MHSC

MINE HEALTH AND SAFETY COUNCIL

Alterations, Building Works, Internal Fit-Out, Furnishing and Fire Protection for the MHSC Offices

BID No.: MHSC 013/2025-26

PLUMBING AND DRAINAGE

SPECIFICATION

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PLUMBING AND DRAINAGE SPECIFICATION

1 GENERAL SPECIFICATION

1.1 GENERAL

The drawings form part of the project specification and shall be read in conjunction with the scope of works.

Conflicts, errors, or discrepancies found in this specification or drawings shall be brought to the Engineer's attention for resolution.

Any deviations from the specifications, drawings and/or equipment specified shall be listed together with the alternatives offered and shall be submitted as part of the tender. If no deviations are listed, it will be assumed that the Tenderer comply with all the relevant technical parts of this specification.

All installations shall be complete in all respects, and the Contractor shall allow for the completion and successful operation of the complete installation, irrespective of whether every separate item is specified or not.

1.2 SITE AND SITE INSPECTION

The site is located at:

- Section 8, Tuscany Office Park
- 2 Coombe Place, Rivonia, Sandton, 2128, Gauteng

Tenderers are advised to visit the site and acquaint themselves with the nature and extent of the work involved before submitting their tenders.

1.3 NOTES ON THIS SPECIFICATION

This specification must be read in conjunction with the specification provided by the Civil Engineer for all underground piping. This specification provides guidelines for underground piping networks but does not supersede the requirements of the Civil Engineer or their relevant specification. Where underground piping is specified, this must be installed with the relevant guidelines outlined in the Civil Engineer's specification.

The standard specifications included define the standard of equipment and materials as well as the quality of the services required for the various sections of the installation.

Not all the clauses in this section of the standard specification shall necessarily be applicable on this project. Refer to the detailed or material specification for materials and equipment to be used and the Civil Engineer's specification where applicable.

The contractor shall at all times adhere to this specification unless otherwise specified on the drawings and/or in this detailed specification.

In instances where this specification differs in any way or form from the engineering drawings, this must be brought to the Engineer's attention during the tender stage and be clarified immediately.

Failing this. It shall be at the engineer's discretion which form of documentation to proceed with without any further consequence to the project or pricing.

The engineers' drawings show broad principles of design, general arrangements and when read together with the specifications and the drawings of other disciplines and other contractors, they carry sufficient information to enable the contractor to determine how the installation is to be installed, operated, services and maintained.

Pipe sizes and possible positions are shown on the engineers' drawings strainers etc must adapt to these pipe sizes.

The contractor shall submit workshop drawings, samples, catalogues, performance characteristics etc., on all equipment, except when specifically included by the engineer.

The contractor shall take in situ measurements for installation of the equipment of the system and produce complete workshop drawings for fabrication and installation. These drawings shall be co-ordinated by the contractor with all other relevant equipment and services. Dimensions given on the engineers' drawings shall be adapted to suit the relevant measurements of the specific fittings and/or equipment.

1.4 DEFINITIONS AND ABBREVIATIONS

1.4.1 DEFINITIONS OF TERMS USED HEREIN:

"Provide": to supply, install and connect up, complete and ready for safe and regular operation particular work referred to unless specifically indicated or specified otherwise.

"Install" : to erect, mount and connect complete with all related accessories.

"Supply": to purchase, procure, acquire and deliver complete with all related accessories.

"Work": all labour, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation.

"Concealed": embedded in masonry or other construction, installed in furred spaces within double partitions or hung ceiling, in trenches, in crawl spaces or in enclosures.

"Exposed" : not installed underground or "concealed" as defined above.

"Indicated", "Shown" or "Noted": as indicated, shown or noted on drawings and/or specifications.

"Similar" or "Equal": of approved manufacture, equal in materials, weight, size, design and efficiency of specified product.

"Approved", "Satisfactory", "Accepted" or "Directed": as approved, satisfactory, accepted or directed by the Engineer.

1.4.2 ABBREVIATIONS:

"SABS": The South African Bureau of Standards and the number following shall refer to the latest amendment of the relevant specification or Code of Practice as the case may be.

"BSS" : British Standard Specifications

"NB" : Nominal Bore

"WWP": ; Water Working Pressure

"WOG": ; Water, Oil, Gas

"PB" : Polished Brass

"CP" : Chromium Plated

"AASHTO" : American Association of State Highway and Transportation Officials.

"CKS" : Co-ordinating Specifications issued by the Central Co-ordinating Committee under the auspices of the South African Bureau of Standards.

1.5 COMPLETION DATE

Completion dates are stipulated in the tender pack included in this document. The Contractor is required to complete the works within this date.

1.6 PROGRAM

Directly after acceptance of this tender, the Contractor must submit time schedules for each activity to the Client. This must be done with due consideration of site conditions observed during the site visit.

A copy of the program (and revisions thereto) shall be submitted to the Engineer well within time and at regular intervals.

The following items shall be programmed :

- Equipment detail submission for approval
- Ordering of material
- Piping installation
- Approval of first fix
- Equipment installation
- Second fix
- Commissioning and testing
- Final inspection

1.7 FINISHING AND TIDYING

In view of the intense concentration of construction activities likely to be experienced during the contract period, progressive and systematic finishing and tidying will form an essential part of this contract. On no account, must spoil, rubble, materials, equipment or unfinished operations be allowed to accumulate in such a manner as to unnecessarily impede the activities of other and in the event of this occurring, the Employer shall have the right to withhold payment for as long as may be necessary in respect of the relevant works in the area(s) concerned without prejudicing the rights of others to institute claims against the Contractor on the ground of unnecessary obstruction. Finishing and tidying must be done daily and not simply be left to the end of the contract. All finishing and tidying

shall be carried out to the best advantage of the project.

1.8 SCAFFOLDING

The Contractor shall provide their own scaffolding . For installation purposes the Tenderer shall allow for his own lifting equipment, cranes etc. which may be necessary to complete the installation as none of these facilities will be available on site.

1.9 SUPERVISORY STAFF AND IDENTIFICATION

At all times while on the premises, all artisans and labour members of the mechanical contractors and subcontractor's staff will wear clothing adequately marked with the relevant contractor's name.
The work shall be done by, or always be under the personal supervision of a qualified artisan (or qualified technician) in the respective trade.

1.10 QUALITY OF MATERIALS AND WORKMANSHIP

All materials shall be new, undamaged and free from rust or other defects. Only material of the best quality, which has been approved by the Engineer, shall be used.

The Contractor shall, upon the request of the Engineer, furnish documentary proof to the engineer's satisfaction that the material is of the quality specified. Samples of materials for testing, if required, shall be supplied by the Contractor, free of charge.

Where applicable, all material shall be in accordance with the relevant standard specifications of the South African Bureau of Standards and the British Standard Specifications.

The installation shall be carried out according to the latest modern engineering practices.

The Engineer reserves the right to reject any work or part thereof that, according to his judgement, does not meet the highest standards of material and workmanship and to enforce replacement of the work at the expense of the Contractor.

1.11 RATING OF EQUIPMENT

The Contractor shall supply the sizes and rating of all the equipment offered to the Engineer for approval prior to purchasing or ordering such equipment.

All equipment offered shall operate well within the manufacturer's ratings, and equipment to be operated beyond these limits will not be considered.

1.12 SPACE REQUIREMENTS AND ACCESS

Tenderers shall ensure that the equipment offered by them can be installed in the available space as shown on the drawings. Should it be found at a later stage that the equipment offered does not fit, all costs arising from the rectification of this problem shall be for the Contractor's account.

The equipment shall be installed in such a manner that complete access is provided for operating and maintenance purposes.

Tenderers shall also ensure that the equipment offered by them will pass through available building openings. Large

equipment shall be made up in sections and each section shall be small enough for access through doors and other building openings. All additional costs involved for the modification of equipment or to change the maker of equipment in order to allow access shall be for the account of the Contractor.

1.13 REGULATIONS AND STANDARDS

The equipment, installation, commissioning and maintenance shall in all respects comply with the following authorities and regulations, but not limited to:

- The Occupational Health and Safety Act, Act No. 85 of 1993.
- Local Municipal Regulations, by-laws and Ordinances.
- Local Fire Department Regulations.
- SANS 10400: 1990: The application of the National Building Regulations.
- Local Electrical Supply Authority Regulations.
- The wiring of premises Part1: Low-voltage installations, SANS 10142-1 as amended.

All losses, costs or expenditures, which may arise as a result of negligence to comply with any regulation applicable to this service as specified above, shall be for the account of the Contractor.

Where trade names and references to catalogues are found in the specification, the intention is to set a particular standard of equipment. Where “other approved” equipment is specified, the Tenderer shall obtain written approval from the Engineer before he may deviate from the specified equipment. This approval must be obtained at tender stage.

The Contractor shall work strictly according to this specification and shall ensure that only the best quality material is used, and that the installation is handed over as a complete working system.

