the thrust blocks the bend shall be wrapped with a Densopol 80 HT Tape or similar approved.
- (xi) HDPE pipe connections to uPVC pipes up to 50 mm can be done by means of SG Iron manufactured saddles with the appropriate gaskets and cadmium-plated bolts and nuts.
- (xii) All pipe crossings under roads and parking areas shall be backfilled as specified in subclause CA 04.04.02(b).
- (xiii) All pipework shall be pressure tested with all joints uncovered, to the satisfaction of the Engineer.
- (xiv) Suitably sized air release valves built into valve chambers shall be installed at all high points of the pipeline.

(d) HDPE underground pipe installations

- (i) HDPE piping shall be Type 4 HDPE pipe to SABS 533.

- (ii) All fittings shall be of Plasson compression type and shall conform to ISO/DIS 3458.
- (iii) All pipes shall be laid on a 100 mm sand bedding cradle and covered with 300 mm of sand of selected material.
- (iv) All backfilling shall be in accordance with SABS 1200 DB and to the Engineer's and approval.
- (v) Pipe trenching and bedding:

AREA	MINIMUM COVER	BEDDING TYPE	MAIN FILL
Vehicle traffic	1 100	Flexible pipe bedding as per SABS 1200 LB	Soilcrete
Under surface bed	600		Soilcrete
Other areas	900		90 % of modified AASHTO density

- (vi) No concrete shall come into direct contact with the HDPE pipe. At these points the fittings shall be wrapped with Densopol 80 HT tape or similar approved.
- (vii) All pipe crossings under roads and parking areas shall be backfilled as specified in subclause CA 04.04.02(b).
- (viii) All pipework shall be pressure tested with all joints uncovered to the satisfaction of the Engineer.
- (ix) Suitably sized air release valves built into valve chambers shall be installed at all high points of the pipeline.

(e) Valves

- (i) Gate valves underground in valve chambers to connect to uPVC piping (65 mm NB and larger)

Gate valves are to be equipped with non-rising spindle, spherical graphite iron body to SABS 936 Grade 42, cast-iron nitrile butadiene rubber covered gate, stainless steel spindle, nitrile butadiene rubber O-rings and seals, cast-iron bonnet and gunmetal thrust collar to BS 1400 LG2.

The valves shall conform to SABS 664 and/or 665 and shall be capable of withstanding a working pressure of 1 600 kPa.

The valves shall be fitted with a square key spindle top to close the valves in clockwise direction and socket ends to SABS 665 to fit into uPVC Class 12 pipe and shall be installed to details provided.

- (ii) Gate valves underground in valve chamber to connect to HDPE piping

The gate valves shall be of the dezincified brass type with brass gate, brass body, non-rising spindle and BSP threaded socket ends. The valves shall conform to SABS 776 Class 125. The valves shall be able to withstand a working pressure of 1 600 kPa. The valve shall be fitted with a hand wheel on an extended spindle shaft of 700 mm to close in a clockwise direction and shall be installed to details provided.

(iii) Gate valves above ground for temperatures up to 40 °C to connect to steel piping (65 mm NB and larger)

Gate valves are to be equipped with non-rising spindle, spherical graphite iron body to SABS 936 Grade 42, cast-iron nitrile butadiene rubber covered gate, stainless steel spindle, nitrile butadiene rubber O-rings and seals, cast-iron bonnet and gunmetal thrust collar to BS 1400 LG2.

The valves shall conform to SABS 664 and/or 665 and shall be capable of withstanding a working pressure of 1 600 kPa.

The valves shall be fitted with flanged ends to SABS 1123, table 16, hand wheel to close the valves in a clockwise direction and installed in an upright position or sideways to a maximum 90 ° from upright.

(iv) Gate valves above ground for temperatures above 40 °C to connect to steel piping (65 NB mm and larger)

Gate valves shall be equipped with non-rising spindle, spherical graphite iron body to SABS 963 Grade 42, cast-iron gate, gunmetal seat and gate rings, high-tensile bronze spindle, cast-iron bonnet and gunmetal thrust collar to BS 1400 LG2.

The valves shall conform to SABS 665 and shall be capable of withstanding a working pressure of 1 600 kPa and a temperature of 90 °C.

The valve shall be fitted with flanged ends to SABS 1123, table 16, hand wheel to close the valve in a clockwise direction and installed in an upright position or side ways to a maximum 90° from upright.

(v) Gate valves above ground to fit to copper pipes (65 mm NB and larger)

Gate valves shall be equipped with non-rising spindle, gunmetal bronze or dezincified brass body, gunmetal or dezincified brass gate and graphite asbestos packing in the gland.

