



HVAC System Installation Specifications

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1 General requirements

These Standard Specifications cover the general technical requirements for the equipment, materials, installation, testing, commissioning, and scheduled maintenance of the Air Conditioning System for UN R.C Residential house located in Maseru West, Lesotho. These requirements shall be read in conjunction with the Documents as specified below.

- (a) "Document" shall mean the complete set of contract documents, including the Tender Conditions, Tender Qualifications, the Standard Specification and the Detail Technical Specification, including all drawings layouts.
- (b) Where reference is made to the "Contractor" or "Sub-Contractor", it shall be read to mean a company or firm appointed to execute the contract specified in this Specification. Where applicable, the Builder or Principal Contractor shall be referred to as "Main Contractor".
- (c) Where reference is made to "Client", it shall be read to mean United Nations (UN).
- (d) Where reference is made to "Engineer", it shall be read to mean Enercon Group (Pty) Ltd.
- (e) Where brand or trade names are referred to in the Specification or bill of quantities, these shall indicate the quality and type of material or fittings required. No substitution of materials so specified will be permitted unless the Engineer approves.
- (f) Quality refers to:
- (g) The value of the article
- (h) Materials (new)
- (i) Aspect (appearance)
- (j) Price
- (k) Performance refers to:
- (l) The output of the article
- (m) Economical use of the article
- (n) Cost of maintenance
- (o) Ease of maintenance
- (p) Accessibility for maintenance

1.1 Standard specifications

Unless otherwise specified in the design documentation, the following standard specifications (including amendments) of the organizations indicated shall form part of this Specification.

- SANS 10147: 2014; Refrigerating systems including plants associated with air conditioning systems.
- SANS 1125: Room air conditioners and heat pumps.
- The Occupational Health and Safety Act, Act No. 85 of 1993.
- SANS 10400; The Application of the National Building Regulations.

All losses, costs, or expenditures that may arise as a result of negligence to comply with any regulation applicable to this contract shall be for the Contractor's account.

1.2 Materials and workmanship

All work is to be executed with materials of the best quality and most substantially under inspection and to the entire satisfaction of the Engineer.

All apparatus, components parts, fittings, and materials supplied and installed, whether especially specified herein or not, shall conform in respect of quality, manufacture, tests and performance with the requirements of the appropriate current South African National Standards (SANS) or British Standard Specifications (BS) and Addenda to it, except where otherwise required by this Specification or permitted by approval of the Engineer in writing.

All materials and workmanship which may, in the Engineer's opinion, be inferior to that specified for the work will be condemned. All condemned material and workmanship must be replaced or rectified as the case may be, to the Engineer's satisfaction. No second-hand equipment of any description may be offered for supply or installation.

If so required, the Engineer may call for samples of material and equipment for approval. Such samples shall be submitted within 14 working days of the request, and, if judged necessary by the Engineer, may only be returned after completion of the installation to ensure that the quality of the installed product is the same as that of the approved sample.

Any fitting or item of equipment not specifically mentioned but obviously necessary for the successful completion of the installation must be included to form a complete working installation.

1.3 Drawings

The tender drawings issued are schematic and do not necessarily purport to show the exact position, size or details of equipment construction.

Tenderers must satisfy themselves that the equipment offered by them can be accommodated in the available space and positioned in such a way that access for maintenance, repairs or removal is not obstructed.

1.4 Contractor's drawings

Where indicated in this Specification, these drawings are to be prepared by the Contractor at his expense per this document and shall be on a scale equivalent to that used on the design drawings.

Positions and sizes of refrigeration and condensate drain pipes through external walls, etc., as indicated on the tender drawings, shall be adhered to as far as possible. Amendments will only be considered if absolutely unavoidable.

1.4.1 Shop drawings

These shall be based on the design drawings and show in detail the construction of all the parts of the works, method of assembly where applicable, erection and construction, materials and connections, welds, gaskets, sealants, fastenings, reinforcing and all other necessary details.

1.4.2 As-Built drawings and wiring diagrams

These are up-to-date approved drawings after the contract. Tenderers shall allow in their price for submitting to the Engineer each of the up-to-date shop drawings and electrical drawings together with the O&M manuals specified herein.

1.4.3 Submission of Contractor's drawings

Drawings shall be submitted to the Engineer in orderly fashion commencing within the following time limits or as determined by the main Contractor's programme (where applicable) and project magnitude:

- a) Shop drawings: Within six (6no) weeks of tender acceptance.
- b) As-built drawings: At completion before first hand-over.

By submitting drawings, the Contractor represents that he/she has determined and verified all site measurements, site instruction criteria, materials, catalogue numbers and similar data. The Contractor will do so and that he/she has checked and coordinated each of their drawings with the requirements of the works, including the contract documents, taking into account drawings of all other relevant disciplines.

At the time of submission, the Contractor shall inform the Engineer in writing of any deviation in the Contractor's drawings from the requirements of the original design documentation.

After scrutiny, the Engineer may, depending on the number of discrepancies, require amendment and resubmission before approval. Drawings shall be resubmitted until approved before any portion of the works related to the drawings is commenced.