1.14 DRAWINGS

The dimensions and positions of equipment shown on the Engineer’s drawings are schematic and for tender purposes only. The drawings are not suitable for manufacturing purposes. The responsibility for dimensional and layout accuracy remains with the Contractor. The exact positions will be pointed out on site where necessary.

The following drawings shall be submitted by the Contractor to the Engineer for approval, within four (4) weeks of acceptance of the tender:

1.14.1 BUILDERS DRAWINGS

All building requirements are to be indicated on these drawings to meet the dimensional requirements of the equipment and materials to be installed by the Contractor

1.14.2 MECHANICAL DRAWINGS

These are workshop and equipment layout drawings required for the manufacture and installation of equipment, showing detailed dimensions. ***No work may be conducted on site without approved workshop drawings approved only by the mechanical engineer!!***

1.14.3 ELECTRICAL DRAWINGS

These include switchboard layouts, circuit diagrams, interconnection diagrams, and cable and equipment schedules.

Any work done by the Contractor without an approved drawing shall be at the Contractor's own risk, and any changes required to conform with the contract documents or co-ordinate his work with other trades, shall be for the account of the Contractor.

The approval of drawings by the Engineer shall not relieve the Contractor of his responsibilities to carry out the work in terms of the contract documents.

The mechanical and electrical drawings shall be updated during the contract period and shall be included in the operation manual at the end of the contract period as "as built" drawings.

1.15 OPERATION MANUALS AND MAINTENANCE INSTRUCTIONS

The Contractor shall submit three (3) copies of operation and maintenance manuals to the Engineer.

Manuals shall consist of:

- Comprehensive literature of the different components of the installation.
- Paper prints of all approved drawings and diagrams where applicable.
- Start-up and shutdown procedures.
- Commissioning data of all equipment in tabulated form.
- Prescriptions for routine tests, which shall be performed by the user together with the time when such tests shall be, performed (e.g., pressure tests).
- Schedule of apparatus and equipment complete with model numbers, optional extras, modifications, electrical requirements, etc.
- Detailed daily, weekly, monthly, quarterly, bi-annual, or annual preventative maintenance procedures where applicable.
- Manufacturer's catalogues.
- List of spares for all equipment.
- Suppliers telephone numbers and addresses.
- Wiring diagrams.
- Test certificates.

The operation manuals shall be sturdily bound in a strong hard cover. Material in the manual shall be clear, legible and well-arranged and provided with an index.

In addition to the manuals the sub-contractors shall also provide a very simple operational instruction with areas/zones affected, on A4 or A5 paper sheet size, framed and mounted in sprinkler cabinets and adjacent to control console to which it pertains. This is to enable a non-technical person to operate the system. It shall give clear instructions of how to stop and start the plant/system, the use of the auxiliary/standby equipment, etc.

The above manuals shall be available three weeks before first handover / practical completion of the installation and no handover shall be considered without these manuals.

1.16 MAINTENANCE AND GUARANTEE

All equipment supplied and work done as part of this contract shall be maintained and guaranteed for a period of one year from date of practical completion.

The Contractor is responsible for all material and labour during this period.

The Contractor shall visit the installation uninterrupted and do the scheduled maintenance as prescribed in the operating instructions. On completion of the monthly visit a full report shall be prepared and submitted to the Client within seven (7) days from the visit.

In case of a breakdown, the Contractor shall react within reasonable time and repair the installation to the satisfaction of the Client. Should the Contractor, in the discretion of the Client, not react within reasonable time, the Client shall commission another Contractor and the cost thereof shall be recovered from the defaulting Contractor.

1.17 PAINTING

Where applicable the following painting specifications shall apply:

Iron and steel surfaces shall be properly cleaned by removing all dirt, oil, scale and rust by brushing and sanding until a clean shiny surface is obtained. Hereafter a metal primer shall be applied.

Galvanized surfaces shall be cleaned with a galvanizing cleaning agent and then washed with clean water to remove the factory applied protection against white rust. Hereafter a calcium plumbate primer shall be applied, followed by an undercoat between 24 and 72 hours after application of the primer.

Other surfaces shall be cleaned by removing all dirt and a primer as specified by the paint supplier for the particular surface shall be applied.

The primer coat shall be followed by a matt undercoat and a final topcoat of high gloss enamel of an approved colour. Each layer of paint shall be clearly distinguishable from each other by means of different colours and each layer shall be properly sanded before the following coat is applied.

All paint shall at least be of SABS quality for industrial use and shall be approved by the Engineer. Equipment shall be painted according to the National Colour Standards, SANS 1091.

1.18 DAMAGE AND PROTECTION OF WORKS

The Contractor shall take all precautions necessary for the protection of life, equipment and property in connection with the works during installation.

The Contractor shall be held completely responsible for any damage of equipment during transport and installation, as well as any damage to the building and shall repair any such damage at his own expense. Where equipment cannot be repaired to an “as new” condition, it will be completely replaced at the expense of the Contractor.

Equipment delivered to site shall be stored in a well-protected area where it cannot be damaged by either the weather or other trades.

1.19 WELDING

Welding shall be carried out in accordance with the current edition of SANS 10044 Parts 1 to 2 where applicable. All welding shall be performed according to the latest technology and where exposed, it shall be smoothly finished off.

1.20 BUILDING WORK AND REMOVAL OF EQUIPMENT

The following work shall be carried out by the builder/main Contractor.

- Drilling and cutting of necessary holes in the concrete, brickwork, ceilings and wooden doors, including making good to match finish.
- Concrete plinths for installation of equipment.
- Waterproofing of roof penetrations and plinths.
- Provide drain points where required.

1.21 TESTING

The piping system shall be tested and operated to meet the performance figures and duties specified. All safety features and interlocks shall be tested.

Pressure tests for water and piping shall be done at a test pressure of 1.5 times the maximum working pressure at the lowest point in the system, but not less than 700 kPa. All instrumentation, which could be damaged during the test, shall be removed from the pipe system.

The relevant system shall be filled with water and all high points shall be vented at least 24 hours before the test. The duration of the pressure test shall be 2 hours, after which no water leaks shall be visible and no pressure drop shall occur after corrections have been made for changes in ambient temperature during the test period.

Pressure tests shall be completed prior to insulating or covering piping. If leaks are found, welded connections shall be cut out and re-welded. Rectified piping shall be retested.

1.22 COMMISSIONING

The installation shall be commissioned in accordance with the relevant codes and recognised commissioning procedure or code approved by the consulting engineer:

The Contractor shall submit a commissioning program to the engineer at least two weeks prior to the commencement of commissioning and at the same time shall notify the consulting engineer of the code or procedure to which the equipment will be commissioned.

The results of all checks and measurements shall be recorded in writing during the commissioning period. Commissioning records shall be handed over to the engineer prior to the first acceptance of the plant. The commissioning records shall also be included in the operation manuals.

1.23 DIAMETERS OF PIPES

All diameters of pipes given are the nominal bore or external diameters in accordance with the normal conventions

of the materials being used.

1.24 CODES OF PRACTICE, LAWS AND STANDARDS

All workmanship and materials used in the execution of the works shall be of the highest class and, where not fully covered by the Specification, shall be carried out in conformity with best modern practice, as determined by the Engineer.

It shall be the contractor's responsibility to ensure that the with all relevant requirements of governmental and Local Authorities whose jurisdiction embraces the location of the Site of the Works and the equipment provided for those installations which shall comply in every respect with the National Building Regulations and Building Standards Act, Act 103 of 1975 and the Occupational Safety Act, Act Nº6 of 1983, both as amended to date, excepting only where exemption from any such regulations has first been obtained in writing from the said authorities, provided that the approval of the Engineer has been given prior to application for any exemption.

All materials and equipment supplied and installed shall carry the SABS or BS mark of approval unless otherwise specified or agreed to in writing by the engineer. Where alternatives are offered, the submission is to include full details of the item together with tests and compliances with any other standards.

All electrical wiring shall comply fully with the latest edition of the Standard Regulations for the wiring of Premises, SABS 0142 and the additional requirements of any local authority who has jurisdiction over the Site of Works, as well as being in accordance with best modern practice.

Wherever relevant, this Specification shall be understood to be amplified to embrace Codes of Practice and Standards promulgated by recognised authorities in the field of Plumbing and Drainage Technology and all other branches of engineering science applicable to this project.

It shall be assumed that the contractor is conversant with the abovementioned requirements. Should any requirement, by-law, or regulation, which contradicts the requirements of this document, apply or become applicable during the erection of the installation, such requirement, by-law, or regulation shall overrule this document and the contractor shall immediately inform the Engineer of such a contradiction. Under no circumstances shall the contractor carry out any variations to the installation in terms of such contradictions without obtaining written permission to do so from the Engineer.

It shall be the responsibility of the contractor to make the necessary arrangements at this own expense with the local supply authority and to supply the labour, equipment and means to inspect, test, commission and to hand over the installation.

The Subcontractor shall supply and install all Notices and Warning signs that are required by the appropriate laws, regulations and/or by this document.

