

PART 1
DBSA
HUEWELLAND PRIMARY SCHOOL
HOT AND COLD WATER SPECIFICATION

TECHNICAL SPECIFICATION

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PART 1
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TECHNICAL SPECIFICATION

1. PREAMBLE

- 1.1 The installation shall be suitable for operation at the altitude and under the atmospheric conditions outlined on the Schedule of Details.
- 1.2 The onus is on the Tenderer to ascertain any other local conditions or peculiarities which might affect the working of the system, and no allowance in price or standard of materials and workmanship will be made for any ignorance on the part of the tenderer in this respect. This also applies to the nature and construction of the building, details of which can be obtained from the Principal Agent.
- 1.3 Tenderers shall include for everything required for the completion and successful operation of the installation, whether such items are expressly mentioned or not.

2. QUALITY OF MATERIAL

- 2.1 Only material of first quality shall be used. All material is subject to the approval of the Engineer.
- 2.2 Where applicable, all materials must comply with the relevant standard specifications of the South African Bureau of Standards or the British Standard Specifications.

3. STANDARD OF WORKMANSHIP

- 3.1 The whole of the above installation shall be executed in accordance with the best modern practice, and the Engineer shall have the right to reject, and demand satisfactory replacement at the Contractor's cost, of any part of it which, in his opinion does not conform to the highest standards of material and workmanship.
- 3.2 If required by the Engineer, the Contractor shall perform at his own cost such a test in the presence of the Engineer.

4. RESPONSIBILITY OF CONTRACTOR

The Contractor, by tendering, will have to satisfy himself as to all the conditions and circumstances affecting his tender and as to the general circumstances of the Site of Works, the Conditions of Contract and the Nature of the Work to be carried out under this contract. No claim by the Contractor for additional payment will be entertained which is consequent upon failure on his part to obtain correct information as to any matter affecting his tender or the execution of the work.

IT IS A SPECIFIC REQUIREMENT OF THIS CONTRACT THAT
SPECIALISTS WHO ARE CONVERSANT WITH THIS TYPE OF WORK
SHALL DO THIS PART OF THE WORK.

5. SCOPE OF WORK

This part of the contract comprises the supply, delivery, installation, testing, commissioning, handing over and guaranteeing for twelve (12) months, of the following:

- 5.1 Internal cold water piping services for the Huewelland Primary School

6. CONSTRUCTION PROGRAMME

- 6.1 Before commencing the work, the Contractor shall submit a written construction programme in collaboration with the main contract programme to the Engineer for information purposes.
- 6.2 The Engineer shall have the right to alter the programme mutually agreed upon if, in his opinion, circumstances so dictate, and any such alteration or deviation shall in no case be deemed a basis for claims for extra work or cost by the Contractor.

7. VISIT TO SITE

Tenderers must acquaint themselves with local site conditions, such as access areas available on site, type of ground, space available for on-site fabrication, storage, transport, loading and unloading facilities, scaffolding, tackles and tools needed, etc. as no claims by the Sub-contractor, which may arise from ignorance of the site conditions, will be considered.

8. SCHEDULE OF DETAILS

8.1 Site Conditions

Altitude	:	23 m
Barometric Pressure	:	101 325Pa

8.2 Electrical Supply

415V/240V \pm 10% 50 Hz

8.3 Water Supply

Main Water Supply to be specified in Civil Reports.

9. SUPPLY AND INSTALLATION

- 9.1 The contract shall include for the complete supply, delivery, installation, testing, commissioning and handing over in working order (to the satisfaction of the Engineer) of the hot and cold water service system(s) as specified and shown on the drawings.
- 9.2 The contract shall include for all work, labour, material, plant, equipment and everything necessary for the completion of the whole installation in accordance with the requirements of the SANS standards, and no extras will be allowed on the contract price for non-compliance with these requirements.

10. MATERIAL AND WORKMANSHIP

- 10.1 The sub-contract works shall be executed in accordance with the specified standards and level of workmanship, to the satisfaction of the Principal Agent.
- 10.2 All materials shall be of the quality specified and the Sub-Contractor shall, upon request of the Principal Agent, furnish him with proof to his satisfaction that the materials are of the specified quality.
- 10.3 All materials and equipment used for the installations shall be new and undamaged.
- 10.4 The Sub-Contractor shall, if requested by the Principal Agent, provide samples of material and equipment for approval. If judged necessary by the Principal Agent, such samples, may only be returned after the completion of the installation, in order to ensure that the quality of the installed product is the same as that of the approved sample.

11. REFERENCE SPECIFICATIONS AND STANDARDS

- 11.1 The latest revision of any Specification referred to in this specification, will be applicable.
- 11.2 Where a specification or standard is not specifically referred to, it will be assumed that the relevant SANS, ISO, BSS, DIN or equivalent American standard, listed in order of preference will apply.
- 11.3 The SI ("Le Systeme International d' Unites") – Metric System of Units will apply. Refer to SANS – M33A: The International Metric System: Guide to the use of the SI in South Africa.
- The entire new installation shall be carried out in accordance with:
- 11.3.1 The Application of the National Building Regulations SANS 10400 (including all SANS addenda).
- 11.3.2 The South African Bureau of Standards Code of Practice for wiring of Premises SANS 10142.
- 11.3.3 The Occupational Health and Safety Act No 85 of 1993.
- 11.3.4 The Municipal by laws and any special requirements of the Supply Activities of the area or district concerned.
- 11.3.5 The Municipal Fire Regulations.

12. DRAWINGS

12.1 ENGINEER'S DRAWINGS

- 12.1.1 Unless otherwise specified, the Engineer's Tender drawings are not manufacturing drawings and the dimensions given are only sufficient for tendering purposes or to enable the contractor to complete manufacturing drawings. It is the responsibility of the contractor to verify all dimensions.
- 12.1.2 The Engineer shall make available to and at the request of the contractor any available record drawings of the present installation.