Should the Contractor, during drawing amendment, alter any portion of their drawings not explicitly required by the Engineer, they shall point this out in writing when resubmitting the drawing.

Approval of the Contractor's drawings is in no way indemnifies them from being responsible for the correctness of the drawings and satisfactory operation of the installation.

If the Tenderer wishes to submit alternative proposals, differing from the Specified design, drawings indicating such proposals comprehensively shall be submitted with their tender.

1.5 Site conditions

By submitting a tender, it is accepted that the Tenderer is fully aware of all site conditions as well as the access to it and has allowed for this in his/her tender price. It is the responsibility of the Tenderer to visit the site during the tender phase and to familiarize themselves with conditions related to it. If the site's location is not indicated in the Specification, it can be obtained from the Engineer. No claim for additional payment related to ignorance of site conditions will be accepted.

1.6 Deviations from tender documents

No deviations or alterations from that of the Specification, schedules or drawings shall be made without first obtaining the written approval of the Engineer.

1.7 Programming of work

The contract works shall proceed concurrently with the building renovation works or per an approved programme in all respects.

The Contractor must programme their work in conjunction with the Main Contractor and the main contract programme to avoid possible delays or clashes of trades.

For direct contracts, the Contractor shall submit a detailed programme in the form of a bar chart or an approved scheduling programme based on the contract period and the various activities and components of the installation. This programme shall be submitted to the Engineer within two weeks of site hand-over.

1.8 Manufacturer's ratings

All equipment such as air conditioners, etc., shall be selected to be operated well within the manufacturer's ratings. Equipment offered for use beyond these limits will not be considered.

Tenderers must submit manufacturer's ratings of all equipment offered. Ratings shall be given in the SI unit system.

2 Technical requirements

2.1 Erection of equipment

Tenderers shall allow for a complete installation, including the provision of measuring equipment, precision levels, and all other special or regular tools and equipment that may be needed to complete the entire installation per the Specification and to the Engineer's satisfaction. However, the main Contractor may provide some of the large equipment for all other subcontractors.

The Contractor will be responsible for any damage caused to the building, equipment, etc., during the erection of his equipment.

2.2 Noise and vibration control

Unless otherwise specified in the supplementary documentation, the design, manufacture and installation of all the mechanical equipment shall be such that it

ensures compliance with the relevant sections of SANS 10103 of 2008 "The Measurement and Rating of Environmental Noise to Annoyance and Speech Communications", as amended.

Any installation where the measured residual sound level exceeds the maximum desired residual sound level as per SANS 10103 shall be rectified to comply with SANS 10103 at the Contractor's own expense.

2.2.1 Vibration Isolation

Proper provisions shall be made in the foundations and mountings of all equipment capable of transmitting vibration forces to its environment, whether local or remote (As is the case with pipes), for vibration isolation.

Selection of vibration isolation equipment and, in particular, mountings for equipment and machines shall be made with due regard to the forcing frequency of the driven machinery and the mounted natural resonant frequency of the device.

In the case of installation of equipment on upper floors, suspended floors, roofs etc., it is of prime importance that floor stiffness, floor, deflection and natural frequency of the floor be taken into consideration to ensure that resonant conditions cannot occur.

2.3 Air Conditioning units

Room type air conditioners shall be completely self-contained units of the direct expansion unitary or split-type design. These air conditioners shall be in accordance with SANS 1125: 2004 with sound levels not exceeding the values specified in the relevant SANS defined in this Specification. Unless otherwise specified, room type air conditioners in the cooling mode shall be rated at 35 ° C ambient dry-bulb air temperature onto the condenser, 27 ° C dry-bulb and 19 ° C wet-bulb air entering conditions to the evaporator, all at sea level with the cooling capacities specified at these conditions. For reverse cycle heating, the rating shall be based on 7 ° C ambient dry bulb and 6 ° C wet-bulb air onto the outdoor coil with 21 ° C dry-bulb air onto the indoor coil.

The indoor/outdoor units shall be connected with insulated refrigerant piping, electric wiring and interlocking control and cabling. In addition, the provision shall be made in the unit design to re-evaporate condensate from the condenser, where this is applicable.

2.4 Split Type Units

Split-type units shall consist of a direct expansion indoor fan coil unit and a separate (remote) externally located air-cooled condensing unit. The indoor fan shall be wall-mounted, and ceiling cassette mounted type as specified. Gas piping (insulated as specified) and wiring shall be installed in galvanized steel trunking throughout for protection, painted as specified.

2.5 Condensing Unit

Condensing units shall be of air-cooled type. They shall be completely self-contained units with stainless steel or epoxy powder coated casings and cladding, suitable for

permanent outdoor use where required. Condensing units shall be selected for a maximum compressor running operation of 8 hours per day.

Condensing units shall be of the heat pump inverter type.

Condensing units shall be suitable for operating with ambient wet-bulb temperatures as low as -10°C and as high as 35°C.