1.25 ORGANISATION AND STAFF CONTRACT

In addition to the site supervisor and/or foreman, the contractor shall employ as many competent and experienced persons as may be necessary for the purpose of the contract and shall be bound to remove from the contract works any person to whom the employer or his agent or the principal contractor may reasonably object by reason of any failure, neglect, incompetence or substandard work execution by or under the supervision of such person.

The duties and responsibilities of the contractor's management not be limited to the following:

I. Selection of equipment and components into working assemblies in conformance with the design concept in the subcontract specification.

II. Submission of equipment and installation drawings for approval in accordance with the required procedure.

III. Programming and planning of the work to fit within the timelines.

IV. Attendance at routine site progress meetings and programme monitoring meetings organised by the principal contractor.

V. Conducting of all tests required.

VI. Expediting of the work.

VII. Directing his employees to ensure efficient, timely and safe execution of the work, and co-operation with the principal contractor and other trades to ensure such execution.

VIII. Attendance at meetings from time to time with the engineer in order to discuss any technical matters that need clarification.

1.26 CO-ORDINATION WITH OTHER TRADES

The contractor shall acquaint himself with the general arrangement of all other services and ensure that in fixing the work it will not obstruct the fixing or future maintenance of the contract works or other services.

The contractor shall also fully co-operate with other trades and take all reasonable precautions to ensure that the work of does not impede the progress of, or damage the work of other contractors.

1.27 TEST AND INSPECTION PRIOR TO COMPLETION

Except where otherwise provided in the contract, the contractor shall provide all labour, materials, power, fuel, accessories and properly calibrated and certified instruments necessary to carry out such tests. Arrangements for such tests shall be made by the contractor and he shall give at least 72 hours' notice to the engineer, in writing, of the test prior to commencement.

In the event of the installation not passing the test, the Client shall be at liberty to deduct from the contract price all reasonable expenses incurred by himself or his agents attending the repeated tests.

Whenever any installation or equipment is operated for testing or adjusting as provided, 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 client may assign operating personnel as observers but such observation time shall not be counted as instruction time.

After complete installation of the system all equipment shall be tested, adjusted and readjusted until it operates to the satisfaction and approval of the engineer and the client.

The contractor shall submit certificates of tests carried out to prove all equipment and also certificates to be obtained from all relevant authorities and statutory bodies etc.

1.28 WORKSHOP DRAWINGS

The contractor shall prepare at his own expense and shall submit copies of shop drawings for all fabricated work, working or setting out drawings, shop details and schedules to the Client's representative for approval and no

installation shall be performed by the subcontractor until such approval has been given.

As soon as approval has been given the contractor shall forward to the Client's representative two prints of the approved shop drawings, setting out drawings and schedules. The contractor shall also furnish to the Works as many prints of the approved shop drawings and schedules as are required. No work shall be performed from shop drawings and/or catalogues not stamped with the Original approval stamp of the engineer. All approvals, and such stamped drawings and/or catalogues shall be kept available at the job site as evidence of such approval.

The contractor shall be responsible for dimensions, design of adequate connections, details for the satisfactory construction of all work and the furnishing of materials for work required by the subcontract even if not indicated on the submissions that have been approved by the Client's representative.

The Client's representative will check drawings for design on drawings, schedules and catalogues by the Owner's representative as a complete check but shall not relieve the subcontractor of his responsibility as above stated. If the submissions differ from the requirements of the subcontract, the subcontractor shall make specific mention of each difference in his letter of transmission, with a request for substitution, together with his reasons for same, in order that, if acceptable, suitable action may be taken by Otherwise, the subcontractor will not be relieved of the responsibility for executing the work in accordance with the requirements of this subcontract.

Corrections of shop drawings by the Owner's representative are scope of work. Should any such corrections constitute a change of scope of work, the subcontractor shall notify the Owner's representative in writing within 7 calendar days of such change and shall not proceed with the fabrication until so authorised by the Owner's representative. Claims for change of scope, work constituting the claimed change of scope, will not be considered.

1.29 "AS-BUILT'" DRAWINGS AND MANUFACTURERS INFORMATION

The contractor shall provide the Engineer with a complete signed transparent set of "as-built" drawings together with stored drawings in DXF electronic format as a pre-requisite to final payment; and the Engineer shall hand the set over to the client after having established their correctness. The "as-built" set shall include all mechanical and electrical work.

If "as-built" variations cannot be clearly shown thereon, then the Subcontractor shall prepare supplementary transparent drawings that will properly impart the necessary information. Manufacturer's and Subcontractor's shop drawings shall be corrected to correspond with the "as-built" drawings and copies of each shall also be furnished to the Engineer.

"As-built" drawings shall be maintained on a current basis as work progresses, and all deviations in work as actually installed accurately entered, at least once a week, on paper prints of design drawings affected, with such prints kept available at the site for the inspection of the Engineer. QUALITY ASSURANCE SYSTEM

The contractor shall institute an approved Quality Assurance system (QA) which shall be submitted to the engineer for his approval. The records of this QA system shall be kept throughout the duration of the contract and shall be submitted to the engineer at regular intervals as required by the engineer.

1.30 QUALITY ASSURANCE SYSTEM

The contractor shall institute an approved Quality Assurance system (QA) which shall be submitted to the engineer for his approval. The records of this QA system shall be kept throughout the duration of the contract and shall be submitted to the engineer at regular intervals as required by the engineer.

1.31 OPERATING AND COMMISSIONING OF INSTALLATION

The completed installation shall be put into operation after all tests and adjustments have been carried out to the satisfaction of the engineer. The contractor shall run and operate the system for a period of time as specified by the engineer.

The contractor shall submit a full commissioning report.

1.32 MAINTENANCE OF THE INSTALLATION DURING THE PERFORMANCE GUARANTEE PERIOD

The contractor shall furnish, free of charge, all maintenance on the entire equipment supplied by him for the guarantee period. Maintenance shall include systematic examination and adjustment of all this equipment as specified in the maintenance guide. The contractor shall, in the course of such maintenance or on call during the maintenance period, repair or replace defective parts as required and shall use only genuine standard parts produced by the manufacturer of the original part, Renewals or repairs resulting from misuse of air wear and tear, however, shall not be made at the expense of the contractor where certified as such by the engineer. Specified spares shall not be used during this period. If any spaces are used due to operational necessity and with the engineer's permission, such spares shall be replaced in full by the contractor. The maintenance period shall only begin with completion of the Main Contract and when the engineer has certified the contract works as completed, unless otherwise specified.

1.33 COMPLETION OF CONTRACT WORKS

Completion of the contract works will only occur after the following procedure has been certified by the engineer as having been carried out in accordance with the specification:

- Physical completion of all installations and all defects made good before reporting to the engineer.
- Acceptance tests have successfully taken place as specified and test results have been witnessed (where required), recorded and approved by the engineer.
- "As-built" drawings, commissioning reports and maintenance manuals have been submitted to and approved by the engineer.

The installations shall only be deemed handed over when completed, tested and fully commissioned and then signed off by the Engineer.

1.34 WORKMANSHIP AND INSTALLATION

1.34.1 PIPING GENERAL

Materials and workmanship shall be the best of their respective kinds. Only new and undamaged materials shall be used in the Works. Materials to be permanently installed into the works shall not be used for any temporary purposes on site. Work shall be to the approval of the engineer and shall be executed in accordance with the relevant manufacturer's written recommendations and instructions.

Drawings are generally diagrammatic and indicative of work to be installed. Run and arrangements of piping shall be approximately as indicated, subject to modifications as required to suit conditions at building, to avoid interference with work of other trades, or for proper, convenience and accessible location of all parts of piping systems. Due to small scale of drawings all required offsets, fittings, valves, traps, drains etc., may not be indicated. Refer to and carefully check architectural, structural, electrical and mechanical drawings and details, noting locations where walls, partitions, ceilings, beams, columns and other surfaces are furred, location of beam cuts, location of pipe

shafts and conflicts with work of other trades and arrange work accordingly, providing all offsets, fittings, valves, traps, drains etc., required to meet such conditions.

Run piping in wall chases, recesses, pipe shafts and hung ceilings where same are provided. No piping shall run in floor fill unless indicated or specifically approved. Exterior utilities are diagrammatic and exact location and invert elevations shall be as required to meet existing conditions. Install piping under buildings as high as possible. Do not permanently close up, fur in or cover piping before examination and testing of both the civil and mechanical engineers.

Run piping as straight and direct as possible, in general forming right angles with or parallel to walls or other piping and neatly spaced with risers erected plumb and true. Install piping so that there is clearance of at least 25mm between finished coverings (fitting hubs on uncovered piping) of piping and also between finished coverings or fitting hubs and adjoining work, hang piping at or in ceiling from construction above, as close as possible to bottom of slabs, beams etc., always maintaining maximum headroom. Obtain from Engineer approved ceiling heights and install work above this height.