12.2 CONTRACTOR'S DRAWINGS

- 12.2.1 The contractor will be furnished, on request, with the Engineer's drawings and a complete set of "as built" drawings identified as available in this document.
- 12.2.2 The contractor shall supply two (2) copies of each detail design drawing for approval. The contractor shall allow the Engineer one (1) week for drawing approval. After a marked-up copy with all the Engineer's comments has been returned, the contractor shall update the original, which shall then be submitted to the Engineer for signature. This will ensure that all prints used for construction will be certified as approved.
- 12.2.3 Two (2) copies of the certified drawing shall be issued to the Engineer for distribution.
- 12.2.4 The contractor will be required to produce the following detail design drawings:
- (a) Builder's Work Drawings.
 - (b) Mechanical Drawings

These are all Workshop and Equipment Layout Drawings required for the manufacture and erection of the installations.

- (c) Instrumentation Drawings, such as:
Schematic Control Diagrams.
General Arrangement Drawing of Control Board.
- (d) Electrical Power Drawings, such as:
General Arrangement Drawing of Switchboard.

Circuit Diagrams and interconnecting diagram giving cable schedules with numbers and sizes corresponding with the circuit diagrams and interconnection diagram.

- 12.2.5 Unless otherwise specified, cable routes shall be superimposed on the Mechanical Layout Drawings, showing the runs and fixing details.
- 12.2.6 Any work done by the contractor without an approved signed drawing, will be at the risk of the contractor.
- 12.2.7 The Contractor shall update all drawings ("record drawings") once the installation has been completed. One (1) set of paper prints and one (1) set of sepia copies shall be supplied to the Engineer as part of the O & M Manual.

12.3 **EQUIPMENT DRAWINGS**

The contractor shall provide the Engineer with working drawings of all items of equipment, with a detail technical specification of the equipment, for approval, before placing an order for the equipment.

13. OPERATING AND MAINTENANCE MANUAL

13.1 The contractor shall, at his cost, prepare and supply manuals for the successful operation and maintenance of the installation.

13.2 Six weeks prior to the commencement of commissioning, the contractor shall supply a draft of the manual to the Engineer for approval. Two weeks after commissioning, the Contractor shall supply three (3) additional manuals, which have been updated and included all commissioning data and "record" drawings.

13.3 These manuals shall contain the following information:

INDEX OF CONTENTS

SECTION 1: SYSTEM DESCRIPTION

A comprehensive description of the installation.

SECTION 2: OPERATING INSTRUCTIONS

2.1 Starting and stopping instructions.

2.2 Pre-start checks.

2.3 Equipment running checks.

SECTION 3: MECHANICAL EQUIPMENT

The following information shall be provided in full for each item of equipment:

3.1 General information
Description, Make, Model Number, Name and Address of Supplier, Manufacturer, etc.

3.2 Design information

Design Data Sheet containing all design and selection parameters, calculations, selection curves, etc.

3.3 Settings and values recorded during commissioning.

3.4 Manufacturer's Brochures and Pamphlets.

3.5 Maintenance Data and Schedules

The lapse of time between services and the description of the service required of each part, lubrication requirements, etc.

14. INSPECTIONS AND TESTING

14.1 INSPECTIONS (PART III, SAACE – 1978)

The Engineer shall have general supervision and direction of the Contract Works. Supervision shall comprise such periodic visits as the Engineer may consider necessary to inspect the Contract Works for conformity with the Contract documentation and to provide clarification and further information as necessary.

The Engineer shall have the power at any time to inspect and examine any part of the Contract Works or any materials intended for use in or on the Contract Works, either on the site or at any factory, workshop or other place where such parts or materials are being constructed or manufactured or at any place where same are lying or from where they are being obtained and the Contractor shall give all such facilities as the Engineer may reasonable require to be given for such inspection and examination.

The Contractor shall not be liable for the cost of inspecting materials at the place of manufacture, construction or storage nor be responsible for any travelling or accommodation costs arising out of the execution of such inspection, etc.

14.2 TESTING

14.2.1 The Contractor shall supply all test equipment, test facilities and everything necessary, at his cost, to perform these tests. The minimum testing and commissioning equipment that is required, is as follows:

1. Pitot tube and manometer.
2. Hot wire anemometer.
3. Crane type manometer for balancing valves.
4. Thermometer for insertion into pipe and duct pockets alongside temperature detectors.
5. Sling psychrometer.
6. Revolution counter suitable for measuring fan and motor shaft rotation.
7. Megger equipment.
8. Clamp on ammeter.
9. Voltmeter.
10. Power factor meter.
11. Ohmmeter suitable for continuity testing.
12. Neon type ON/OFF test lamp.
13. Maximum indicating ammeter suitable for measuring peak motor starting currents.
14. Vacuum pump.
15. Thermo couple – electronic or calibrated micrometer gauge.

14.2.2 The contractor shall record all measurements taken during testing and shall do the necessary adjustments until the Engineer is satisfied with the results.

14.2.3 The Engineer shall be notified one (1) week in advance of any tests so that he may witness such tests.

14.2.4 Unless otherwise specified, the contractor will be required to perform the following tests:
Electrical Switchboards

- (a) A simulated functional test in the factory to ensure the correct operation of equipment, controls, interlocks and measuring circuits.
- (a) A 2, 5 kV pressure test in the factory

Ducting

Pressure test medium and high pressure ducting in terms of SANS 10173: Code of Practice for the Installation, Testing and Balancing of the Air Conditioning Ductwork.