2.6 Piping

2.6.1 Refrigerant pipes

Refrigerant piping in critical applications shall be supported on anti-vibration mountings. In addition, delivery and suction piping at compressors and air handling units shall be provided with at least two braided flexible connections installed at 90 degrees and in close proximity of each other.

Refrigerant pipes and equipment shall be tested with dry nitrogen with a small quantity of refrigerant for a period of 24 hours at a test pressure of 1.1 times the appropriate maximum working pressure in terms of SANS 0147-1978 (or later): Code of Practice for refrigeration and Air Conditioning Installations. Using a sensitive detector and soap bubble test, all connections shall be inspected for leaks.

2.6.2 Condensate drain pipes

All air-conditioning units shall be provided with condensate pipes and connected to the units as per the manufacturer's recommendations. The Contractor shall supply and install all condensate drain piping required for the works.

The drain lines from individual air-conditioning units shall be trapped and have a minimum internal diameter of 15 [mm] (pipe diameter to match respective indoor and outdoor units).

Internal condensate drain lines shall be in PVC piping insulated with neoprene to prevent condensate dripping on ceiling tiles.

2.6.3 Pipe penetrations through walls

Under no circumstances will pipe penetrations through walls be permitted where the pipe comes in direct contact with the surrounding wall or structure.

At such penetrations, it is required that a sleeve of 25 mm thick, soft neoprene, or other approved material be provided around the piping at the penetration. Where plastering is applied, plastering shall be cut back to the outer edge of this sleeve.

2.6.4 Drain connections

All plumbing between equipment and drain points shall form part of the contract. The exact details of drain points have been set out in the design documentation issued. The Contractor shall liaise with the contract's plumber in providing these points.

2.7 Air conditioning Controls

Controls shall be of the same manufacture as the air-conditioning equipment.

Controls shall have the following minimum functionality:

- Manual ON/OFF.
- Room temperature display.
- Room temperature adjustment.
- Cooling/heating selection.

3 Commissioning and testing

3.1 Commissioning Engineers

The Tenderer shall allow in his/her tender price for the services of approved and expert Commissioning Engineers, as may be appropriate for the individual specialized sections of his/her contract and a competent Engineer in overall control of the installation. These Engineers shall carry out testing and commissioning.

Should unnecessary problems be encountered at any time, the Contractor may be requested by the Engineer to obtain the services of a representative of the manufacturer of specified items of equipment at the Contractor's own expense.

3.2 Notice of Testing and Commissioning

The Engineer shall receive not less than 48 hours advance notice of any tests to be witnessed.

3.3 Failure of Works, Site or Commissioning Tests

Should the Engineer be notified to attend official tests as laid down, and should the equipment fail the test for any reason whatsoever, such that the Engineer is required to re-witness the test, the time, transport and disbursement by the Engineer in so doing will be for the Contractor's account, which amount may be deducted, at the option of the Engineer, from monies due to the Contractor.

3.4 Quality Testing of Equipment

The Engineer reserves the right to arrange for testing any piece of equipment at will, to check on compliance with the relevant specifications. Should the particular piece of equipment pass the test, the Engineer will bear the cost of such testing. However, should it fail the test, the cost of the test, the rectification of the shortcomings, re-testing and repetition of the same test on the remaining like items will be for the Contractor's account.

3.5 Inspection during Manufacture

The Contractor will advise the Engineer when the items to be supplied are in the course of manufacture. The Engineer reserves the right to inspect any items during the period of manufacture and witness any performance tests that may be required thereon. The Contractor shall give the Engineer at least ten working days advance notice of works tests.

3.6 Testing

The Contractor shall be responsible for carrying out all tests laid down in the specific sections elsewhere in this document, in addition to those listed hereafter and in any other design documentation issued to the Contractor.

- (a) Testing and balancing shall not begin until the system is completed and in full working order.

- (b) The plant shall be tested and operated to meet the performance figures and duties specified.
- (c) All safety features and interlocks will be tested.
- (d) The works will be deemed to be incomplete until all tests have been conducted successfully.

The Contractor will be responsible for all costs incurred in the testing, including the supply, calibration and use of all instruments and tools, but not the water supply or power on site.

The Contractor shall provide all instruments and test equipment used and be accurately calibrated and maintained in good working order. All test instruments used for tests to be witnessed by the Engineer shall be provided with calibration certificates, which must be available to the Engineer.

Specific attention is drawn to the fact that calibration certificates will be required for the following: Wattmeters, ammeters, voltmeters, frequency meters, pressure gauges, flow meters, orifices plates, temperature gauges and dynamometers.

All instruments shall be above standard grade, and test pressure gauges shall not exceed 150 mm in diameter. The maximum scale of the instrument shall not exceed 1.5 times the full test requirement.

It is essential that the Contractor inspects and tests all equipment before requesting the Engineer to inspect or witness acceptance tests thereon.

All acceptance tests, whether in the manufacturer's works or on-site, must be carried out in the presence of the Engineer.