No piping shall be run in elevator machine rooms (except where special ducts are provided), telephone rooms containing telephone equipment, relays and terminal strips, and electric rooms and closets containing exclusively equipment such as transformers, switchgear, motor control centres, panel boards, or similar items of equipment, and in emergency generator room. This specification is the proprietary intellectual property of the client. Elsewhere, no piping shall be run within 1,75m laterally of such electrical apparatus as motor control panels, switchboards and electric motors, except for branch piping connecting to equipment.

All pipes are to be carefully examined for defects and flaws before installation and to be neatly fitted. They shall be run in such manner as to prevent the formation of airlocks. Automatic air vents shall be installed on all high points of the installation.

The ends of all pipes are to be cleaned, free from burrs, and rough edges, and joined together tightly. An approved pipe joint 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.

Exposed CP piping about fixtures and equipment shall not show tool marks or more than one thread at fittings. Fittings, valves and hangers on CP piping shall have CP finish.

Use reducing fittings for changes in pipe sizes. Use no bushings except with special permission.

Use extra heavy pipe for nipples where unthreaded portion is less than 40mm. Use no close nipples, except with special permission; use only shoulder nipples.

Provide unions or flanges in connections to risers, by-passes and equipment.

All vertical pipes must be securely fixed with brackets and supports of an approved type securely fixed into the wall, not more than 40mm from the wall. **These fixings must be strictly adhered to.**

Pipes installed in service ducts and ceiling voids are to be perfectly plumbed and to be secured by approved brackets securely fixed at distances not exceeding the specified distances and to be not more than 40mm away from the face of the walls or soffits. Pipes inside buildings and where specified shall be chased into walls, wrapped with approved materials and properly secured and covered. Pipes must be free to move in the brackets.

During construction all pipe ends shall be kept plugged to prevent any ingress of dirt, rubble etc.

1.34.2 EXPANSION SWINGS

Make adequate provision for proper expansion and contraction of piping and for piping passing through building expansion joints. At connections of branches to water mains and risers and at connections to heaters, tanks, pumps, coolers and other equipment, provide sufficient number of elbow swings to allow for proper expansion and

contraction of piping. Provide adequate elbow swings, or expansion loops, or approved type expansion joints, wherever indicated or required to allow for proper expansion and contraction of mains and risers.

Where flanged "Bellows" type expansion compensators are specified they are to be installed as detailed and in accordance with the manufacturer's recommendations.

Should these compensators be specified for installation in wood truss roof structures the Contractor is to report to the engineer, who will provide details of the location and installation requirements.

1.34.3 SLEEVES

Provide sleeves large enough to accommodate pipe and its covering passing entirely through floors, ceiling, walls, or partitions. Pack sleeves through firewalls with a minimum of 2-hour fire rated material in accordance with structural & fire engineer's requirements.

Provide cast iron or steel pipe sleeves for pipes passing through exterior walls, footings or beams or through floors (interior) or machinery rooms containing Plumbing, Heating, Ventilation, or Air Conditioning equipment, and here extending 50mm above finished floor. Provide sleeves through exterior walls below grade and floors specified above with continuously welded centre flange buried in construction. At exterior walls, make pipe watertight in sleeve with oakum packing and caulked lead joints on both sides of wall.

Except as otherwise noted, provide 0,710mm galvanised iron sleeves for all pipes passing through roof slabs, interior floors, ceilings, walls or partitions, unless framed opening is provided in general construction.

Copper pipes shall have PVC sleeves or be covered with "Thermoflex" or equal protection strip where they pass through walls.

Sleeves shall extend 10mm beyond finished surface.

1.34.4 ESCUTCHEONS

Unless otherwise noted, provide exposed pipes, both bare and covered with approved type cast brass or cast-iron escutcheons where they pass through walls, partitions, floors, or ceilings; held in place by set screws or on covered pipes by internal spring tension. In toilet rooms, at tile walls and in connections with chromium plated piping, escutcheons shall have chromium plated finish.

Where sleeves, hubs or fittings project slightly from wall, partition, floor or ceiling, provide special deep type escutcheons to cover each case.

1.34.5 OFFSETS

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 installed directly through the cornice will not be allowed. In multi-storey buildings where wall thicknesses vary, the same shall apply.

1.35 MATERIALS

1.35.1 GENERAL

All materials, etc. specified herein under a trade name, catalogue number or reference shall be either exactly as described or equivalent (in the opinion of the Engineer, of equal quality, specification and mass in all respects to those described). Written approval shall be obtained for the use of any alternative to the specification before the submission of tenders, otherwise it will be assumed that the specified materials, etc. have been allowed for in the tender.

Unless specified, materials shall be new, unused, best of their respective kinds and free from defects.

Galvanising shall be by hot process on both inside and outside of pipe with zinc coating averaging at least 600g/m² and free from defects.

For Chromium Plating, materials shall be cleaned and polished before plating and plated heavily, thoroughly and evenly and guaranteed not to strip or peel. Steel or cast iron shall be firstly copper plated. Brass, copper and copper plating shall be nickel plated before being chromium plating. Finish shall be polished or satin as further specified.

1.35.2 COPPER PIPE INSTALLATIONS

The installation of copper piping systems shall be done in accordance with the manufacturer's Practice Code and all relevant codes, standards and regulations.

Copper pipes shall only be installed downstream of galvanised mild steel pipes when applicable.

Where dissimilar metals are joined, di-electric or isolating couplings shall be used. This is not required where copper and brass dezincified alloys join.

Copper pipes shall be of the hard-drawn type Class "O" accordion joined by means of capillary soldered type fittings. Compression fittings should not be used unless specifically authorised by the engineer and only on Class 2 or 3 piping.

The soldering flux to be used shall be water based and easily flushed out, withstand temperatures above 240oC and shall contain no ammonia. The flux shall be non-toxic when dissolved in water.

The solder to be used shall be in accordance with SABS and shall consist of a material containing 97% tin and 3% copper. Solders containing lead, resin core and acid core shall not be used.

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 wiped 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.

All bronze or brass equipment and fittings shall be of the dezincified type.

Pipes chased or built into walls or floors shall be wrapped with 2 layers of building paper or similar approved material. Hot and cold-water pipes running next to each other shall have a minimum clearance of 50mm.

Equipment fixed to copper pipe outlets, where the pipes are mounted surface or built into walls, shall be done by means of copper wall plate fittings on the copper pipe, properly secured to the structure to prevent structural damage to soldered joints.

Pipe hangers and brackets shall be of copper, copper alloy or nonconductive 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.

Pipe hangers and brackets shall be installed according to specification on the following maximum spacings. Vertical pipes shall be supported at least at every floor.

PIPE DIAMETER	HORIZONTAL	VERTICAL
(mm)	(metre)	(metre)

15	1.3	1.9
22 & 28	1.9	2.5
35 & 42	2.5	2.8
54	2.5	3.9
67 – 108	2.8	3.9

All copper pipes open to structural damage shall be protected by steel sleeves or a structurally designed cover.

Where flanged fittings are used cadmium plated bolts, nuts and spring washer shall be used to join these flanges.

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.

Shut-off valves shall be installed on all branch pipes, connections to equipment, sanitaryware and other fittings.

All pipes shall be marked in accordance with SABS 0140 or as specified by the engineer.

1.35.3 MEPLA (OR EQUIVALENT) PIPE INSTALLATIONS

The installation of the MEPLA (or equivalent) piping systems shall be done in accordance with the manufacturer's relevant codes, standards and regulations.

MEPLA (or equivalent) pipes shall only be installed downstream of galvanised mild steel pipes when applicable.

Where dissimilar metals are joined, di-electric or isolating couplings shall be used for all MEPLA (or equivalent) piping or as required by the manufacturer's specification.

The heat source to be used shall be in accordance with the manufacturer's specification requirements and shall be the responsibility of the contractor to ensure compliance. The heat source shall not be a temperature higher than 240^{o}C. The pipe ends and fittings shall be cleaned and wiped with a product approved by the manufacturer, before heating is applied. The pipe and fittings shall then be fitted together and heated to the correct temperature before the coupled together. This specification is the proprietary intellectual property of the client Care must be taken not to add too much or too little heat to the joints. Immediately after setting of the joint, it shall be wiped clean with a wet cloth. Pipes shall be washed out as soon as possible after jointing and all traces of flux or similar materials shall be removed.

All bronze or brass equipment and fittings shall be of the dezincified type.

Pipes chased or built into walls or floors shall be wrapped with 2 layers of building paper or similar approved material. **Hot and cold-water pipes running next to each other shall have a minimum clearance of 50mm**.

Equipment fixed to MEPLA (or equivalent) pipe outlets, where the pipes are mounted surface or built into walls, shall be done by means of wall plate fittings on the MEPLA pipe, properly secured to the structure to prevent structural damage to soldered joints.

Pipe hangers and brackets shall be of copper, copper alloy or nonconductive materials approved by the mechanical engineer. No piece of MEPLA (or equivalent) 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.

Pipe hangers and brackets shall be installed according to specification on the following maximum spacings. Vertical

pipes shall be supported at least at every floor.