Water Piping

Pressure test of all piping 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 or other equipment, which could be damaged during the pressure 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 24 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 in sections, which adhere to the schedule as specified in this specification, prior to insulating or covering piping.

If leaks are found, welded connections shall be cut out and rewelded and screwed joints shall be dismantled, cleaned and reconnected. Rectified piping shall be retested.

Pressure Vessels

Refer to the requirements set out in the Occupational Health and Safety Act of 1993.

Refrigerant Piping

Refrigerant pipes and equipment shall be tested in terms of SANS 10147: Code of Practice for Refrigeration and Air Conditioning Installations.

Prior to the pressure test, equipment which has been factory tested and refrigerant charged, as well as any other equipment which could be damaged or cause personal injury by imposed pressure test, shall either be isolated or removed from the system. Safety relief valves and rupture discs where not part of factory sealed systems shall also be removed and openings plugged.

Pressure control and excess pressure protection shall also be provided. The pressure test shall be applied in two stages, before any joints are insulated or piping covered. The test gas shall be dry nitrogen.

The first stage shall be at 69 kPa with every joint checked with a thick soap or colour indication solution. The test pressure and ambient temperature is to be recorded to which the system is exposed.

The second stage shall be tested at pressure not less than the lower of the system design operating pressure or the protecting pressure relief device with 10% increments above 690 kPa. The final pressure shall be maintained for 24 hours with

the system pressure and ambient temperature recorded. Should any leaks be found, then the joints shall be removed, thoroughly cleaned and re-installed as a new joint. Joints repaired by calking, remelting or back welding shall not be acceptable. After the necessary repairs, the system shall be re-tested.

Following a successful pressure test, each system shall be relieved and evacuated to an absolute pressure 300 micrometers. The ambient temperature is to be higher than 2°C during a vacuum test. Once the desired vacuum is reached, the vacuum shall be closed and stand for 1 hour. Should the pressure rise over 500 micrometers after 1 hour, the system shall be evacuated down to 300 micrometers and left for 1 hour. The system shall not be charged until a vacuum of at least 500 micrometers is maintained for 1 hour without a vacuum line. Should any leaks occur, they are to be repaired with vacuum procedure redone.

15. COMMISSIONING AND HANDING OVER

15.1 PROCEDURE

15.1.1 Physical Completion

After physical completion of the erection phase of the installations, the Engineer will issue a Snags List certifying that commissioning can proceed. Items which would not influence the commissioning process could, at the discretion of the Engineer, be attended to during commissioning stage.

15.1.2 Commissioning Stage

After commissioning the Engineer will issue a second Snags List (the Commissioning Snags List). Any outstanding work will be recorded on this list.

15.1.3 Engineer's Certificate

After completion of all outstanding items and receipt of all manuals and drawings as recorded on the Commissioning Snags List the Engineer will issue a First Delivery Certificate. This certificate will accompany a certificate of acceptance by the Client's representative.

The one year maintenance and guarantee period will commence on the date of the First Delivery Certificate.

15.2 COMMISSIONING

The Commissioning of the entire installation shall be carried out timeously. The workshop drawings, to be produced by the Contractor, are to be perused and approved, in principal, by the Contractor's Commissioning Engineer who is to confirm that the installation as indicated can be commissioned.

The commissioning of the installation shall be in terms of the following codes, or any other code approved by the Engineer:

(a) Air Distribution Systems:

SANS 10173: Code of Practice for the Installation, Testing and Balancing of Air Conditioning Ductwork.

(b) Refrigeration Systems:

CIBS: Commissioning Code: Series R: Refrigeration Systems.

(c) Control System:

CIBS: Commissioning Code: Series C: Automatic Controls.

(d) Water Distribution Systems:

CIBS: Commissioning Code: Series W: Water Distribution Systems.

The Contractor shall submit the Commissioning program to the Engineer, at least four (4) weeks prior to the commencement of commissioning.

The power connections to the various installed equipment must be energized to facilitate commissioning of the installation.

To enable this switch-on to take place the installation must be substantially complete.

The Contractor shall inform the Engineer within (4) weeks of his appointment, what time allocation has been allowed for commissioning purposes. This must be reflected on the Critical Path Schedule to be submitted by the Contractor.

15.3 **TRAINING AND MAINTENANCE**

The Contractor shall provide a suitably qualified and trained person to train the Employer's staff in the correct operation and maintenance of the installation. The Contractor shall allow for this person to be full time on site as called for in the maintenance contract conditions.

16. CODING, LABELLING AND NOTICES

16.1 **GENERAL**

The Contractor shall supply and install all coding, labelling and notices as required under this Clause.

The wording shall be in English.

To reduce the possibility of incorrect labels and/or notices, the Contractor shall submit a schedule of labels and notices to the principal agent for approval. Costs to rectify inscriptions, resulting from the failure by the Contractor to obtain approval, will be for his account.

16.2 **CODING**

16.2.1 **General**

Codes and numbers for wiring shall be CRITCHLEY IZ-type, or other approved, Cable Marker interlocking endless expanding markers, as supplied by CABLE ACCESSORIES (PTY) LTD. CRITCHLEY C-type, or other approved, Cable Markers shall only be used with the approval of the Engineer where wires and piping have already been terminated.

Lettering shall be marked in black on a white background.

16.2.2 Electrical

Provide and install the following coding:

- (a) Numbering of both ends of power and control conductors in switchboards.
- (b) Numbering of both ends of field cables.
- (c) Numbering of both ends of individual field conductors within cables of control circuits only, where such conductors are not uniquely identified by means of insulation colour codes.

16.3 **LABELLING**

16.3.1 General

Labelling shall be CRITCHLEY UNILABEL, or other approved, Cable Marker, as supplied by CABLE ACCESSORIES, or engraved "IVORENE" or "TRAFOLITE" labels.