Should the Engineer wish to verify the calibration of any instruments, the Contractor shall make the necessary arrangements to be re-calibrated by a recognized authority. Should the instrument prove to be correctly calibrated, the Engineer will bear the cost of the re-calibration test. Should the instrument prove to be in error, the cost of the tests will be borne by the Contractor.

Two copies of the complete test reports shall be submitted to the Engineer before the first delivery of the project. Reports shall cover all tests carried out on individual sections, including such works tests as conducted. All reports shall be neatly typed.

3.7 Commissioning

The Contractor shall carry out all tests and commission the systems installed by them in a coordinated and adequately organized manner.

Air Conditioning installations shall be commissioned according to applicable Codes or other recognized commissioning procedures or codes approved by the Consultant.

The testing procedures shall be sufficiently comprehensive to prove the correct functioning of every piece of equipment and its suitability for the application.

After all systems and equipment have been tested and commissioned to the Engineer's satisfaction, a detailed demonstration of all functions of the system shall be carried out in the presence of the Engineer to allow them to become thoroughly acquainted with the system's operation.

The commissioning tests shall include the tests laid down under the specific sections hereafter and a full operational test of all air conditioners in all modes of operation.

The Contractor shall allow for the replacement and cost of any materials and fuel used for testing purposes as part of the contract.

The demonstration to the users shall include a repeat of the operational tests above. The planning of this demonstration shall take place in collaboration with the Engineer.

A certificate of completion will not be issued until all tests have been satisfactorily completed and the plant has operated successfully, to the complete satisfaction of the Engineer.

3.8 Performance tolerance

All performance figures obtained during testing and commissioning must be within $\pm 5\%$ of the specified performance figures given in the design documentation. Should the plant fail to comply with these figures after it has been tested and operated for seven days, the Contractor shall have a further four weeks to meet the Specification requirements. After the four weeks, the Engineer shall have the right to reject the plant and recover all monies paid to the Contractor for the rejected plant.

3.9 Test certificates

The Contractor shall ensure that copies of all relevant test certificates, inspection reports, materials analysis certificates and similar data required under various sections of this Specification, or by Government Licensing and Inspection Authorities or Local Authorities, shall be provided before handing over the site. Acceptance of the installations will be delayed if such certificates are not available.

3.10 Service access

Where any equipment is installed above the ceiling, the Contractor shall ensure that access will be possible for maintenance purposes after installation.

3.11 Montreal protocol

Tenders for equipment utilizing chlorofluorocarbons (CFCs), hydro chlorofluorocarbons (HCFCs) or hydrofluorocarbons (HFCs), to be supplied and installed shall be within the constraints and schedules of the Montreal Protocol and the Copenhagen Agreement and such amendments thereto as may be made by the international community.

Where tenders are submitted for equipment not complying with this Protocol, it shall be indicated in writing in the tender submission.

4 Maintenance and servicing

Unless otherwise specified, the Contractor shall be responsible for all maintenance and servicing of the installation for the full 12-month guarantee period. During this period, the Contractor shall make good any defect due to inferior materials or workmanship and maintain all plant and equipment in perfect operating condition.

The Contractor shall be entirely responsible for carrying out regular inspections at intervals not greater than one (1) month, unless otherwise specified, and for fully servicing all installation components per the manufacturer's instructions. For this purpose, the Contractor shall prepare a detailed inspection and service report in the form of a checklist and log sheet showing all functions to be carried out at each

inspection and service. Copies of these service reports shall be regularly submitted to the Engineer after each service.

The Contractor shall also maintain a system logbook on-site in which he shall record, sign, and date all work carried out at each inspection and log all temperatures, pressure readings, etc.

The Contractor shall allow for all expendable materials necessary for servicing, such as lubricating oils, grease, refrigerant and cleaning materials.

4.1 Guarantee

The 12-month guarantee shall apply to all plant items such as condensers, etc., delivered to the site and erected. It is the Contractor's responsibility to negotiate with his suppliers to secure their equipment guarantee on this basis.

The guarantee shall cover all defects to the works and shall provide for the replacement or repair of all components that become defective within the guarantee period. Consumable components are excluded from the guarantee.

The acceptance date shall appear in the acceptance certificate issued by the Engineer and shall define the start of the guarantee period and free maintenance period (where applicable).

No Claims for extended guarantee or otherwise from Suppliers, Principals etc., will be considered even if the equipment is required on-site long before the acceptance date.

4.2 Operating, maintenance instructions, wiring and control diagrams

The Contractor shall prepare and supply comprehensive manuals for the successful operation and maintenance of the installation. A manual draft shall be submitted to the Engineer after commissioning for approval. The draft shall then be corrected if required, and three sets of the manual shall be submitted before the first acceptance of the plant. The manuals in soft copy shall also be submitted to the Engineer (where available).

Manuals shall be prepared in the same language as the contract document unless otherwise required by the Engineer. These manuals shall be bound in hard file covers with clear titles and indices.