PIPE DIAMETER	**HORIZONTAL**	**VERTICAL**
(mm)	(metre)	(metre)
16	1.3	1.9
20 & 26	1.9	2.5
32 & 40	2.5	2.8
50	2.5	3.9
63	2.8	3.9

All MEPLA pipes open to structural damage shall be protected by steel sleeves or a structurally designed cover.

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.

Shut-off valves shall be installed on all branch pipes, connections to equipment, sanitaryware and other.

All pipes shall be marked in accordance with SABS 0140 or as specified by the engineer.

1.35.4 GALVANISED STEEL PIPE INSTALLATIONS

All galvanised steel pipes shall, unless otherwise specified, 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 dipped galvanised to SABS 763.

All fittings shall be malleable cast iron fittings to SABS 509 and galvanised to SABS 763.

All 100mm diameter and larger pipes shall be joined with Class 16 flanged couplings to SABS 1123/1600. The bolts, nuts and washers to be used on these joints shall be cadmium plated.

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.

Pipes shall be supported according to the manufacturer's specifications at the maximum intervals:

NORMAL SIZE	**HORIZONTAL**	**VERTICAL**
(mm)	(mm)	(mm)
15 Ø to 20 Ø	1.2m	1.8m
32 Ø to 40 Ø	1.8m	2.5m
50 Ø to 150 Ø	2.5m	3.0m

Pipes shall be installed in such a manner as to prevent airlocks. A minimum rise of 1:250 shall be maintained to high points which shall be fitted with suitable air release valves.

All pipes shall be marked according to SABS 0140 or as specified by the Engineer. All exposed pipes shall be painted

to the required colour as specified by the architect.

Make joints in screwed piping with hemp and "Stag" jointing engineer and sparingly used with good quality hemp. For pipes larger than 80mm Ø a jointing compound such as Eperdermix 32 (or equivalent) shall be used. Hemp and jointing compound shall be used sparingly and applied to the male thread only.

Any pipe buried shall have at least 900mm cover and be coated and wrapped to SABS 1117 and tested in the presence of the engineer.

All pipework and fittings shall be pressure tested and sterilised to specifications.

Valves shall be installed on all branch pipes and ball-o-stop valves on al connectors to basin pillar cocks, sink mixers, cistern type WCs and other fittings, as indicated by the engineer.

Approved type expansion bellows shall be installed where required for expansion and contraction to prevent excessive stain on fittings and pipe joints.

1.35.5 UPVC UNDERGROUND PIPE INSTALLATIONS

Unless otherwise specified all underground pipework >50mm Ø shall be Class 12 uPVC to SABS 966 with rubber ring type joints.

All bends shall be uPVC Class 12 type fittings with rubber ring joints. All other fittings such as T-pieces, reducers, flanges etc shall be bitumen dipped cast iron rubber ring jointed fittings to SABS 546.

No solvent weld type fittings will be allowed.

All cast iron fittings shall be coated and wrapped to SABS 1117.

All pipes shall be laid on a 100mm sand bedding cradle and covered with 300mm and before backfilling.

All backfilling shall be to the CIVIL engineer's specification and approval. Pipe trenching and bedding:

AREA	MINIMUM COVER	BEDDING TYPE	MAIN FILL
Vehicle Traffic	1100	Flexible pipe bedding	Soilcrete
Under surface bed	600	SABS 1200 LB	Soilcrete
Other areas	900	90% MOD	AASHTO

All thrust blocks shall be cast between the pipe and the undisturbed trench material.

No concrete shall come into direct contact with the uPVC pipe. At the thrust blocks the end shall be wrapped with a "Densopol 80rovedHT Tape" or equivalent.

All pipes shall be laid with at least 900mm cover to the top of the pipe.

Marker blocks shall be installed at all tees or changes of directions.

HDPE pipe connections to uPVC pipes up to 50mm Ø ca n be done by means of SG Iron manufactured saddles with the appropriate gaskets and cadmium plated bolts and nuts.

All pipe crossings under traffic areas shall be backfilled with soilcrete and compacted as specified.

All pipework shall be pressure tested with all joints uncovered, to the satisfaction of the Engineer.

Suitably sized air release valves built into valve chambers shall be installed at all high points of the pipe line.

1.36 HDPE PIPE INSTALLATIONS

1.36.1 UNDERGROUND PIPEWORK

Unless otherwise specified all underground pipework <50mm Ø shall be Class 12 Type

HDPe pipe to SABS 533.

All fittings shall be of "Plasson" compression type.

All pipes shall be laid on a 100mm sand bedding cradle and covered with 300mm of sand or selected material.

All backfilling shall be to the Civil engineer's specification and approval. Pipe trenching and bedding:

AREA	MINIMUM	BEDDING TYPE	MAIN FILL COVER
Vehicle Traffic	1100	Flexible pipe bedding	Soilcrete
Under surface bed	600		Soilcrete
Other areas	900	SABS 1200 LB	90% MOD AASHTO

No concrete shall come into direct contact with the HDPe pipe. At these points the fittings shall be wrapped with "Densopol 80HT Tape" or equivalent.

Marker blocks shall be installed at all tees or changes of directions.

All pipe crossings under traffic areas shall be backfilled with soilcrete and compacted as specified.

All pipework shall be pressure tested with all joints uncovered to the satisfaction of the engineer.

Suitably sized air release valves built into valve chambers shall be installed at all high points of the pipe line.

1.37 DRAINAGE PIPEWORK

HDPE drainage pipework shall be "Geberit" or equivalent system of fittings.

The pipe shall be annealed to eliminate residual manufacturing tension stresses.

The following jointing methods are acceptable for the pipe system depending on application:

I. Butt welding for general pipe joints

II. Electroweld sleeve coupling (or equivalent) in areas of limited access

III. Ring seal socket for individual prefabricated sections

IV. Expansion socket where movement is necessary

V. Screw threaded joint for detachable connections

VI. Flange connections for connection to equipment

VII. Joints shall be made with a smooth interior to ensure there is no restriction flow inside the pipes.

1.38 UPVC SOIL AND WASTE PIPES AND FITTINGS

Where specified 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 791 for underground systems and to SABS 967 for above ground system.

All underground and soil pipe above ground pipes and fittings shall be joined by means of rubber ring seal couplings and fittings in accordance specification. All waste and vent pipe and fittings 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.

1.39 STRUCTURAL WALL UPVC PIPES AND FITTINGS

Where specified a structural wall uPVC drainage pipe can be used for underground drainage systems. This piping system shall be used with standard underground uPVC pipe fittings as specified under item 3.4, equipped with rubber ring joints. The pipe shall be equipped with z-lock type rubber ring joints.

1.40 VALVES FOR DOMESTIC WATER INSTALLATIONS

Gate Valves Underground in Valve Chambers to connect to uPVC Piping (65 NB and larger)

Gate valves to be equipped with non-rising spindle, spherical graphite iron body to SABS 936 Grade 42, cast iron nitrile butadine rubber covered gate, stainless steel spindle, nitrile butadine rubber 0-rngs and seals, cast iron bonnet and gunmetal thrust collar to BS 1400 LG2.

The valve shall conform to SABS 664 and/or 665 and shall be capable of withstanding a working pressure of 1600 kPa.

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

1.40.1 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 BSO threaded socket ends. The valve shall conform to SABS 776/1965 Class 125. The valve shall be able to withstand a working pressure of 1600 kPa. The valve shall be fitted with a handwheel on an extended spindle shaft of +/-700mm to close in a clockwise direction and installed to detail.

1.40.2 GATE VALVES ABOVE GROUND FOR TEMPERATURE UP TO 40^{O}C TO CONNECT TO STEEL PIPING (65 NB AND LARGER)

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

The valve shall conform to SABS 664 and/or 665 and shall be capable of withstanding a working pressure of 1600 kPa.

The valves shall be fitted with flanged ends to SABS 1123/1600 (1977), hand wheel to close the valve in a clockwise direction and installed in an upright position or sideways to a maximum 90o from upright.

1.40.3 GATE VALVES ABOVE GROUND FOR TEMPERATURES ABOVE 40^{O}C TO CONNECT TO STEEL PIPING (65 NB AND LARGER)

Gate valve 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 valve shall conform to SABS 665 and shall be capable of withstanding a working pressure of 1600 kPa and a temperature of 90o.

The valve shall be fitted with flanged ends to SABS 1123/1600 (1977), hand wheel to close the valve in a clockwise direction and installed in an upright position or sideways to a maximum 90^{o} from upright.

1.40.4 GATE VALVES ABOVE GROUND TO FIT TO COPPER PIPES (65 NB AND LARGER)

Gate valves shall be equipped with non-rising spindle, gunmetal bronze or dezincified brass body, gunmetal or dezincified brass gate, 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 90o from upright.

1.40.5 GATE VALVES ABOVE GROUND TO FIT TO COPPER PIPES (65 NB AND LARGER) CONTINUED

The valve shall be equipped with flanges to SABS 1123/1600, hand wheel to close the valve in a clockwise direction and installed in an upright position or sideways to a maximum 90^{o} from upright.