The valve shall be fitted with a hand wheel to close in a clockwise direction and installed in an upright position or sideways to maximum 90° from upright.

The valve shall be equipped with flanges to SABS 1123, table 16, hand wheel to close the valve in a clockwise direction and installed in an upright position or sideways to a maximum 90° from upright.

(vi) Gate valves above ground for temperatures up to 100 °C (up to 50 mm NB)

The gate valves shall be of the dezincified brass type with brass gate, brass body, non-rising spindle and BSP threaded socket ends. The valve shall conform to SABS 776, Class 125.

The valves shall be able to withstand a working pressure of 1 600 kPa.

The valve shall be equipped with a hand wheel to close in a clockwise direction.

The valve shall be installed in an upright position or sideways to a maximum 90° from upright and shall be so placed with other fittings to be removable without cutting the pipework.

(vii) Ball-O-Stop valves (15 mm diameter - 25 mm diameter)

These valves shall be full-way ballcock type with BSP threaded ends. The valves shall conform to SABS 1056, Part 3, shall be rated for a test pressure of 2 000 kPa, and shall be chrome-finished where exposed.

(viii) Angle regulating valves

These valves shall be 15 mm chromium-plated angle regulating valves with a 350 mm chromium-plated copper tube and cap nuts where required.

(f) Strainers

(i) Strainers for connection to steel or UPVC pipes (65 mm NB and larger)

These strainers shall be of the Y-type with cast-iron body, stainless steel or bronze strainer element and shall be equipped with flanged ends to SABS 1123, table 16. The hole sizes of the strainer element shall be maximum 1 mm diameter and be removable without dismantling of pipework. The strainer shall be suitable for a temperature of up to 90 °C at a 1 000 kPa pressure rating and installed with the element facing downwards or a maximum of 45° sideways.

(ii) Strainers for connection to copper pipes (65 mm NB and larger)

These strainers shall be of the Y-type with bronze or dezincified brass body, stainless steel strainer element and must be equipped with flanged ends to SABS 1123, table 16. The hole sizes of the strainer element shall be maximum 1 mm diameter. The strainer element shall be removable without dismantling of pipework. The strainer shall be suitable for a temperature of up to 90 °C at a 1 000 kPa pressure rating and installed with the element facing downwards or a maximum of 45° sideways.

(iii) Strainers for connection to steel and copper pipes (up to 50 mm NB)

These strainers shall be of the Y-type with bronze or dezincified brass body, stainless steel strainer element and must be equipped with BSP threaded socket ends. The hole sizes of the strainer element shall be maximum 0,8 mm diameter. The strainer shall be suitable for a temperature of up to 90 °C at a pressure rating of 1 000 kPa and installed with the element facing downwards or a maximum of 45° sideways.

(g) Non-return valves

(i) Non-return valves for cold water (65 mm NB and larger)

The non-return valve shall be of the spring-loaded dual flap plate type fitted between two flanges (wafer).

The non-return valve shall be equipped with a cast-iron body, aluminium bronze plates, stainless steel springs and neoprene seals on the plates. The valves shall be suitable for a working pressure of 1 000 kPa.

- (ii) Non-return valves for hot water (up to 100 mm NB and cold water (up to 50 mm NB)

These non-return valves shall be of the spring-loaded piston type, with bronze or dezincified brass body, stainless steel spring and bronze disc with neoprene seal fitted with BSP threaded socket ends. The valve shall be suitable for a working pressure of 1 000 kPa and a temperature of up to 90 °C. All valves shall be installed as to be removable without extensive pipework removal.

- (h) Air release valves and vacuum breakers

- (i) Double orifice double-acting air release valves with sizes from 50 mm NB to 200 mm NB

This air release valve shall be fitted with small and large orifice. The air release valve shall be fitted with a cast-iron body, stainless steel or fibreglass balls, integral shut-off valve and flanged ends to SABS 1123, table 16.

The valve shall be suitable for maximum pressure of 1 600 kPa.

- (ii) Single orifice air release valves for main water lines with sizes from 25 mm NB to 50 mm NB

This air release valve shall be fitted with a small orifice, cast-iron body, fibre glass or stainless steel ball float and BSP threaded inlet.

When the valve is installed a shut-off valve shall be installed on the inlet side.

The valve shall be suitable for maximum pressure of 1 600 kPa.

- (iii) Single orifice double purpose air release valves for domestic water lines up to 15 mm NB

This air release valve shall be fitted with a stainless steel float, brass or cast steel body with an integral shut-off valve fitted.

The valve shall be capable to withstand a working pressure of 1 000 kPa at 110 °C.