5 Training

The Contractor shall provide a suitable and trained person to train the Employer's facility management in the correct operation and maintenance of the installation. Training shall include, but not be limited to, comprehensive theoretical and practical tuition with additional fault simulations to ensure that maintenance staff are fully conversant with the air conditioning system, equipment and components and its operation.



Wet Services Installation Specifications – R.C. House refurbishment

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1 General requirements

These Standard Specifications cover the technical requirements for the equipment, materials, installation, testing, commissioning, and scheduled wet services for U.N. R.C Residential House located in Maseru West, Lesotho. These requirements shall be read in conjunction with the Documents as specified below.

- (a) "Document" shall mean the complete set of contract documents, including the Tender Conditions, Tender Qualifications, the Standard Specification and the Detail Technical Specification, including all drawings layouts.
- (b) Where reference is made to the "Contractor" or "Sub-Contractor", it shall be read to mean a company or firm appointed to execute the contract specified in this specification. Where applicable, the Builder or Principal Contractor shall be referred to as "Main Contractor".
- (c) Where reference is made to "Client", it shall be read to mean United Nations (U.N.).
- (d) Where reference is made to "Engineer", it shall be read to mean Enercon Group (Pty) Ltd.
- (e) Where brand or trade names are referred to in the specification or bill of quantities, these shall indicate the quality and type of material or fittings required. No substitution of materials so specified will be permitted unless the Engineer approves.
- (f) Quality refers to:
 - The value of the article
 - Materials (new)
 - Aspect (appearance)
 - Price
- (g) Performance refers to:
 - The output of the article
 - Economical use of the article
 - Cost of maintenance
 - Ease of maintenance
 - Accessibility for maintenance

1 Section 1A: Domestic water supply

1.1 Scope

This section covers the installation of domestic water piping.

1.2 Standards Applicable

The entire installation shall comply with these standards and Codes of Practice unless otherwise specified elsewhere in this document;

- SANS 10252: Water supply installations for buildings
- The Occupational Health and Safety Act, Act No. 85 of 1993.
- SANS 10400: The Application of the National Building Regulations.

1.3 Pipe types

The use of any other type of pipe not mentioned in 1.3.1 and 1.3.2 shall only be used with the Engineer's approval. Cost considerations are to be considered when deciding on the type of piping to be used.

1.3.1 Underground water piping

All underground water piping shall be class 16 high-density polyethylene (HDPE).

1.3.2 Above ground cold water piping

All coldwater pipework above ground level, but concealed in roofs etc., shall be of galvanized iron for diameters of 32 mm and greater or class 2 copper for all other smaller diameters.

1.4 Protection of pipes

Water pipes in buildings shall be installed such that:

- They cannot be easily damaged by other equipment during maintenance;
- They do not rest on each other, and they are not used to support any additional equipment;
- They are well suspended (supported) in-ceiling space using approved brackets;
- They are not close to any hot objects;
- They are not close to any moving objects;
- Many bends are avoided to minimize pressure losses.
- All pipes shall be chased in walls when dropping to the fixtures.
- Galvanized pipes shall not be heated during installation.

1.5 Insulation of pipes

- All copper domestic hot water pipes running in ceiling space shall be insulated with an approved SABS material;
- All insulation material shall be well attached to the pipes such that no part of the pipe is exposed to the environment;
- The outer surface of the insulation should be made as smooth as possible to minimize the exposed surface area.
- After completing the works (at the handover stage), all insulation shall be checked for damage.

1.6 Pipes in ceiling

- All pipes in ceiling space shall run parallel to the walls;
- All pipes in ceiling space shall have the minimum number of connections;
- All pipes in ceiling space shall assume the shortest routes with minimum elbows;
- All pipes shall be well supported with approved brackets;

1.7 Pipes in walls

All pipes chased in walls shall;

- Be either vertical or horizontal with no or minimal joints or elbows;
- Be buried and not visible at any point.

1.8 Valves**1.8.1 Isolating valves**

- Isolating valves on water reticulations shall be installed as per the given design drawings and schematics complying with SANS 10252-1;
- Isolation valves shall also be installed in all locations required to facilitate maintenance;
- If isolation valves are installed in the ceiling space, such isolation valve shall be indicated by a labelling sticker on the ceiling bearing "cold water isolation valve" or "hot water isolation valve".
- These can either be a ball or gate valves with rubber seats and suitable for water with temperatures up to 60 deg C.
- All bathrooms and the kitchen area shall have a main isolating valve easily accessible to aid maintenance.

1.8.2 Non-Return valves

- All non-return valves shall be of lift type pattern.

1.9 Pressure testing

- All piping shall be pressure tested before use. The Engineer shall witness this test. The section of pipe shall be hydraulically pressure tested using 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;
- Tests shall not be performed against closed valves.
- Leakages that occur shall be measured, calculated and checked against the allowable losses.

2 Section 1B: Hot water generation and supply

2.1 Scope

This section covers the generation and installation of hot water storage and pipe reticulation. The method of hot water provision shall be as given in the design drawings, which comprise sustainable energy.