1.40.6 GATE VALVES ABOVE GROUND FOR TEMPERATURES UP TO 100^{O}C (UP TO 50 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 valve shall be able to withstand a working pressure of 1600 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 of 90o from upright and shall be so placed with other fittings to be removable without cutting the pipework.

1.40.7 BALL-O-STOP VALVES (15MM Ø – 25MM Ø)

Ball-o-stop valve shall be a full-way ballcock type with BSP threaded ends. These valves shall conform to SABS 1056 Part 3 and shall be rated for a test pressure of 2000 kPa. Valve shall be chrome finished when exposed.

1.40.8 ANGLE REGULATING VALVES

Angle regulating valve shall be a 15mm Ø chromium plated angle regulating valve with a 350mm chromium plated copper tube and capnuts where required.

1.40.9 VALVE TAG AND CHARTS

Provide on all valves and controls, identifying numbered metal tags, including letter to indicate system, fastened by heavy brass hooks or chain.

Tags: Not less than 50mm square, 1.25mm thick, aluminium with stamped numbers and letters filled in with black paint.

Provide separate diagrammatic charts showing essential features of each system with all valves and control lettered and numbered to correspond to designation on metal tags. Also furnish list of all valves and controls giving location and function.

Charts and lists: Type, size and character as approved. Mount in glazed metal frames permanently fastened in locations as approved by the engineer.

1.41 STRAINERS

1.41.1 STRAINERS FOR CONNECTION TO STEEL OR UPVC PIPES (65 NB AND LARGER)

This strainer 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 1123/1600)1977). The hole sizes of the strainer element shall be maximum 1mm Ø and be removable without dismantling of pipework. The strainer shall be suitable for a temperature of up to 90ºC at a 1000 kPa pressure rating and installed with the element facing downwards or a maximum of 45 º sideways.

1.41.2 STRAINERS FOR CONNECTION TO COPPER PIPES (65 NB AND LARGER)

This strainer shall be of the Y-type with bronze or dezincified brass body, stainless steel element and must be equipped with flanged ends to SABS 1123/1600 (1977). The hole sizes of the strainer element shall be maximum 1mm in diameter. The strainer element shall be removable without dismantling of pipework. The strainer shall be suitable for a temperature of up to 90ºC at a 1000 kPa pressure rating and installed with the element facing downwards or a maximum of 45º sideways.

1.41.3 STRAINERS FOR CONNECTION TO STEEL AND COPPER PIPES (UP TO 50 NB)

The 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 0.8mm in diameter. The strainer shall be

suitable for a temperature of up to 90ºC at a 1000 kPa pressure rating and installed with the element facing downwards or a maximum of 45º sideways.

1.42 NON-RETURN VALVES

1.42.1 NON-RETURN VALVES FOR COLD WATER (65 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 1000 kPa.

MHSC OFFICE RENOVATIONS - TUSCANY

PLUMBING AND DRAINAGE SPECIFICATION

2 SANITARY DRAINAGE PIPING & RETICULATION

2.1 GENERAL

The complete sanitary drainage systems, including connections to main outfall sewer and drainage connections to plumbing fixtures, kitchen and other equipment requiring same shall be installed in accordance with requirements of the Authorities having jurisdiction and the National Building Regulations and Building Standards Act of 1977 as amended.

The contractor shall arrange with the local authorities for all inspections and tests.

Before any part of a drainage system is permanently covered or otherwise rendered inaccessible it shall be inspected and approved by the local Authority and the Engineer.

All equipment, materials and labour necessary for inspection and testing as required shall be made available by the contractor.

All plumbing and drainage work shall be carried out under the direct supervision of a registered plumber and drain layer in terms of the requirements of the local authority and Act. A copy of the registration certificate of all persons carrying out or supervising such work shall be kept on site for inspection at all times. The contractor shall in addition be registered by the local authority.

2.2 DRAINS

ALL UNDERGROUND DRAINAGE PIPING SHALL BE AS PER THE CIVIL ENGINEER'S DETAILS AND SPECIFICATIONS. WHERE SUCH SPECIFICATION IS IN CONFLICT WITH THIS SPECIFICATION IT SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER AND/OR SHALL FOLLOW THE CIVIL ENGINEER'S DETAIL AND SPECIFICATIONS.

All drains shall be laid in a straight line between points where changes of direction or gradient occur.

Where drains pass under any wall other than a free-standing wall such drain shall be as specified on the drawing and shall be completely encased in concrete not less than 100mm thick measured at the hub as per the civil's engineer's drawings.

Where any drain passes under a building or where indicated, the pipe shall be cast iron or appropriate sized HDPE and shall be encased in concrete, along its entire length, not less than 100mm thick measured at the hub. The drain shall be so arranged that all junctions, bends and access eyes are readily accessible.

Access to drains shall be in accordance with the requirements of the local authorities and Act.

Horizontal drainage piping shall be installed at a gradient not less than that indicated, unless approved by the Engineer.

All exposed drainage pipe and pipework within the building shall be spun cast iron pipe or HDPe drainage pipe as specified.

Underground piping external to the building shall, unless otherwise specified or indicated, be structural wall uPVC or HPDE Class 12 as specified.

Vent pipes shall be as indicated on the drawings using approved drainage fittings.

Connections to fixtures shall be provided with approved type reseal traps and shall be installed to be readily accessible.

All pipe laying is to be carried out in accordance with the procedure described in SABS 058.

Laying is to commence at the points of junction with existing drains or at points of discharge.

Before each pipe is laid, it shall be examined to ensure that the bore is clean and any foreign material removed. Plug open ends and junctions, whenever work is suspended, to prevent the entrance of rubbish during construction.

Gulley traps are to be as per Civil Engineer's detail.

Cleaning eye covers shall be as per Civil Engineer's detail, where not specified, it shall be constructed of cast iron A.B.C. covers and frames, jointed to top of drain with Gaskin and T.O.K. strip grooved for and including stopper with raised letters "C.E", cast on same, bedding in tallow and screwed to frame with gunmetal set screws. The frame shall be encased in cement concrete 1:3:6 finished on top with untinted granolithic including excavation and casing.

Manholes shall be to Civil Engineer's detail, unless otherwise described, shall be constructed of precast reinforced concrete rings, with cast iron frames and covers, in accordance with the Civil Engineer's Drawings. The invert channels shall be smooth and semi-circular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with mortar, or shall be half tile laid in concrete, or shall be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than one inch per foot (1:12) nor more than (1:6). Free drop inside the manholes shall not exceed 450mm measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels, and drop manholes shall be constructed whenever the free drop would otherwise be greater than 450mm.

All manholes to be with stepirous fixed in the factory.

Where ground waters are suspected, a special concrete foundation must be built against the buoyancy forces. The calculation will be issued by the Engineer.

2.3 VENTS

The drainage system shall, unless otherwise specified, be of the one pipe system and all necessary vents and anti-syphonage pipe shall be provided in accordance with the system requirements and in accordance with the relevant bylaws. The contractor will be required to ensure the design/completion of the drainage venting system is correct for the design to be completely workable to the engineer's requirements

Vents extending above the roof level shall be located at least 3m away from any window, door or air intake opening, and shall be properly flashed.

Vent piping shall be run with long radius bends at changes in direction and shall be graded back towards the drain.

When the "so vent" system is used, the fittings shall be Besaans du Plessis "nu vent" or equivalent and shall be provided with openings as indicated or required.

When back to back W.C. arrangement is used, a double bend shall be provided between the W.C. outlet and the "nu vent" or equivalent.

2.4 STAINLESS STEEL FLOOR DRAINS AND FLOOR CHANNELS

2.4.1 STAINLESS STEEL FLOOR TRAPS & DRAINS

Floor drains shall be of the Rofo type or equivalent.

All floor drains shall be manufactured from Stainless Steel 304 and be acid corrosion and stain resistant.

The drains shall be manufactured in a manner that allows it to operate with a double water seal to ensure odour free operation.

The drain shall be easily dismantled in position and allow access to the main drain pipe which shall connect in the vertical position to the drain.

The cover to the drain shall be of the square grating type and allow a minimum flowrate of 4l/s to pass through into the drain unobstructed

The drain shall be constructed in a manner that allows the top of the drain cover to be flush with the room floor finish

The drain shall be able to handle a minimum load capacity of 2500kg

The outlet diameter of the drainpipe shall be able to connect directly onto the mains connection and shall be sized suitably.

2.4.2 CAST IRON FLOOR TRAPS

Cast iron floor traps shall be used where indicated on the drawings or specified. These units shall be manufactured out of cast iron as per detail supplied in the detail specification. The units shall be fitted with a water seal and a large sludge box and lid to be easily removable for maintenance purposes. The units shall be designed in such a manner as to provide access to the drainage system and to be used as a cleaning point.