- (iv) Vacuum breaker up to 40 mm diameter

The vacuum breaker shall be fitted with neoprene seal, spring-loaded disc in a dezincified brass or bronze body. The valve shall seal watertight and shall be designed to withstand a working pressure of 1 000 kPa and a temperature of 90 °C.

- (i) Pressure-reducing valves

- (i) Combination pressure-reducing stations

Where a high peak flow as well as a small flow can occur and the small flow is out of the range of the large pressure-reducing valve, a small pressure-reducing valve is installed in parallel with the large pressure-reducing valve. The two pressure-reducing valves in parallel shall be set according to the manufacturer's specification.

(ii) Large pressure-reducing valves (65 mm NB and larger)

This pressure-reducing valve shall be equipped with a cast-iron body, neoprene nylon-reinforced diaphragm, bronze seal disc washer, stainless steel shaft and flanged ends. The valve shall be pilot operated and shall be designed to handle high flows at a minimum head loss.

The valve must be adjustable to handle a wide range of incoming pressures at a constant downstream pressure.

The valve shall be equipped with flanged ends to SABS 1123, table 16.

(iii) Small pressure-reducing valves (15 mm NB to 50 mm NB)

This pressure-reducing valve shall be equipped with brass body, balanced single seat and integral strainer. The valve shall be able to handle a wide range of incoming pressures while the downstream pressure stays constant with maximum inlet pressure of 1 000 kPa and a maximum water temperature of 40 °C.

The valve shall be equipped with BSP male threaded brass union couplings.

(j) Water meters

(i) Combination water meters

Where high peak flow, as well as a small flow, can occur and the small flow is out of the registration range of the large water meter, a small water meter shall be installed in parallel with the large water meter to cater for the small flows with integral automatic change-over valves. These valves shall be designed to have a minimum pressure drop at operating point.

(ii) Water meters (50 mm NB and larger)

These water meters shall be of the dry type with all gears and transmission and roller counters in a dry head, and shall be equipped with flanged ends to SABS 1123, cast-iron body with high quality corrosion-proof coating. The meter shall be protected from magnetic fields and sealed to prevent tampering with adjustments. The meter must be able to work up to a pressure of 1600 kPa under a maximum water temperature of 40 °C. The scale of meter must be in cubic metre (m<sup>3</sup>) and equipped with needle indicators reading in litres. Accuracy of meter shall be not less than 98 %.

The meters shall be installed with leading and trailing lengths of pipes to the manufacturer's specification.

(iii) Water meters (up to 50 mm NB)

The meter shall be of the volumetric rotary piston type with brass body equipped with union couplers. The meter reading must be in kilolitres. The meter shall have an accuracy of not less than 98 %. The meter must be able to operate up to a water pressure of 1000 kPa at a water temperature of 40 °C.

The meters shall be installed with leading and trailing lengths of pipes to the manufacturer's specification.



(k) Adjustable balancing valves

Adjustable balancing valves shall be supplied and installed as indicated on the applicable drawings. A portable differential pressure meter shall be used, with all the necessary pipes, shut-off valves and air release valves to set the balancing valves. A graph chart shall be supplied to indicate the flow units against the valve adjustment and as the pressure differential over the valve.

The pressure gauge shall be calibrated according to the current accepted SI units.

The calibrated adjustable balancing valves shall be of the angle valve type equipped with bronze valve body, bronze disc, internal seals with BSP threaded ends. The valve shall be fitted with stop-cock connection ends on inlet and outlet onto which the differential pressure gauge can be coupled. The valve shall be equipped with an indicator on the valve handle to show the position of the valve opening. The valve shall be suitable for operating at a temperature of 90 °C against a pressure of 1 000 kPa.

(l) Semi-conductive reheating tape for hot-water pipes

Semi-conductive reheating tape shall be strapped to the hot-water pipes under the thermal insulation. This reheating tape shall be installed strictly according to the manufacturer's specification.

The system shall be fitted with all the necessary end seals, tee splices, straps, etc, as required by the supplier.

The reheating tape shall be of the self-regulating type equipped with a parallel circuit, self-regulating conductive core, polyolefin jacket and tinned copper braid on the outside.

The reheating tape shall be sized to maintain an operating temperature of 60 °C of water inside the pipe.

(m) Expansion bellows

(i) Expansion bellows for pipes (50 mm NB and larger)

Expansion bellows shall be of the rubber-lined type fitted between flanges. These bellows shall be suitable for an operating temperature of -10 °C to 110 °C at an operating pressure of 1 500 kPa. The bellows shall be installed strictly in accordance with the manufacturer's specifications.

(ii) Expansion bellows for copper pipes (up to 40 mm NB)

These expansion bellows shall have a copper body with corrugated stainless steel lining and soldered capillary type couplings. The bellows shall be able to withstand a working pressure of 600 kPa at a temperature of 140 °C. Installation shall be strictly in accordance with the manufacturer's specifications.