2.2 Applicable Standards

The following Standards shall apply to all plumbing installation designs;

- SANS 10106: The installation, maintenance, repair and replacement of domestic solar water heating systems.
- SANS 10252: Water supply and drainage for buildings.

2.3 Specific Requirements

- All hot water piping is to be of class 2 copper or galvanized steel for large diameters;
- All hot water pipes shall be insulated with an approved amarfex;
- The pipe runs shall be made as short as possible;
- A hot water installation and a riser pipe to a roof hot water storage shall be provided with a stop valve;
- All hot water storage tanks shall be wholly insulated;
- All solar collectors shall be of high-pressure flat plate/evacuated tube type and shall be insulated such that maximum solar energy is captured;
- All solar systems shall be protected by pressure reducing valves, pressure relief valves and vacuum valves.
- No installation shall be done before any structural survey is conducted on the area of installation;
- Suitably qualified plumbers and electricians shall install all solar water heaters as per South African Norms and Standards;
- Any fittings or item of equipment not explicitly mentioned but necessary for the successful completion of the installation is to be included to form a complete working installation.

Section 2: Fire protection installation

3 Scope

This section covers fire protection and installation.

3.1 Standards applicable

The equipment, installation, commissioning and maintenance shall in all respects comply with the following regulations:

- SANS 10400 – T: 2011 (or later): Fire Protection
- SANS 10400 – W: 2011 (or later): Fire Installation

3.2 Firefighting equipment

Portable fire extinguishers shall be provided at the positions as indicated on the drawings. They shall be installed to ensure that they are readily accessible and immediately available in the event of a fire. The positions of this firefighting equipment shall be identified using signs complying with the provisions of SANS 1186-1.

3.2.1 Fire extinguishers

- Fire extinguishers shall be provided at the positions as indicated on the drawings. Extinguishers shall be mounted on brackets or installed in cabinets.
- The positions of the fire extinguishers shall be identified using signs complying with the provisions of SANS 1186-1. Operating instructions shall be provided on the extinguisher.
- Installation of fire extinguishers shall be such that the carrying handle of the extinguisher is not more than 1,5 m above the floor level.
- The extinguishers are to be installed in cabinets; the cabinets shall not be provided with a lock of any type.
- As indicated in the design drawings, fire extinguishers shall be of mass 4.5kg DCP, 9kg DCP and 5kg CO₂.

3.2.2 Fire signage

The general escape route signage and fire protection equipment indicating signage shall be specified under this section of the project specification:

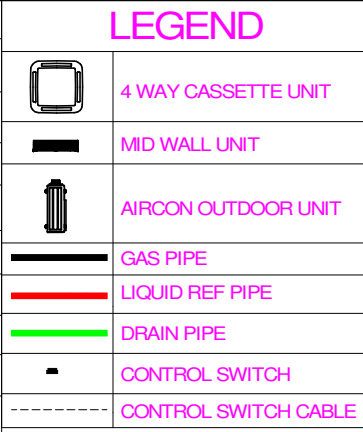
- All signage shall comply with SANS 1186 regarding the type of sign, specific dimensions and the colour specified. Furthermore, all signs shall specifically comply with Table 8 of SANS 1186;
- All signs shall be mechanically mounted to walls or ceilings with screws, and the use of glue or masking tape shall not be tolerated;
- All signs shall be installed such that they are visible to the people for which they are intended;
- The actual location of fire signs shall only be verified during construction in consultation with the Engineer.

4 Maintenance and servicing

Unless otherwise specified, the Contractor shall be responsible for all maintenance and servicing of the installation for the full 12-month guarantee period. The Contractor shall correct any defect due to inferior materials or workmanship during this period. In addition, the Contractor shall maintain all plant and equipment in perfect operating condition.

The Contractor shall be entirely responsible for carrying out regular inspections at intervals not greater than one (1) month, unless otherwise specified, and for complete servicing of all installation components per the manufacturer's instructions. For this purpose, the Contractor shall prepare a detailed inspection and service report in the form of a checklist and log sheet showing all functions to be carried out at each

inspection and service. Copies of these service reports shall be regularly submitted to the Engineer after each service.



NOTES:

1. ALL WORKS SHALL BE CARRIED OUT IN ACCORDANCE TO SANS 204(2011)
2. THIS DRAWING SHALL BE READ TOGETHER WITH RELEVANT ENGINEERS DRAWINGS
3. ALL REFRIGERATION PIPES SHOULD BE INSULATED
4. ALL THE CONDENSATE PIPES SHALL BE INSTALLED WITH CORRECT SLOPE AND CONNECTED TO INDOOR UNITS AS RECOMMENDED BY THE MANUFACTURER.
DRAIN PIPE PIPES SHALL DROP AGAINST THE WALL TO APRON LEVEL AND PAINTED TO MATCH THE WALL COLOUR

[illegible]