Black letters on a white background shall be used.

Labels shall be fixed with screws or acceptably glued to all equipment.

16.3.2 Equipment

All mechanical, electrical and instrumentation equipment shall be identified by means of an equipment code.

Minimum height of letters: 10mm.

16.4 **NOTICES**

16.4.1 Supply and install all notices required in terms of Statutory Regulations.

16.4.2 In terms of the Occupational Health and Safety Act, Act 85 of 1993, the following notices are required:

(C.52)

At the entrance to each plantroom, the following notice shall be provided:

- (a) Prohibiting unauthorized persons from entering.
- (b) Prohibiting unauthorized persons from handling or interfering with electrical apparatus.
- (c) Directions as to procedure in case of fire.
- (d) Directions as to restoration of persons suffering from the effects of electrical shock.

(C.73)

Manufacturer's Plate on Pressure Vessels:

- (a) Manufacturer's name.
- (b) Country of Origin.
- (c) Maker's Number.
- (d) Year of Construction.
- (e) Maximum permissible working pressure in Pascal.
- (f) Capacity in cubic metres
- (g) Name and Number of Code of Manufacture.

17. PAINTING AND MARKING

17.1 GENERAL

All steelwork, piping, lagging, etc. supplied under this contract shall be painted as required under this clause:

Exposed portions of boilers, calorifiers, cylinders, etc. in the plant room shall be properly cleaned, primed and painted two coats of heat resistant paint.

All other exposed metal parts such as pumps, belt guards, all piping, pipe lagging, fittings, dampers, fans, coils, motors, pumps, packaged units, control panels, steelwork, exposed ducts and lagging, expansion tanks, make-up tanks, cooling tower, unit shelters, etc. shall be cleaned, primed, undercoated and finished in a high quality gloss paint of approved colour.

All external equipment exposed to the weather must be cleaned, primed and painted with two coats of epoxy paint.

The lagged surface of calorifier, headers and pipes shall be primed, undercoated and finished in a high quality gloss of approved colour. Unlagged steam piping shall be painted with heat resistant paint.

All plants shall be generally painted in accordance with SANS 10140 as indicated below.

Machinery, Structural steelwork etc

- | | | | |
|----|---|---|-------------|
| 1. | All exposed metal parts
Checker plates, Pipe supports
Handrails, Base plates | : | Black |
| 2. | Body portions of machines | : | Olive Green |
| 3. | All machinery external to
the building (except piping
and valves and fittings) | : | Dove Grey |
| 4. | All moving parts which are
visible when operating. In-
side surfaces of all machine
guards, belt guards etc. | : | Orange |
| 5. | All handles, levers, handwheel
centres adjustment knobs, etc. | : | Yellow |
| 6. | All lagging on boilers, calo-
rifiers, tanks, cylinders etc.
except on piping and pump sets
and ducting) | : | Aluminium |
| 7. | Electrical distribution boards
(except where transparent
covers are used) | : | Light Grey |

Control panels

Indicator panels

8. Water treatment plant (except on piping.

Air Conditioning plant (except on piping. : Light Blue

9. All points which constitute a physical hazard, e.g. (stay-wires, low pipes, access doorways, etc.) : Yellow and Black Cross Hatch

10. Drainage piping : Black

17.2. **PIPING, PUMPS, VALVES, FITTINGS ETC.**

17.2.1 The colour code for pipelines and machines is based on the following:

- (1) SANS, 10140-3 : Identification colour marking; Contents of Pipelines
- (2) BS 1710-1975 : Identification of pipelines

17.2.2 All unlagged black piping, holderbolts, supports anchors fittings, etc. shall be painted in accordance with British Standard Specification No. BS 1710.

17.2.3 In enclosed horizontal or vertical ducts, surfaces, mezzanine spaces and basements where pipelines are already painted or galvanised or are lagged, painting may be restricted to 150 mm long lengths at a maximum spacing of 4 m, and at all branches, tees, valves, and at the entry from such ducts, spaces, etc.

17.2.4 Except where otherwise specified all piping on surfaces shall be painted with a primer, an undercoat and a finishing coat in an approved high quality gloss paint. to the colour indicated in the schedule. This also applies to all holderbolts, supports, anchors, fittings and valves. Where only 150 mm lengths of the pipe are painted the colour and specification of the painting shall be in terms of this clause.

17.2.5 Pump sets, valves, fittings, etc. shall be painted the same basic colour as the pipelines, except those of fire fighting services, which shall be painted red.

17.2.6 Bands

The length of the band shall be same as the final pipe diameter, but not less than 100 mm. Where three strips are required per band, each strip shall be one third of the final pipe diameter but not less than 35 mm. Where 150 mm lengths alone are colour painted, the 50 mm band shall be centrally placed on the 150 mm length.

17.3 **ARROWS**

The direction of flow shall be indicated with a 25 x 100 mm long black arrow at intervals of approximately 4 m and at valves and junctions. Flow lines shall be marked with an F and return lines with an R at each arrow.

17.4 **SERVICE OUTLETS**

Where outlets require identification the colour identification shall take the form of coloured centre pieces on handwheels or cocks, and/or other suitable approved marking on the neck of the outlet fittings as specified. The colour shall primarily be that of the pipe colour and where banding is used, the colour shall be that of the band and stroke.

17.5 **RADIATORS AND PIPES IN FINISHED AREAS**

All radiators, pipes, fittings etc. in finished areas such as wards, offices, passages, etc. shall be cleaned, primed, undercoated and finished in a high gloss paint to match the existing finish.