(n) Lagging of hot-water pipes

(i) Preformed closed cell flame retarded flexible insulation sections

Where pipes are installed in service ducts, ceiling voids, etc, the pipes shall be insulated with Thermaflex preformed pipe insulation sections. This insulation shall be used with pipe systems where the maximum

temperature is 80 °C. For a temperature higher than 80 °C preformed fibreglass sections shall be used with galvanized sheet metal muffs.

All bends and T-pieces shall be cut in a 45° mitre box to form a neat joint. All joints shall be glued together with a contact adhesive supplied by the manufacturer. Pipe sizes larger than 50 mm diameter shall be insulated with preformed fibreglass sections with canvas covers glued together with cold wood glue.

Thermaflex thickness for various pipe sizes shall be as follows:

PIPE SIZE (STEEL)	PIPE SIZE (COPPER)	THERMAFLEX THICKNESS
50 mm dia	54 mm dia	20 mm
40 mm dia	42 mm dia	20 mm dia
32 mm dia	35 mm dia	15 mm dia
25 mm dia	28 mm dia	15 mm dia
20 mm dia	22 mm dia	15 mm dia
15 mm dia	15 mm dia	15 mm dia

(ii) Preformed fibreglass sections with galvanized sheet metal muffs

All hot-water pipes in service tunnels, service corridors and where exposed to damage and/or weather shall be insulated with preformed fibreglass sections covered with galvanized sheet metal muffs in a watertight manner. Sheet metal muffs shall be installed with the joints overlapping at least 50 mm and the longitudinal overlap pointing downwards to prevent ingress of water. The sheet metal muff shall be strapped with 10 mm galvanized straps by means of a strapping tool with a minimum of 2 straps/section. All pipe bends, T-pieces, etc, shall be insulated with 25 mm diameter fibreglass rope covered with a 12 mm thick layer of self-setting fibre cement. A reinforcing gauge shall be wrapped over the fibre cement while wet and painted with mastic paint when dry.

Fibreglass section thickness for the various pipe sizes shall be as follows:

PIPE SIZE (STEEL)	PIPE SIZE (COPPER)	FIRBREGGLASS THICKNESS
100 mm dia	108 mm dia	50 mm dia
80 mm dia	76 mm dia	40 mm dia
65 mm dia	67 mm dia	40 mm dia
40 mm dia	54 mm dia	25 mm dia
40 mm dia	42 mm dia	25 mm dia
32 mm dia	35 mm dia	25 mm dia
25 mm dia	28 mm dia	20 mm dia

20 mm dia	22 mm dia	20 mm dia
15 mm dia	15 mm dia	20 mm dia

**AA 09.05****SANITARY AND BRASSWARE EQUIPMENT**

Repair work to the sanitary and brassware equipment is detailed in the Particular Specification and shall include but not be limited to the following:

- (a) Damaged and/or broken irreparable sanitary and brassware equipment shall be replaced with equal specification equipment or approved alternative. These shall be installed strictly to the manufacturer's specifications.
- (b) Sanitary and brassware equipment that is unsuitable for the purpose and application they serve are to be replaced with suitable equipment.
- (c) The quantities of sanitary and brassware equipment needed for the number of people and application they serve, shall be investigated in accordance with the current SABS 0400 application regulations. If found to be insufficient these items of equipment facilities shall be increased only if approved by the Engineer.
- (d) Loose sanitary ware shall be re-fixed and bracketed to structures in accordance with the manufacturer's specifications.
- (e) Stained sanitary ware equipment shall be cleaned, where possible, with approved cleaning agent in accordance with the manufacturer's specification.
- (f) All cisterns are to be cleaned out and filling and flushing mechanisms shall be serviced and repaired. Where beyond repair status, these items shall be replaced with items of equal specification or approved alternatives.
- (g) Unserviceable flushvalves to be repaired utilizing the manufacturers repair kits only. Valves that are worn or damaged beyond repair shall be replaced with valves of equal specification. The design of the valve shall be of such type that all working components can be replaced or repaired without the necessity of changing the valve body – wear and tear must not affect the body of the valve.

Brushed chrome concealed type with integral vacuum breaker, non hold open feature and shut off device. Chrome plated vandal resistant pushbutton activation, "Through Wall" guide tube, wall fixing and captive linkage rod assembly.

Valve to be of either piston type or diaphragm type with replaceable working cylinder and piston or diaphragm.