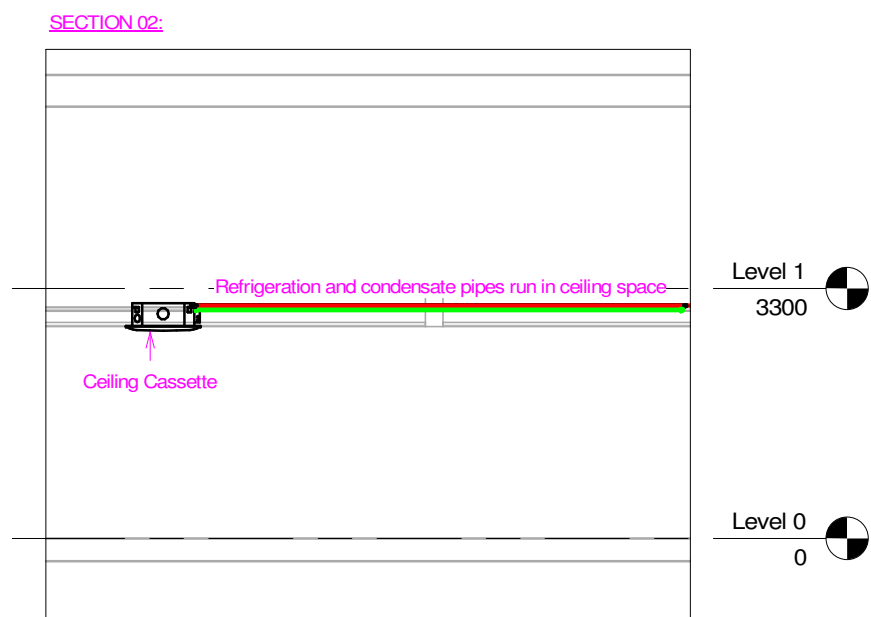
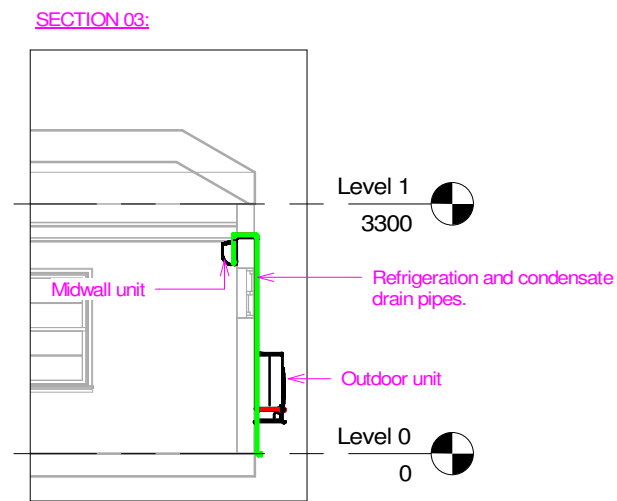
Copyright vests in the Enercon Group (Pty) Ltd
Drawing Purpose: For Tender
Certified drawings as per SANS 204(2011)
Name: _____
Date: _____
Professional Registration no: _____