17.6 **IDENTIFICATION COLOURS**

	<u>Basic Pipe Colour</u>	<u>Banding Colour</u>
Cold water supply (drinking water)	Brilliant green	Cornflower
Condenser water	Brilliant green	White
Boiler feed water	Brilliant green	Crimson/white/Crimson
Boiler condensate lines	Brilliant green	Crimson/Emerald Green/Crimson
Chilled water lines	Brilliant green	White/Emerald Green/White
Domestic hot water	Brilliant green	Crimson/Cornflower
Fire fighting mains	Signal red	
Central heating hot water	Brilliant green	White/Yellow/White
Steam	Pastel grey	
Gas (except air and medical gas)	Light stone	
Compressed air	Artic blue	
Ducts and conduits for electric services	Light orange	
Diesel	Golden brown	White
Acids and alkalis	Jacaranda	

17.7 **IDENTIFICATION COLOUR CODES**

Colour name	Colour classification no.
Artic blue	F28

Brilliant green	D10
Cornflower	F29
Crimson	A03
Emerald green	A14
Golden Brown	B13
Jacaranda	F18
Light stone	C37
Light orange	B26
Pastel grey	G54
Signal red	A11

17.8

COLOUR CODING FOR DUCTWORK

All ducting in plantrooms is to be colour coded according to the schedule below. If the duct is internally lined, then the whole duct surface shall be painted in accordance with the schedule below. If the duct is externally lined with insulation, then the ducting must be painted with a symbol to the relevant colours. The form of these symbols are to be as follows:

- (a) In order to make the colour clearly visible it may be necessary to paint the symbol colour onto a neutral colour background. This background colour is to be agreed upon by the Consulting Engineer.
- (b) The colour symbols are to be 150 mm wide band, running around the duct. The background colour is to extend 300 mm on either side of the colour symbol strip.
- (c) In the case of conditioned air where the colour symbol is both red and blue, one colour strip is to be used (150 mm wide) but the two colours shall alternate each being 200 mm long.

Duct/Air type	Colour	Colour No.
Ventilation Air Supply	Blue with Yellow Band	F11 and C61
Exhaust Air	Brown	B07
Reticulated air	Grey	G25
Outside air	Green	P14
Hot deck (on dual duct)	Blue with Red Band	F11 and A14
Cold deck (on dual duct)	Blue with Dark Blue Band	F11 and F02

The colours as defined as above are according to SANS 10173-1980

17.9

GALVANIZING

Unless otherwise specified the following items shall always be galvanised:

- Fabricated mild steel sections exposed to the weather
- Steel grilles and louvers exposed to the weather

Where hot dip galvanizing is called for, items to be galvanised shall be entirely pre-fabricated and then dismantled in sections for galvanizing. No cutting of threads or welding will be accepted after galvanizing.

All hot dip galvanizing shall be carried out in accordance with SANS 3575 and SANS 4998 where applicable, including preparation for galvanising.

Mild steel plate and sections shall be of good commercial quality, or higher grades, best suited for galvanizing. The materials shall be free from slag or coarse laminations, fine fissures and rolled-in impurities.

Castings shall be sound, dense and clean, and free from distortion, porosity, carbon and slag enclosures, blowholes, and other injurious conditions.

Welding flux shall be chipped away and all welds wire brushed before galvanizing.

The surface to be galvanised shall be free from paint, oil, grease and similar impurities.

All exposed surfaces including welds shall be thoroughly sand blasted prior to galvanizing.

The Engineer reserves the right to inspect all steel components before galvanizing, and shall have the right to reject or ask for remedial treatment of any material which is considered to be unsuitable. This applies particularly to welds.

The galvanizing coating shall be smooth, adherent, continuous and free from black spots or flux stains.

Globular extra-heavy deposits of zinc which interfere with the intended use of the material will not be acceptable. Excessively protuberant lumps and nodules shall be removed by hot wiping or by the skilful application of mechanical means, however there shall remain a sufficient minimum thickness of unbroken zinc coating. Flaws on small parts and working surfaces shall be repaired only by stripping and re-dipping.

Repairs to galvanised coatings will not be accepted. Items damaged will need to be re-galvanised.

Coating thickness shall be to SANS 121 and SANS 32 unless otherwise specified in the supplementary specification. The SANS requirement for uniformity shall apply.

Galvanised surfaces specified with paint finishing shall not be passivated.

18. ASSISTANCE TO OTHER CONTRACTORS

The Contractor shall offer every possible assistance to the main building contractor and other associated contractors to ensure that all work is carried out and completed in an efficient and smooth manner.

19. GUARANTEE

- 19.1 The installation shall be guaranteed for a period of twelve calendar months from the date that the installation is taken over (first delivery).
- 19.2 If any part of the installation fails or does not operate satisfactorily within this period, it shall be replaced or rectified free of charge. This includes the making good of all damage caused by the failure or rectification or replacement.

20. ALTERNATIVE TENDERS

- 20.1 Tenders must in the first instance be submitted for the installation in accordance with the specification and as shown on the drawings.
- 20.2 Alternative tenders based on an alternative arrangement may, however, also be submitted provided such alternative proposals are fully detailed and accompanied by calculations and drawings, clearly indicating the advantages and savings in relation to the system specified herein.

21. COLD WATER SUPPLY

21.1 GENERAL

The piping system shall include all piping and valves except the final connections to handwash basins, showers, WCs, urinals, etc.

22. COLD WATER DISTRIBUTION

Cold water shall be supplied as indicated on the Civil Engineers Designs. All existing cold water reticulation shall be decommissioned and removed from site. New cold water reticulation shall be implemented and pipework shall connect from the proposed new mains to the various departments.

All domestic water pipes underground/drainage pipework shall be HDPE CLASS 16 unless otherwise indicated. All pipework above ground shall be Gereberit Mepla.

23. ASSISTANCE TO OTHER CONTRACTORS

The Contractor shall offer every possible assistance to the main building contractor and other associated contractors to ensure that all work is carried out and completed in an efficient and smooth manner.