- (h) All pillar taps, mixers, sink taps and other taps are to be serviced, utilising repair kits. Where equipment is beyond repair these items shall be replaced with items of equal specification or approved alternatives. Where equipment connections are loose these shall be properly secured to sanitary ware and other equipment.
- (i) Leaking, corroded or damaged chromium-plated flush pipes to water-closets and urinals are to be replaced where required.
- (j) Replace missing and/or damaged shower gratings with gratings of equal specification or approved alternatives.
- (k) Service and repair water metering taps by utilising manufacturer's replacement kits where necessary. Where damaged beyond repair the complete item shall be replaced with one of equal specification or approved alternative.

- (l) Replace missing or damaged tap handles with matching handles from the manufacturer of the tap with a countersunk cap screw for the fixing of the handle to the head pot.
- (m) Readjust all timing mechanisms on flush valves and metering taps to the correct flushing and flow times.
- (n) Replace damaged or missing basin and/or sink mixer swivel arms with items of equal specification or approved alternative.
- (o) Replace missing or damaged toilet seats and covers with items of equal specification or approved alternatives.
- (p) Repair and service urinal syphonic valves with replacement kits from manufacturer. Where no spares are available or equipment is damaged beyond repair, these items are to be replaced with values of equal specification or approved alternatives.
- (q) Repair and clean out all bottle traps. Bottle traps that are damaged beyond repair are to be replaced with traps of equal specification or approved alternatives.
- (r) Repair and service bath taps and mixers by utilising manufacturer's replacement kits. Where damaged beyond repair, the taps and mixers shall be replaced with items of equal specification or approved alternatives.
- (s) All tap handles to be of the crutch type where the handle is fixed to the spindle by factory press fit.

## **AA 09.06      FIRE WATER PIPED RETICULATION NETWORKS**

### **AA 09.06.01      General**

Repair work to the fire water piped reticulation networks is detailed in the Particular Specification and shall include but not be limited to the work described below. This specification only covers the water piped reticulation for the fire water protection system, while the equipment related to this installation, such as fire hydrants, hose reels and extinguishers, are covered and detailed in Technical Specification JC: Conventional Fire Fighting Equipment. This specification has to be read in conjunction with the aforementioned specification.

- (a) Replace damaged, broken, leaking, corroded above and underground pipework, fittings and equipment.
- (b) Repair, and service valves which shall include the installation of new gaskets, gland packings, seals, bolt and nuts, etc. If necessary the valves shall be replaced.
- (c) Where valves do not close properly, all these valves are to be refurbished, descaled and if necessary replaced.
- (d) Repair, service and check the proper functioning of all non-return valves and backflow preventers.
- (e) Repair, service, readjust and calibrate all pressure gauges.
- (f) Repair bracketing systems including fixing and repair of existing brackets and the provision of additional brackets where required.

- (g) Report all problems related to fire fighting equipment to the Engineer.
- (h) Water storage tanks are to be emptied, cleaned out, repaired, sealed and put back into operation. Ball float and/or filling valves to these tanks are to be serviced and repaired where required.
- (i) Pressure test and sterilise repaired new installations and equipment.
- (j) Reinstate and make good walls, tiling, floors, concrete, finishes, holes, chases, surfaces, etc, to an acceptable level where any repair, upgrade and/or service work has been executed.
- (k) Record pressure readings on supply to installation.

#### **AA 09.06.02 Material and equipment specification for fire water piped reticulation networks**

Materials and equipment to be used for repair items shall be suitable and/or adaptable to the existing installation and shall comply with the following:

- (a) Galvanized steel pipe installation
  - (i) All galvanized steel pipes shall be medium gauge mild steel screwed and socketed pipes to SABS 62 and shall be normalised and marked as such by the manufacturer. Pipes shall be hot-dip galvanized to SABS 763.
  - (ii) All fittings shall be malleable cast-iron fittings to SABS 509 and galvanized to SABS 763.
  - (iii) All 80 mm diameter and larger pipes shall be joined with Class 16 flanged couplings to SABS 1123/1600. The bolts, nuts and spring washers to be used on these joints shall be cadmium-plated.
  - (iv) In pipe ducts and elsewhere pipes shall be fixed onto walls, soffits, etc, with approved type of supports, holderbats, clamps, etc. Brackets shall be designed to structurally support and fix the pipe system and shall have enough clearance from walls, soffits, etc, to maintain equipment.
  - (v) Pipes shall be supported according to the manufacturer's specifications at the following maximum intervals:

NORMAL SIZE (mm)	HORIZONTAL (mm)	VERTICAL (mm)
15 dia to 20 dia	1 200	1 830
32 dia to 40 dia	1 830	2450
50 dia to 150 dia	2 450	3 050

- (vi) All pipes shall be marked according to SABS 0140 or as specified by the Engineer. All surface pipes shall be painted.
- (vii) Pipes shall be installed on the surface, unless otherwise specified.
- (viii) Provision shall be made for thermal contraction and expansion.