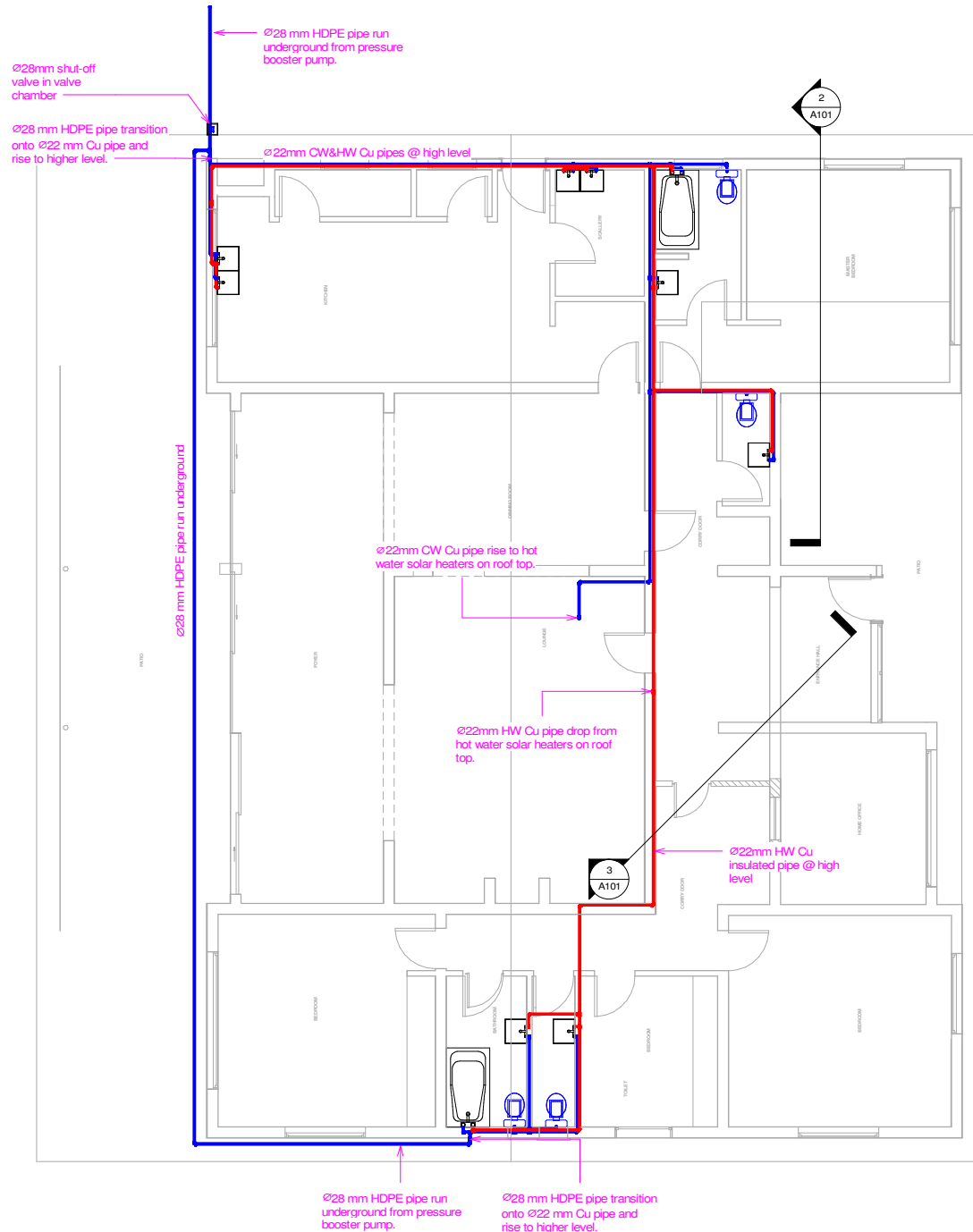
File name	Page type
UNDP RC House	A3

Consultant

enercon group
engineering, energy & management

Discipline: Mechanical Services	
Service: HVAC	
Drawing title: UNDP RC House	
HVAC Layout- Ground Floor	
Ref.no. 20220303	Designed: T. Mähtömlä
Scale: 1/70	Drawn: T. Mähtömlä
Date: 03/2022	Checked:
Drawing number: 20220303.HVAC.GF.ME	





LEGEND

	BATHTUB
	WATER CLOSET
	WASH HAND BASIN/ SINK
	COLD WATER PIPE
	HOT WATER PIPE
CW	COLD WATER
HW	HOT WATER

- NOTES:**
1. This drawing shall be read in conjunction with the Bill of Materials.
 2. All the existing cold and hot water internal pipework routes will be re-used. This drawing is just an assumption of the existing internal re-connection. The Contractor should confirm existing pipe routes on site.
 3. All work is to be carried out strictly in accordance with SANS 10 252.
 4. All copper piping to SANS 460-Class O.
 5. All hot water piping to be insulated to SANS 10400-XA.
 6. Hot water capacity shall be in accordance with SANS 10252-1: 2004 or later.

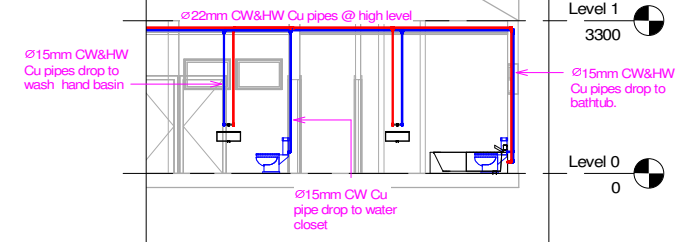
SECTION 3:

150 Liters high pressure solar water heater with 2 kW electric back up on roof, mounted on galvanised steel frame. The panel shall face true North. Panel shall be installed as per SANS 10106.

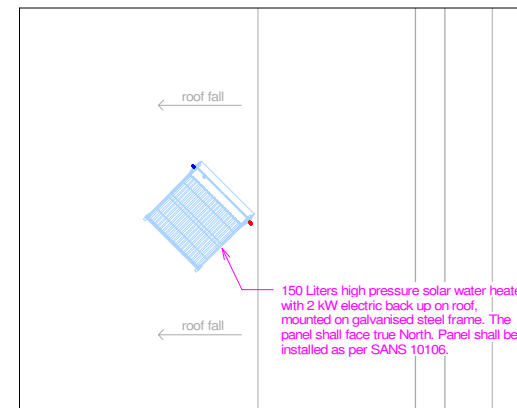


22mm CW&HW Cu pipes to & from hot water solar heaters on roof top, respectively.

SECTION 2:



ROOF SECTION:



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Drawing Purpose: For Tender
Certified drawings as per SANS 10 252
Name: _____
Date: _____
Professional Registration no: _____

For name: UNDP PC House Page type: AD



Discipline: Mechanical Services
Service: Plumbing
Drawing title: UNDP PC House
Plumbing Layout: Ground Floor
Ref. no.: 20200303 Designer: _____
Scale: N/A Drawn: _____
Date: 03/03/22 Checked: _____
Drawing number: 20200303.M.F.G.F.M.E.