2.5 SOILCRETE

Excavating trenches of required width for pipes etc., including excavation for sockets and dressing of sides, ramming of bottom including getting out the excavated soil and then returning the soil as required in layers including consolidating each deposited layer by ramming, watering, etc., and disposing of surplus excavated soil as directed with in a lead of 50 mts. (pipe not exceeding 300mm diameter)

Supply and fixing of UPVC Soil & Waste pipes ISI marked /SWR jointed with solvent cement/rubber ring joints and further protected with Fibreglass paste, including all specials such as bends, tees reducers etc., with or without door as required, including any cutting & making good of floors/walls that may be necessary, clamps and stays as per requirements. The pipes laid above the floor level (sunken level), it should be rigidly fixed with PCC bedding and levelled at every 1 metre intervals.

Soilcrete may be used in trench backfilling where specified indicated and where sewer trench bottoms are below the 45o angle of building foundations.

The compaction of the soilcrete shall be as per the civil engineer's details or failing such being specified in the specification shall be as follows:

Soilcrete shall consist of an approved soil or gravel mixed in a concrete mixer with 5% of Portland demand (per volume) and only sufficient water to give a consistency that will permit the soilcrete to be placed. Concrete vibrators shall be used, so that all voids between the pipes and excavation sides and between culverts in the case of multi-barrel culverts are properly fitted. The height to which the soilcrete shall be filled, shall be determined by the engineer or be as show on the drawings and any remaining backfill shall be carried out as described above using a granular material.

The aggregate must consist of approved soil or gravel containing stones not bigger than 38mm and with a plasticity index not exceeding 10. Detrimental percentages of silt or clay must be avoided and the aggregate shall be obtained from an approved source.

2.6 TESTING OF THE DRAINAGE INSTALLATION

The contractor is to carry out all the tests on the drainage installation as required by the Local Authorities and shall receive their approval before requesting final payment and hand over of the installation.

The Engineer shall be informed when the tests are to be carried out in order that he may witness and approve these.

All drains are to be tested by passing a ball, 20mm smaller in diameter than the internal pipe diameter, through the drain and it shall pass without assistance.

MHSC OFFICE RENOVATIONS - TUSCANY

PLUMBING AND DRAINAGE SPECIFICATION

3 DOMESTIC HOT AND COLD-WATER RETICULATION

3.1 GENERAL

Provide complete domestic hot and cold-water supply systems, including connection to supply authority, hot water heating equipment and required hot and cold-water connection to plumbing fixtures, kitchen and other equipment requiring same all as indicated.

Run piping free of traps wherever possible, and grade and valve for complete control and drainage of system with drain cocks at low points and at base of risers.

Provide on main water branches to dishwashers, domestic washing machines and where noted, properly sized shock absorbers.

3.2 PREVENTION OF WATER CONTAMINATION

Wherever possible, provide over-rim water supplies to plumbing fixtures and equipment. Provide necessary below-rim connections, water closet and urinal flush valves, hose bibs and hose connections with approved vacuum breakers and/or check valves as noted or required.

Kitchen or other equipment supplied under other divisions of work and/or by owner, and having below-rim water supply connections, may not arrive on job in code approved condition, in which case Subcontractor shall provide missing vacuum breakers and/or check valves, or re-locate same to code approved positions.

3.3 PIPE AND FITTINGS

Unless otherwise noted hot and cold-water pipe shall be copper tubing or MEPLA or equivalent with cast bronze or wrought copper solder capillary fittings. Connection to valves and fittings shall be by means of copper to iron adaptors male or female as required. Cold water piping above 65mm shall be galvanised mild steel.

Exposed piping at plumbing fixtures shall be CP copper pipe or MEPLA or equivalent with CP threaded cast brass fittings.

Make connections to equipment with flanges or unions and with threaded adaptors used for swing connections. Terminate noted plugged or capped connections in threaded plug or threaded nipple and cap as required, unless otherwise noted.

Provide insulating bushings, couplings, unions, or flanges where brass or copper piping connects to galvanised piping at location of equipment connection.

When copper pipe is built into walls, floors, etc. and when laid underground, the piping shall be wrapped for its entire built-in length with Denso tape or equal approved protective covering.

The use of brown paper or any building paper is forbidden.

3.4 INSULATION

The contractor shall provide insulation as specified herein on all hot water pipes and hot water heaters.

The Contractor shall provide a suitable storage area for all insulation on site prior to fitment and will be liable for replacement of same due to damage, as determined by the Engineer, at their own expense.

Where pipes are installed in service ducts, ceiling voids and where specified shall be insulated with "Therma-formed flex" or equivalent pipe insulation sections. This insulation shall be used with pipe systems where the maximum temperature is 80°C, for temperature higher than 80°C pre-formed fibreglass sections shall be used with galvanised sheet metal muffs.

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

All piping shall be cladded with 0,5 mm galvanised sheet-steel over the insulation.

Pre-machined wooden blocks shall be used as spacers and as insulating material in brackets.

Insulation material shall be installed hard-up to the all piping connection surfaces

Thickness Table:

Pipe Size (Steel)	**Pipe Size (Copper)**	**Thickness**
=>50mm Ø	54mm Ø	25mm Ø
40mm Ø	42mm Ø	25mm Ø
32mm Ø	35mm Ø	25mm Ø
25mm Ø	28mm Ø	20mm Ø
20mm Ø	22mm Ø	20mm Ø
15mm Ø	15mm Ø	20mm Ø

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

Fibreglass Section Thickness Table

Pipe Size (Steel)	**Pipe Size (Copper)**	**Thickness**
100mm Ø	108mm Ø	65mm Ø
80mm Ø	76mm Ø	55mm Ø
65mm Ø	67mm Ø	55mm Ø

50mm Ø	54mm Ø	55mm Ø
40mm Ø	42mm Ø	55mm Ø
32mm Ø	35mm Ø	40mm Ø
25mm Ø	28mm Ø	40mm Ø
20mm Ø	22mm Ø	30mm Ø
15mm Ø	15mm Ø	30mm Ø

A protective coating equivalent to "Foster Sealfos Coating 30-36" or "Decadex Fire Check" shall be brush applied over the canvas. Coatings shall be applied in accordance with manufacturer's recommendations.

Exposed piping shall in addition be provided with 0,56mm thick galvanised sheet metal cladding over the insulation material. Bends shall be clad with Lobster Back bends also of 0,5mm thick galvanised sheet metal. Cladding shall be secured by stainless steel bands or non-ferrous pop rivets every 50mm.

Cladding shall be painted as previously specified for pipes.

3.5 TRACE HEATER TAPE

Where indicated hot water piping shall be traced with electrical trace tape. "RAYCHEM HWAT" or equivalent, which shall automatically maintain a constant temperature of 50ºC. The tape shall be fixed to the pipe at least every 300mm with approved type adhesive tape capable of withstanding the rated temperature without damage.

The tape shall be installed in accordance with the manufacturer's instructions and shall be inspected and approved by the Engineer before insulation of the pipework.

The tape shall be rated for 220V and shall be limited in length to ensure a maximum of 15A supply. When this rating is exceeded the system shall be divided in separate supplies to limit the current.

The Contractor shall provide all trace heating tape, end caps, junction splices, junction boxes and all necessary fittings for the trace heating system as recommended by the supplier and specified by the Engineer.

The complete system, up to and including the connection to the electrical supply point shall be installed, tested, and commissioned by the Contractor.

Install and test the system in stages if so ordered by the Engineer to facilitate work of others. Repair defects disclosed by tests, or if required by the Engineer, replace defective work.

3.6 24.7 HOT WATER CIRCULATING PUMPS

Provide and install where required hot water circulating pumps, in-line type, with close-grained cast-iron casing, and bronze, balanced impellers. Pumps shall be of the capacity and head as indicated, and have spring loaded mechanical seals, with rubber ring rotating against stationary carbon seat.

3.7 IMMERSION THERMOSTATS FOR STARTING PUMPS

Provide for the automatic control of hot water circulators, immersion type thermostats in the return water line. Thermostat shall operate mercury switch, which shall start and stop the pumps.

3.8 PRESSURE GAUGES

Provide a pressure gauge on each water service at meter location, on discharge headers, on house and hydropneumatics tank pumps, on inlet and outlet of each master pressure reducing valve assembly, and where noted.

Pressure gauges shall be 80mm diameter with black enamel cast iron case, brass ring with heavy glass, phosphor bronze single spring Bourdon tube, phosphor bronze bushed rotary precision movement and suitable dial range with at least 1% accuracy with brass tee handle cock. Pressure gauges shall be calibrated in bars or mb.

3.9 THERMOMETERS

Provide dial type thermometers in oversized tees and nipples on HW supply and return lines, and where noted.

Thermometers shall be 80mm diameter with CP brass case, threaded ring with heavy glass, vapour pressure or liquid actuated bronze single spring Bourdon connection with copper bulb.