- (ix) The type of pipe joint compound shall be approved by the Engineer and used sparingly with good quality hemp. For pipes larger than 80 mm diameter a jointing compound such as Epidermix 32 shall be used.
  - (x) Any buried pipe shall have at least 900 mm cover and be coated and wrapped to SABS 1117 and tested in the presence of the Engineer.
  - (xi) All pipework and fittings shall be pressure tested as specified.
- (b) uPVC underground pipe installations
- (i) uPVC piping shall conform to SABS 966 with rubber ring type joints.
  - (ii) All bends shall be uPVC type fittings with rubber ring joints.
  - (iii) All other fittings such as T-pieces, reducers, flanges, etc, shall be bitumen-dipped cast-iron rubber ring jointed fittings to SABS 546.
  - (iv) No solvent weld type fittings will be allowed.
  - (v) All cast-iron fittings shall be coated and wrapped to SABS 1117.
  - (vi) All pipes shall be laid on a 100 mm sand bedding cradle and covered with 300 mm sand before backfilling.
  - (vii) Pipe trenching and bedding:

AREA	MINIMUM COVER	BEDDING TYPE	MAIN FILL
Vehicle traffic	1 100	Flexible pipe bedding as per SABS 1200 LB	Soilcrete
Under surface bed	600		Soilcrete
Other areas	900		90 % of modified AASHTO density

- (viii) All thrust blocks shall be cast between the pipe and the undisturbed trench material.
- (ix) No concrete shall come into direct contact with the uPVC pipe. At the thrust blocks the bend shall be wrapped with Densopol 80 HT tape or similar approved.
- (x) HDPE pipe connections to uPVC pipes up to 40 mm diameter can be done by means of SG Iron manufactured saddles with the appropriate gaskets and cadmium-plated bolts and nuts.
- (xi) All pipe crossings under roads and parking areas shall be backfilled as specified in subclause CA 04.04.02(b).
- (xii) All pipework shall be pressure tested with all joints uncovered to the satisfaction of the Engineer.
- (xiii) Suitably sized air release valves built into valve chambers shall be installed at all high points of the pipeline.

- (xiv) Duckfoot bends shall be used to all fire hydrants at the foot of fire hydrants. This to be cast into thrust blocks.

(c) HDPe underground pipe installations

- (i) All HDPe piping shall be Type 4 HDPe pipe to SABS 533.
- (ii) All fittings shall be of Plasson compression type and shall conform to ISO/DIS 3458.
- (iii) All pipes shall be laid on a 100 mm sand bedding cradle and covered with 300 mm of sand or selected material.
- (iv) All backfilling shall be to the SABS 1200 DB and to the Engineer's approval.
- (v) Pipe trenching and bedding:

AREA	MINIMUM COVER	BEDDING TYPE	MAIN FILL
Vehicle traffic	1 100	Flexible pipe bedding as per SABS 1200 LB	Soilcrete
Under surface bed	600		Soilcrete
Other areas	900		90 % of modified AASHTO density

- (vi) No concrete shall come into direct contact with the HDPe pipe. At these points the fittings shall be wrapped with Densopol 80 HT tape or similar approved.
- (vii) All pipe crossings under roads and parking areas shall be backfilled as specified in subclause CA 04.04.02(b).
- (viii) All pipework shall be pressure tested with all joints uncovered to the satisfaction of the Engineer.
- (ix) Suitably sized air release valves built into valve chambers shall be installed at all high points of the pipeline.

(d) Valves

- (i) Gate valves underground in valve chambers to connect to uPVC piping (65 mm NB and larger)

Gate valves are to be equipped with non-rising spindle, spherical graphite iron body to SABS 936 Grade 42, cast-iron nitrile butadiene rubber covered gate, stainless steel spindle, nitrile butadiene rubber O-rings and seals, cast-iron bonnet and gunmetal thrust collar to BS 1400 LG2.

The valves shall conform to SABS 664 and/or 665 and shall be capable of withstanding a working pressure of 1 600 kPa.

The valves shall be fitted with a square key spindle top to close the valves in clockwise direction and socket ends to SABS 665 to fit into uPVC.

Valves are to be provided with locking devices to lock valves in open position.

(ii) Gate valves underground in valve chambers to connect to uPVC piping

The gate valves shall be of the dezincified brass type with brass gate, brass body, non-rising spindle and BSP threaded socket ends. The valves shall conform to SABS 776 Class 125. The valves shall be able to withstand a working pressure of 1 600 kPa. The valve shall be fitted with a hand wheel on an extended spindle shaft of 700 mm to close in a clockwise direction and shall be installed to details provided.