24. GUARANTEE

- 24.1 The installation shall be guaranteed for a period of twelve calendar months from the date that the installation is taken over (first delivery).

- 24.2 If any part of the installation fails or does not operate satisfactorily within this period, it shall be replaced or rectified free of charge. This includes the making good of all damage caused by the failure or rectification or replacement.

25. ALTERNATIVE TENDERS

- 25.1 Tenders must in the first instance be submitted for the installation in accordance with the specification and as shown on the drawings.
- 25.2 Alternative tenders based on an alternative arrangement may, however, also be submitted provided such alternative proposals are fully detailed and accompanied by calculations and drawings, clearly indicating the advantages and savings in relation to the system specified herein.

26. COLD WATER SUPPLY

26.1 GENERAL

The piping system shall include all piping and valves except the final connections to handwash basins, showers, WCs, urinals, etc.

The cold water connection to the main supply line, shall form part of this project and the connection of the Mepla Multilayer piping (sizes on drawings) thereon for the domestic water supply to the building, forms all part of this section of the project.

26.2 PIPES AND PIPE FITTINGS

26.2.1 Mepla piping

For the distribution of hot and cold water in and outside of the buildings, Mepla piping shall be used. All Mepla piping shall conform to SANS regulations where applicable.

26.2.2 HDPE Piping

For the distribution of cold water outside the buildings, HDPE piping shall be used. All HDPE piping shall conform to SANS 533 and SANS 4427 Type 4 Class 6. All fittings shall be mechanically joined as per manufacturer's recommendations.

26.2.3 Galvanised Piping

All piping exposed to weather conditions, connections to bulk water storage tanks and as shown on the drawings, shall be galvanised medium class and shall comply with SANS 10400. All galvanised piping and fittings shall comply with SANS 62-1. All joints shall be welded and screwed fittings and joints shall only be used where specified in this part of the specification.

No malleable cast iron fittings shall be used.

26.2.4 Vacuum breaker

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

27.3 **VALVES**

27.3.1 **Ball Valves**

Ball valves shall be of the cobra 1090-15 type or other approved. It shall be chrome plated. The valves shall have Teflon seats. The castings must be of even thickness clean and free of scale, blowholes and defects with the top and inside work face machined. All wearable components must be manufactured and of a corrosive free material and must be replaceable.

27.3.2 **Ballcocks**

Ballcocks with sizes 15 and 20mm diameter shall comply with SANS 1056-3 (SABS 1056 Part 3 – 1985) Class 20 and shall be of the Cobra Watertech 1075-15 and 1075-20 respectively.

27.3.3 **Valve Connections**

All valves on copper piping must be screwed to copper piping for easy removal.

All other equipment must be removable from the piping for easy maintenance or replacement.

27.3.4 **Balancing Valves**

Approved control valves shall be installed on the return piping to control water flow at T-off's connections. The control valve must consist out of a T-piece with a long thread round nose plug and bolt, with which water flow shall be effectively controlled.

27.3.5 **Non-return (check) Valve**

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

27.3.6 **Thermostatic Mixing Valve**

To ensure that the minimum amount of hot water is used, a mixed flow valve will be installed to a cluster of showers. It will control the hot water at a maximum of 42°C. The valve will be of the Cobra KD Master Thermo type or other approved. The valve (32mm) will have an automatic fail safe, anti-scald and anti-chill feature. The extra port on the valve will be used for the return water piping. The link between the hot and cold water will have a ball valve.

27.3.7 **Gate Valve**

Gate valves shall be of the full way type, manufactured of cast iron for larger valves and brass or gunmetal castings for smaller valves. Gate valves up to 50mm

diameter shall comply with SANS 776 and shall be of the Cobra Watertech 1003/125 or other approved type. All wearable components shall be manufactured and of corrosive free material and must be replaceable.

27.4

INSTALLING OF PIPING

Pipe routes indicated on the drawings are only a indication of the approximate position. The final routes shall be determined on site. Routes shall take in account all structures, roof trusses, walkways, entrances and other services. The hot water piping shall be routed to run as close as possible to wash basins, showers, etc.

Piping must follow the profile of the structure as close as possible, approximately 20 -30mm away from walls, beams and slabs and shall either be installed parallel or perpendicular. Sufficient free area for the installation of cladding and maintenance purposes must be allowed for.

Stop cocks must be supplied and installed for the insulation of sections of the installation as shown.

Any airtightness of the hot and cold water piping systems shall be by means of gooseneck which shall be installed as indicated from time to time on site.

Water piping must be installed with an incline of 1 in 250.

Pipe fitting and connections must not fall within the elements of the building structure.

Cut pipe ends must be smoothed before connections and during installation. All open ends must be plugged or sealed off to prevent dirt from entering the pipes.

Multi-layer pipes must be cut with a special pipe scissor or cutter. Cut pipe ends must be reamed with a pipe reaming tool before connections and during installation. All open ends must be plugged or sealed off to prevent dirt from entering the pipes.

Pipe installation should be done according to the manufacturer's installation guide & specifications.

27.5

PIPE SLEEVES

Where piping protrudes through building structures, pipe sleeves are to be installed, as part of the contract, to ensure easy removal thereof, without changing the structure. Pipe sleeves must not be fitted around sharp edges in order to prevent the pipe from kinking or chafing.

The contractor shall be responsible for the drilling of holes.

Pipe sleeves must be of similar material as the pipe and must be large enough to allow enough free space for movement.

Where specified and where the play around the pipe is unsightly blank cover plates must be installed.

Sleeves through outside walls, slabs and piping through roofs and windows must be sealed off watertight.