3.10 TESTS

Test piping and prove tight as specified and/or required by Authorities having jurisdiction; in presence of Engineer and said Authorities, who shall be given 48 hours' notice in advance before tests are made. Make preliminary tests and prove satisfactory before requesting witnessing of final tests. Make tests in stages if so ordered by the Engineer to facilitate work of others. Repair defects disclosed by tests or if required by Engineer, replace defective work.

Subcontractor shall be required to attend with the Engineer and give all assistance required and provide such tools, materials, implements and instruments as are necessary for tests. The Engineer reserves the right to call for such additional tests, such as dynamic tests, as he may consider necessary.

Subcontractor shall be responsible for work of other Trades disturbed or damaged by tests or repair and replacement of work and shall cause work so disturbed or damaged to be restored to its original condition at own expense.

The pipe installation shall be hydraulically pressure tested by means of a suitable manually operated or mechanically driven pressure pump.

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.

Tests should not be performed against closed valves.

Leakage which occurs shall be measured and calculated and checked against the allowable losses.

If the completed section of pipe complies with all specifications and passes the tests and inspection, it could be approved and the contractor may be instructed to backfill the open sections of trench at the joints and connections, where applicable.

The contractor shall then proceed to build all the valve chambers, inspection chambers etc.

3.11 STERILISING OF WATER PIPES

Before any pipeline is taken into use, it shall be sterilised over its complete length and 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 chlorine shock is created or air is trapped in the pipeline.

At least 14 days prior to the commencement of sterilising the contractor shall submit the full details of the proposed method of sterilising the pipeline to the engineer for his approval.

The contractor shall provide all necessary materials, tools, equipment and labour necessary to sterilise 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:

I. Chlorine of lime to SABS 295 yielding 33% free chlorine by mass.

II. Calcium hypochlorite to SABS 295 yielding 70% free chlorine by mass.

III. Chlorine gas applied by chlorinator.

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

After pressure tests have been made, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material which shall provide a dosage of not less than 50 parts per million and shall be introduced into the water lines in an approved manner.

The treated water shall be retained in the pipe long enough to destroy all non-sporic-forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 10 parts per million of chlorine throughout the line at the end of the retention period.

All valves on the lines being disinfected shall be opened and closed several times during the contract period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 parts per million. From several points the contractor shall take samples of water in properly sterilised containers for bacterial examination. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 days. The unit will not be accepted until satisfactory bacteriological results have been obtained. The contractor shall arrange for a field laboratory, approved by the Consultant, to conduct all bacterial examinations required.

It is required to take a control sample of the incoming water at the same time as the other samples are taken.

3.12 SANITARY FITTINGS

Install and connect up kitchen and toilet fittings as specified in the schedules or provided under work of other divisions and/or owner, and provide required trim and "P" traps for same as specified.

Provide water supply fixtures with stop valves. Exposed pipe fittings, traps, escutcheons, valves, valve handles and accessories, both above and below fixtures, shall be CP brass (covering tubes not permitted).

Water supply and drainage nipples shall be brought to the wall and covered by CP escutcheons.

Supply fixtures shall be renewable seat composition washer, all metal indexed handles and integral on separate screw driven or lock shield stops.

During course of construction, protect exposed fittings from damage and cover fixtures with wooden protection housings. Uncover and thoroughly clean fixtures and fittings when directed.

Fixture connections shall be at least as follows:

Fixture	**Drain**	**Vent**	**CW**	**HW**
Water Closets Flush Valve	100mm	50mm	32mm	
Showers	40mm	40 mm	15mm	15 mm
WHB	32mm	32 mm	15mm	15 mm
Bath	40 mm	40 mm	20 mm	20 mm
Sink	40 mm	40 mm	15 mm	15 mm

Sanitary fittings shall be installed as per the architect's specification, layouts and plans, where this is not suitable the contractor must engage the engineer immediately. Once approval has been obtained the following specification may be utilised:

3.12.1 PRECAST CONCRETE WASH TROUGHS

Precast concrete wash troughs shall be bedded on top of pedestals which shall be bedded on floors in 1:3 cement mortar.

3.12.2 STAINLESS STEEL WASH TROUGHS AND WASH HAND BASINS

Stainless steel wash troughs and wash hand basins shall be fixed to walls on a pair of 20mm diameter galvanised mild steel pipe brackets with flanged ends cut and pinned 150mm deep into walls in 1:3 cement mortar.

3.12.3 ACRYLIC RESINOUS WASH HAND BASINS

Acrylic resinous wash hand basins shall be fixed to walls on a pair of standard painted cast iron brackets screwed to underside of basin and bolted to wall with 6mm diameter expanding bolts.

3.12.4 CERAMIC WASH HAND BASINS

Ceramic wash hand basins shall be fixed to walls on a pair of standard painted steel or cast-iron brackets bolted to wall with 6mm diameter expanding bolts.

3.12.5 ACRYLIC RESINOUS BATHS

Acrylic resinous baths shall be bedded in 1:5 cement mortar on three cross rows of bricks or bedded solid on a layer of dry river sand and fixed to wall with galvanised steel brackets under edges (in the middle of the sides against walls) bolted to wall with 6mm diameter expanding bolts and sealed along top against wall finishes with patent mildew resistant silicone rubber.

3.12.6 WASHDOWN CLOSET PANS AND CISTERNS

Washdown closet pans shall be bedded on floors in 1:3 cement mortar. Cisterns shall be fixed to walls with 6mm diameter expanding bolts.

3.12.7 CERAMIC URINALS

Ceramic stall and slab urinals shall be bedded on floors and against wall in 1:3 cement mortar. Slabs, channels, treads etc. shall be jointed in 1:3 cement mortar and pointed in white cement.

Ceramic bowl urinals shall be fixed to walls on standard steel brackets bolted to wall with 6mm diameter expanding bolts. Cisterns shall be fixed to walls on standard brackets bolted to wall with 6mm diameter expanding bolts.

3.12.8 STAINLESS STEEL URINALS

Stainless steel urinals shall be bedded on floors in 1:3 cement mortar and with backs and sides against walls filled in with fine unreinforced concrete. Cisterns shall be fixed as cisterns for ceramic urinals.

3.13 WATER STORAGE GEYSERS

3.13.1 DOMESTIC GEYSERS

The geysers shall be installed as indicated and specified on the drawings and this specification.

All work is to be executed in a first-class workmanlike manner and all equipment supplied shall be of new high-quality material, design and manufacture, suitable for providing an efficient, reliable and trouble-free service.

It will be the contractor’s responsibility to ensure the sanitary fittings align to architectural requirements eg. building space as provided. Where no specified make or quality of material is directed, a standard article as approved by the engineer shall be supplied.

The contractor shall ensure, before ordering of equipment, that the plant room dimensions and access to the plant room are to his satisfaction. Special care shall be taken not to damage equipment during positioning and installation. All faulty and damaged equipment shall be replaced by new before handover (or made good, only if approved by the engineer).

All materials to be used shall be compatible with the total installation.

The water temperature of the geysers shall not be higher than 80^{o}C and shall be set at a temperature as indicated in the detail specification.

The piping to be used shall be as specified in the detail and standard specification for domestic hot and cold-water installations.

The contractor shall ensure that the necessary equipment is installed to protect the geyser from over pressure and over temperature. The necessary test and approval certificates for the geysers shall be supplied to the engineer.

These geysers shall comply with SABS 151. The units are to be manufactured out of a steel cylinder welded by means of the MIG CO_2 process, the interior of the cylinder shall be porcelain coated by means of the vacuum process and the exterior shall be spray coated and fired to 870°C. the unit is to be insulated with a high-density insulation material. The insulation is to be covered with a 0.8mm fully bondirized steel with a baked enamel finish. The unit shall be equipped with wall brackets for mounting purposes.

Each geyser shall be equipped with an immersion element as specified, incalloy elements are to be used for hard water.

The elements are to be controlled by means of a fail-safe thermostat which shall be adjustable between 40°C and 75°C. The geyser is also to be equipped with the following:

Temperature and pressure relief set at 600 kPa and 97°C

20mm diameter in and outlet BSP thermal sockets

3.13.2 UNDER BASIN AND OVER BASIN WATER STORAGE HEATERS

These water storage heaters shall comply with all the relevant IEC standards and Government Notice 466 (Electrical Safety Standard for Appliances). This specification covers geysers up to 30 litre in storage.

The unit is to be rated for a maximum operating pressure of 700 kPa.

The unit is to be manufactured out of a lap welded steel cylinder by means of the MIG CO_2 process. The unit is to be internally coated with two coats of thermofused porcelain with a magnesium sacrificial anode. Insulation material to be high density polyurethane foam. The outer casing shall be manufactured out of injection moulded ABS plastic finished in appliance white.

I. The unit shall be equipped with the following:

II. 700 kPa safety valve

III. Correctly sized expansion valve

IV. Direct immersion element

V. Control thermostat adjustable between 40°C and 75°C with fusible link for over temperature cut

VI. 15mm dis BSP threaded female sockets for water in and outlets.

VII. The units shall be furnished with a 5-year warranty.