(iii) Gate valves above ground to connect to steel (65 NB and larger)

Gate valves are to be equipped with non-rising spindle, spherical graphite iron body to SABS 936 Grade 42, cast-iron nitrile butadiene rubber covered gate, stainless steel spindle, nitrile butadiene rubber O-rings and seals, cast-iron bonnet and gunmetal thrust collar to BS 1400 LG2.

The valves shall conform to SABS 664 and/or 665, and shall be capable of withstanding a working pressure of 1 600 kPa.

The valves shall be fitted with flanged ends to SABS 1123/1600, hand wheel to close the valves in a clockwise direction and installed in an upright position or sideways to maximum 90° from upright.

These valves shall be equipped with locking devices to lock valves in open position.

(iv) Gate valves above ground (up to 50 mm NB)

The gate valves shall be of the dezincified brass type with brass gate, brass body, non-rising spindle and BSP threaded socket ends. The valves shall conform to SABS 776 Class 125.

The valves shall be able to withstand a working pressure of 1 600 kPa.

The valve shall be equipped with a hand wheel to close in a clockwise direction.

The valves shall be installed in an upright position or sideways to maximum 90° from upright and shall be so placed with other fittings as to be removed without cutting the pipework.

The valves shall be equipped with locking devices to lock valves in open position.



**AA 10      MAINTENANCE TO INSTALLATIONS, SYSTEMS AND EQUIPMENT****AA 10.01      GENERAL**

Monthly maintenance responsibilities for each installation including all units and components as specified, shall commence with access to the site. A difference shall be made in payment for the maintenance prior to and after practical completion of repair work.

Maintenance responsibilities of the completed installation shall commence upon the issue of a certificate of practical completion for repair work, and shall continue for the remainder of the 36-month contract period.

This part of the Contract shall include preventative maintenance, corrective maintenance, and breakdown maintenance, as defined in Additional Specification SA: General Maintenance, for the specified installations described under the section AA 01 of this document.

The maintenance work to be performed and executed shall be done strictly in accordance with Additional Specification SA: General Maintenance, and as specified in the Particular Specification and this specification.

The said maintenance work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws and the manufacturer's specifications and codes of practice.

The maintenance schedules and frequency shall be developed under the maintenance control plan to be instituted by the Contractor.

All new equipment, components and materials supplied and installed under the maintenance Contract shall be furnished with prescribed manufacturer's guarantees.

The maintenance work and items are to be categorised for each maintenance activity under the following headings:

- (a) Rainwater disposal system
- (b) Soil and wastewater drainage systems
- (c) Domestic water distribution and reticulation systems
- (d) Sanitary and brassware equipment
- (e) Fire water piped reticulation networks.

**AA 10.02      PREVENTATIVE MAINTENANCE**

This maintenance of the installations, systems and equipment shall be done in accordance with Additional Specification SA: General Maintenance and the Particular Specification related to this work.

The maintenance work to be performed and executed shall include, but not be limited to the items listed in tables AA 10.02/1, AA 10.02/2, AA 10.02/3, AA 10.02/4 and AA 10.02/5 below under each heading.

These actions and findings shall be logged and reported on the relevant approved schedules and reports.

TABLE AA 10.02/1 - RAINWATER DISPOSAL SYSTEM

NO	PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
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1	Clean out and clear all rainwater gutters and full bores	Four-monthly
2	Clean out and clear all catch pits, channel drains and floor outlets	Four-monthly
3	Clean and unblock all drain pipes	Annually
4	Check alignments of gutters	Six-monthly
5	Check and inspect all rainwater outlet gratings and replace if necessary	Six-monthly
6	Check gutter and pipe bracketing system and repair and replace if necessary	Four-monthly
7	Check and inspect manhole covers and frames for damages and replace if necessary	Six-monthly
8	Paintwork repairs to surface piping and equipment	Annually
9	Visually inspect and report on total system	Monthly

TABLE AA 10.02/2 - SOIL AND WASTEWATER DRAINAGE SYSTEM

NO	PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete installation	Monthly
2	Check, service and clean out grease traps	Monthly
3	Check, service and clean out oil separators	Monthly
4	Check, inspect and clean out all floor drains	Monthly
5	Check, inspect and clean out all gullies	Monthly
6	Replace broken or missing gully gratings	Four-monthly
7	Check, inspect, repair or replace all manhole covers and frames and builder's work to manholes	Four-monthly
8	Check, inspect and repair manhole benching.	Four-monthly
9	Check, inspect, repair or replace all inspection eyes, end caps and cleaning eye covers	Four-monthly
10	Check, inspect, repair or replace all bracketing systems	Four-monthly
11	Check, inspect, report and unblock any blockage that occurs	Monthly
12	Check, inspect, repair/replace and clean out all equipment traps	Monthly
13	Paintwork repairs to surface piping and equipment	Annually
14	Video survey and resultant repairs and unblocking of all main sewer lines (See subclause AA 09.03.01(e))	At start of Contract
15	Check, inspect, service, repair/replace all vacuum and two-way vents	Four-monthly