All sleeves must be installed neatly and made watertight. The opening between the pipe and sleeve must be sealed off by means of silicon rubber or any other approved product.

Where piping are installed through ceilings approved blank coverplates must be used to ensure a neat finish.

Hot and cold water piping to basins, showers, baths, etc. shall be plastered into the walls.

27.6 **PIPE JOINTS**

All joints must be done in accordance with a prescribed practice for the different types of piping.

27.6.1 **Copper piping**

Copper piping must be joined with capillary soldered fittings. Conical type screw connections can only be used and must be installed at removable components up to a pipe size of 80mm diameter. On larger, piping flanges must be used. Solder must have a melting point of no less than 500°C and shall comply to SANS 24 (SABS 24-1987), and must be of lead free.

27.6.2 **Multi-layer piping**

Multilayer piping must be joined with press- or clamp fittings and shall comply with SANS 21003. Press fittings must be crimped connected by using the prescribed crimping tool as been prescribed & specified by the pipe & fitting manufacturer.

27.6.3 **HDPE Piping**

All HDPE piping shall be joined with compression fittings as per manufacturer's recommendations. When joining pipes and pipe fittings all ends shall be cleaned and lightly lubricated on the interior of fittings and the pipe ends, before the nut is slackened and the pipe is inserted into the fitting. When tightening the nut, it must be noted that over-tightening may cause the assembly to leak.

27.6.4 **Galvanised Piping**

Pipe connections to pumps, valves, etc. and other removable equipment must be flanged where steam is used. For water connection, screwed connections shall be used up to 80 mm in diameter.

All connections must be done on the dead side of valves.

All flanges must be machined to BS or SANS (SABS) standards.

All equipment and serviceable fittings must be easily removable without the cut of pipes, are to disconnect long section of piping.

All other connections for the central heating installation must be welded.

Flanges must also be welded to piping and not screwed.

All welding must be done by a qualified welder to the satisfaction of the engineer otherwise he can be removed from the site.

The welder must see that all welding to the inside and outside are smooth and that there is no build-up of slag on the inside which can cause blockages.

The contractor must allow in his tender price for the cut out of welding test pieces and the making good of such places.

If the engineer is still in doubt of the welding he may ask for X-ray tests of welds or the flush of the system with an acid solution and the cost thereof will be for the contractor.

Screw joints must be used for piping on the cold water installation. Sealant or seal tape must be used sparingly. Redundant sealant or seal tape must be clean off after completion.

27.7

EXPANSION AND CONTRACTION

The contractor shall ensure that efficient free movement is allowed for piping for expansion and contraction and prevention must be made that no stresses are carried over to the equipment.

The contractor must take note that the indicated expansion bends as shown on the drawings are only diagrammatical and he must see to that that all piping installed are without any stress by ensuring the correct placing of all clamps, tie-downs, supports, etc.

27.8

SUPPORTS AND HANGERS

Piping must be sufficient support horizontal and vertical to the structure. Supports must be designed so that the free movement by expansion and contraction is allowed. Supports shall comply with standard drawing STD44 for wall and roof truss supports and drawing STD 50 for piping supported on concrete slabs.

Supports must be, where possible, installed near to joints and fittings and to the following C-C distances:

Nominal Pipe Size	Centre to Centre Spacing	
Copper	Horizontal Pipe	Vertical Pipe
12mm	1,0m	1,2m
15mm	1,2m	1,5m
22mm	1,5m	1,8m
28mm	1,9m	2,1m
35mm	2,1m	2,4m
42mm	2,4m	2,7m
54mm	2,4m	3,0m

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Nominal Pipe Size	Centre to Centre Spacing	
Multilayer	Horizontal Pipe	Vertical Pipe
16mm	0,5m	0,7m
25mm	0,7m	1,0m
32mm	0,8m	1,1m
40mm	1,0m	1,3m
50mm	1,2m	1,6m
63mm	1,4m	1,8m
75mm	1,6m	2,0m

Extra supports must be supplied at T-offs, valves and other heavy fittings and everywhere on the site where needed.

Supports must consist of the following:

Hangers, pipe clamps, roller, clamps etc. as needed.

In roof areas hangers and supports fixed to roof trusses shall be used.

Piping on roofs and walkways must be support on mild steel frame free from the roof.

Hangers and supports must be adjustable so that piping can be neatly lined up to even inclines as specified.

Piping installed through metal cladding must be sealed off with an approved silicon, non-handling sealing agent which shall be heat-, ultra violet and weather resistant.

27.9

INSULATION

All household hot water and cold water piping installed outside and in roof areas shall be insulated with an approved insulation.

The insulation material shall be of the snap-on preformed glass fibre or other approved isolation material with a density of at least 60 kg/m^3 . The thickness shall be as follows:

Service	Nominal Pipe Size
	Up to 50mm
Cold Water	15mm
Hot Water	25mm

Preformed sections must be covered with canvas glued over the total length with an overlap and must be tie down with 15mm galvanized strips every 300mm.

Where possible movement on rollers etc. and where damage may occur the cladding may be neatly cut back in such a way that insulation may be applied without removing or damage to the insulation material.

Equipment and piping must firstly be pressure test before any insulation shall be installed.

Bends and fittings shall be insulated as follows:

Fittings shall firstly be wrapped with 20mm diameter glass fibre rope then with galvanized chicken wire and lastly plastered with an approved asbestos free insulation material to the thickness of the surrounding cladding. The plaster must then be treated with an approved weather and ultraviolet resistant mastik and then with a double layer glass fibre gauze which shall extend to 30mm over the sheetmetal cladding. Finally the glass fibre shall be covered from sheetmetal cladding to sheetmetal cladding with a watertight mastik.

Before the insulation material is applied the system must be heated and kept at that temperature until the work is done and the insulation material is binded and totally dry.