TABLE AA 10.02/3 - DOMESTIC WATER DISTRIBUTION AND RETICULATION SYSTEMS

NO	PREVENTATIVE MAINTENANCE DESCRIPTION	ITEM	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete system		Monthly
2	Log all water meter readings		Monthly
3	Log all pressure gauge readings		Monthly
4	Check, inspect, report and repair leaks		Monthly
5	Replace all valve gaskets, gland packings and seals		Annually
6	Sample water supply and chemical analyses to be provided by approved company		Annually
7	Water storage tanks to be emptied, cleaned out, inspected, repaired and resealed where necessary		Annually
8	Check, inspect, service, repair and readjust all pressure-reducing valves		Annually
9	Check, inspect and test operation of all valves on site		Four-monthly
10	Clean out all strainers		Monthly
11	Check, inspect, service test and repair/replace all safety and expansion release valves		Six-monthly
12	Check, inspect, repair or replace all bracketing systems		Four-monthly
13	Check, inspect, service, repair/replace all air release valves and vacuum breakers		Four-monthly
14	Check, service, repair or replace all ball float valves		Four-monthly
15	Check, inspect, test, service, repair/replace all geyser installations		Four-monthly
16	Check, inspect, test, service and repair/replace all non-return valves		Four-monthly
17	Paintwork repairs to piping, fittings and equipment		Annually

TABLE AA 10.02/4 - SANITARY AND BRASSWARE EQUIPMENT

NO	PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete installation	Monthly
2	Inspect, repair/replace WC seats and covers	Monthly
3	Replace all tap washers	Six-monthly

4	Replace all tap gland packings	Six-monthly
5	Check, inspect, repair, fix and where necessary replace sanitary ware mountings and brackets	Four-monthly
6	Check, inspect, service, repair/replace all cistern flushing mechanisms	Monthly
7	Check, inspect, service, repair/replace all brassware	Four-monthly
8	Check, inspect, service, repair/replace all sanitary ware	Four-monthly
9	Check, inspect, service, repair, readjust all flushing valves	Four-monthly
10	Replace all flushing valve internal parts with replacement kits	Once per Contract
11	Stained equipment to be cleaned with approved manufacturer's cleaning agent	Six-monthly
12	Check, inspect, report and repair all leaks	Monthly
13	Check, inspect, repair/replace all shower gratings	Four-monthly
14	Paintwork repairs to all equipment	Annually
15	Check, inspect, repair, service, replace all missing valves	Six-monthly
16	Replace missing tap handles	As occur
17	Replace missing bath, basin, sink, etc, plugs	As occur

TABLE AA 10.02/5 - FIRE WATER PIPED RETICULATION NETWORKS

NO	PREVENTATIVE MAINTENANCE DESCRIPTION	ITEM	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete system		Monthly
2	Report any failures/breakage of fire fighting equipment to the Engineer		Monthly
3	Log all pressure gauge readings		Monthly
4	Replace all valve gaskets, gland packings and seals		Annually
5	Water storage tanks to be cleaned out resealed/repared if necessary		Annually
6	Check, inspect, service, repair/replace all non-return valves and backflow preventers		Four-monthly
7	Check, inspect, report and repair all leaks		Monthly
8	Inspect, service, readjust and calibrate all pressure gauges		Four-monthly
9	Paintwork repairs to piping, fittings and equipment		Annually
10	Check, inspect, repair or replace all bracketing systems		Four-monthly

**AA 10.03****CORRECTIVE MAINTENANCE**

The corrective maintenance of the installations, systems and equipment shall be done in accordance with Additional Specification SA: General Maintenance and the Particular Specification related to this work.

The Contractor shall inspect and check all equipment, materials, systems and installation for any pending breakdowns, maladjustments or anomalies of equipment.

The Contractor shall report and take actions to correct such deficiencies.

**AA 10.04****BREAKDOWN MAINTENANCE**

Breakdown maintenance of the installations, systems and equipment shall be done in accordance with Additional Specification SA: General Maintenance and in accordance with the related specifications, standards, regulations and codes.

All breakdown problems experienced shall be acted upon within the time limitations allowed in the General Maintenance documents.

The Contractor shall have access to the necessary spares, equipment and tools for the expected breakdowns.