Other equipment to be insulated as follows:

Insulation must be applied on a basis layer of porcelain clay or any other approved binding substance in layers of 15mm thick.

The layers must be left rough until dry before the next layer is applied. Large surfaces must then be covered with 25mm galvanized chicken wire. Piping must be bound with a 20mm spiral of 0,9mm binding wire before the application of the final hand wound layer is applied.

The hot water cylinders shall be insulated with 50mm blanket type fibre glass insulation with a minimum density of 60kg/m³. The insulation shall be strapped to the cylinder with sheet metal bands and shall be covered with 0,5mm thick galvanised sheet metal that shall be held in position by overlapping joints and fastened with self-tapping screws. The top of the cylinder shall be insulated as specified for other equipment.

27.10

SHEET METAL CLADDING

All piping on the outside of the building and in plantrooms shall be covered with sheet metal cladding.

Galvanized sheet metal covering 0,5mm thick must be tightly strapped around pipes at 300mm centres as additional protection in exposed areas, machine rooms or as shown on the drawings or in the specification. On conical and other shapes self-tapping screws must be used for a solid and neat finish.

All openings in the sheet metal which are exposed to rain or water must be sealed off with a non-hardening, UV resistant silicon sealer.

28. INSULATION

Contractor shall insulate all hot water piping and equipment with preformed fibreglass sections or mineral wool insulation, all in accordance with clause 11 of General Specification For Hot and Cold Water For Building Services – April 2005.

29. VALVES

All valves to be ball valves with stainless steel bodies and balls and PTFE or Teflon seals. They shall be suitable for a working pressure of 1000 Kpa gauge.

Valves shall be fitted into the pipeline by means of capillary hard soldered joints containing silver.

30. COMMISSIONING AND TESTING

30.1 Commissioning

Upon the 'Practical Completion of the Contract Works', the contractor shall efficiently test and commission all relevant items of equipment before setting such equipment into regular operation.

Each item of equipment shall be set to produce the required designed capacity when operating against the calculated duty of the relevant system, i.e.: -

Specified vacuum capacities under full load conditions.
Specified air quantities against the relevant system resistances.

30.2 Testing

When the above commissioning of the installation has been completed to the satisfaction of the Engineer, the contractor shall, initially, set the water and air temperature controls to give specified conditions.

30.3 General

When the contractor has completed the above commissioning and testing, and has set the temperature controls, he shall then carry out temperature and air quantity measurements in the air-conditioned rooms to verify the operation of the plant.

Before the Commissioning and Testing of the overall installation is considered complete, the contractor shall submit to the Engineer, in writing, a full Test Schedule giving the following information: -

Size of pump.
Speed of pump.
Rating of pump motor.
Electrical current drawn by pump motor,
Condenser-water system pump head.

Under no circumstances shall the settings or the specified air quantities be altered without prior permission of the Engineer.

31. DRAWING AND STRUCTURAL REQUIREMENTS

Immediately upon his appointment, the contractor shall prepare full detailed CAD drawings of all concrete bases, plinths and structural openings that are required to accommodate the equipment to be installed by him. Two copies of all such detailed drawings shall be submitted to the Engineer for comment prior to installation.

32. STANDARDS

SANS 460 – Copper tubes for domestic plumbing services.

SANS 966 – HDPE tubes for domestic plumbing services.

The contractor shall provide all protective devices, etc. and arrange for all inspections, tests, certificates, etc. necessary to comply with the said Acts, Regulations and By – Laws, whether specified herein or not.

33 ELECTRICAL

33.1 Scope of Work

The Mechanical contractor shall be responsible for the entire electrical installation associated with this plant. A 200V single phase power isolator shall be supplied by the electrical contractor in the plant room(s) where indicated. The mechanical contractor shall supply and install an electrical control and switchgear panel and shall connect the given power supply into the main isolator on the water control panel. The control panel shall in turn be wired to the equipment isolators. The Mechanical contractor shall be responsible for all interconnecting wiring and conduit and terminations thereof.

All cabling, wiring (power and control) shall be PVC/SWA/PVC ECC Copper Cable.

All wiring shall be installed inside conduit or on cable racks.

33.2 Electrical Control and Switchgear Panel

Supply and install an electrical control panel in the position as indicated on the drawings and be fed from the normal electrical supply as well as the standby generator supply. Schneider circuit breakers and control gear to be used. The water temperature must be set from the control panel. The electrical panel shall accommodate the following equipment:

- (a) Main isolator.
- (b) Circuit breaker and contactor.
- (c) Over/under current protector.

- (d) 3-phase protector.
- (e) 1-phase protection.
- (f) All other equipment shall be supplied through a circuit breaker.
- (g) Phase rotation protection.
- (h) Switches, push-buttons, and indication lamps and gauges shall be so installed that they remain fastened to the doors when doors are opened and indication lamps required for each heat pump shall indicating Run/Stop/Trip/Fail.
- (i) Schedule timer.
- (j) Temperature sensors

The electrical panel shall be a surface panel and shall be installed where shown. The panel must be manufactured from 2mm sheet metal with the necessary supports to install it against the wall. All joints shall be welded. The panel shall be equipped with hinged doors manufactured from sheet metal adequately supported and strengthened. All switches and instrumentation must be secured on the top of the panel door. The panel shall be weatherproof in terms of IP54 and shall be epoxy painted (orange colour).

The panel shall be sized so that the electrical equipment for the circulation pumps, extract fans, heat pumps can also be accommodated therein.

33.3

Electrical Cabling

The supply, installation and connection of all electrical cabling between the electrical panel and the installed equipment shall form part of this contract. All cabling shall be PVC SWA PVC armoured cable neatly installed on cable racks. The cable racks and trays shall be installed as part of this contract.