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**HEALTH INFRASTRUCTURE DEVELOPMENT PROGRAM**

**LUSAKA MAIN PHARMACEUTICAL WAREHOUSE EXTENSION AND UPGRADE PHASE 2 – Rev 3**

**JUNE 2017**

Submitted by:

UNDP – Zambia

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DISCLAIMER:

The authors’ views expressed in this document do not necessarily reflect the views of the United National Development Program (UNDP)

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**APPENDICES**

**A - DRAWINGS**

It is important to note that some of the drawings listed below represent all 3 phases of the MSL Development program. Phase 1 has been completed early 2017, this document represents Phase 2 and some indicate Phase 3 (still be implemented). The scope described in this document represents Phase 2 of the project but all drawings are included for information purposes.

* MWT – 01 EXISTING SERVICES LAYOUT
* MWT – 02 SITE PLAN FOR PROPOSED DEMOLITIONS (this drawing shows demolitions for phases 2 and 3 – refer to figure 2.2 for phase 2 demolitions only)
* MWT – 03 PROPOSED DEMOLITIONS TO WAREHOUSE this drawing shows demolitions for phases 2 and 3 – refer to figure 2.2 for phase 2 demolitions only)
* MWT – 04 EXISTING WAREHOUSE LAYOUT
* MWT – 05 EXISTING SITE PLAN
* MWT – 06 PROPOSED MASTER PLAN (.note that drawing shows all phases)
* MWT – 08 GROUND FLOOR PLAN (note that drawing shows all phases)
* MWT – 09 ELEVATIONS (note that drawing shows all phases)
* MWT – 10 SELECTIONS (note that drawing shows all phases)
* MWT – 11 SECTIONS (note that drawing shows all phases)
* MWT – E12 ELECTRICAL SERVICES (note that drawing shows all phases)
* MWT – E13 ELECTICAL SERVICES (note that drawing shows all phases)
* LG MSL 001 Rev. E   SITE PLAN (note that drawing shows all phases)
* LG MSL 002 Rev. F    WAREHOUSE DETAIL (note that drawing shows all phases)
* LG MSL 003 Rev. F    SECTIONS AND ELEVATIONS (note that drawing shows all phases)
* LG MSL 004 Rev. C    DETAILS (note that drawing shows all phases)
* LG MSL 005 Rev. C PICK SYSGTEM DETAIL
* LG MSL 009 Rev. A CHILLER DETAIL
* LG MSL 010 Rev. A DANGEROUS GOODS

**SECTION A - PROJECT INFORMATION**

**PART A1 - BACKGROUND**

**1.1** Procurement and supply management is a key element of the grants of the Global Fund to fight AIDS, Tuberculosis and Malaria managed by UNDP and other partners in Zambia. MSL/Medical Stores Limited is the central actor for the MoH, for the storage and distribution of health commodities in Zambia with CHAZ as another partner catering for around 10% of the total supply and supply chain of the public sector. The supplies for the three diseases may cater for up to 40% of the total volume of supplies handled in the public sector.

The last years, 2000-2017, have been marked by a dramatic increase of total volumes, volumes of health commodities, handled by MSL. At the same time there have been plans to improve the handling capacity of this supply chain with enlargement of the Lusaka stores. A second central store in the Copperbelt and Hubs in the regions are part of the solution of the public health supply chain as described in the national supply chain strategy.

In 2016 a contract has been awarded for phase 1 of the upgrading of MSL Central Stores and should be completed by early 2017. This document is for the construction of phase 2 of the upgrading of MSL Central Stores in Lusaka, which will provide for increased storage capacity, new receiving area and other elements that may be specified herein.

**1.2** MSL is now starting the process leading to the increase of its warehouse space and upgrading of its central store in Lusaka. UNDP is providing an active support to this process. The increase of warehouse space will be accompanied by a modernization of the structures, equipment and systems, for long-term sustainability. The use of energy efficient equipment and alternative energy solutions has been identified as essential elements of the infrastructure enhancement strategy

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**PART A2 - GENERAL**

**2.1 Local authority approval**

The Contractor shall prepare a complete detailed design package, including structural and descriptive memorandums, for Municipal approvals and required construction licenses issuing.

**2.2 As-built in drawings**

As works progress, the Contractor is required to produce and submit to UNDP complete sets of updated as-built drawings, as well as final as-built drawings at project completion.

**2.3 Commissioning and Hand Over**

The Contractor is responsible for verifying that all works and systems, equipment, and other project elements have been installed, tested, fit the purpose, and are in good operating condition. If defects are found, the Contractor is responsible for correcting these defects. Additionally, the Contractor is required to handover all buildings and systems to UNDP after the completion of the works and after the MSL issued the letter of acceptance.

**2.4 Construction Oversight**

UNDP will issue another independent contract, for construction oversight services for the warehouse of this solicitation.

**2.5 Temperature Control**

The warehouse building should be thermally efficient and designed to maintain an internal temperature in the main open storage area below 25° C. The design should avoid hot spots and air pockets through a combination of insulation, natural, and (if necessary) forced ventilation. The design should be in line with the existing system in the existing store for easy maintenance purpose. The ventilation system shall maintain positive pressure and resist entry of dust and vermin.

**2.6 Warranty and maintenance periods**

The successful Contractor must provide a warranty period of 365 days following completion of each site, which will run concurrently with the Defects Liability period.

The warranty will exclude malicious damage or end user damage to works by third parties.

**SECTION B - PROJECT DETAIL**

**PART B1 - PROJECT OVERVIEW**

**1.1 Overview**

This Part of the narrative summarises the investigations and design decisions made to date for the proposed demolitions, new high bay development, dangerous goods store, refurbishment of existing warehouse, receiving area, hard standings and walls / fencing, solar panel lighting for perimeter wall for MSL Lusaka, Zambia. We have also requested drivers accommodation and drivers ablution, and a portion of the road and parking area. This Part presents the project goals and objectives, the regulatory criteria and considerations of future expansion that define this project. This statement documents the current design directions and serves as the basis for facility design and for furthering discussion of the project goals and objectives. It is intended that based on this Schematic Design Document tender requests will be called, for implementation of the project

**1.2 Existing conditions**

**Site:** The site is situated on Plot no 6446, Mukwa Road, in the industrial area of Lusaka, Zambia and contains an existing warehouse facility, including ancillary buildings and offices with supporting site works and services. Enough vacant space exists on site, to accommodate extensive additional warehouse space, including supporting ancillary structures.

**1.3 Project Goals**

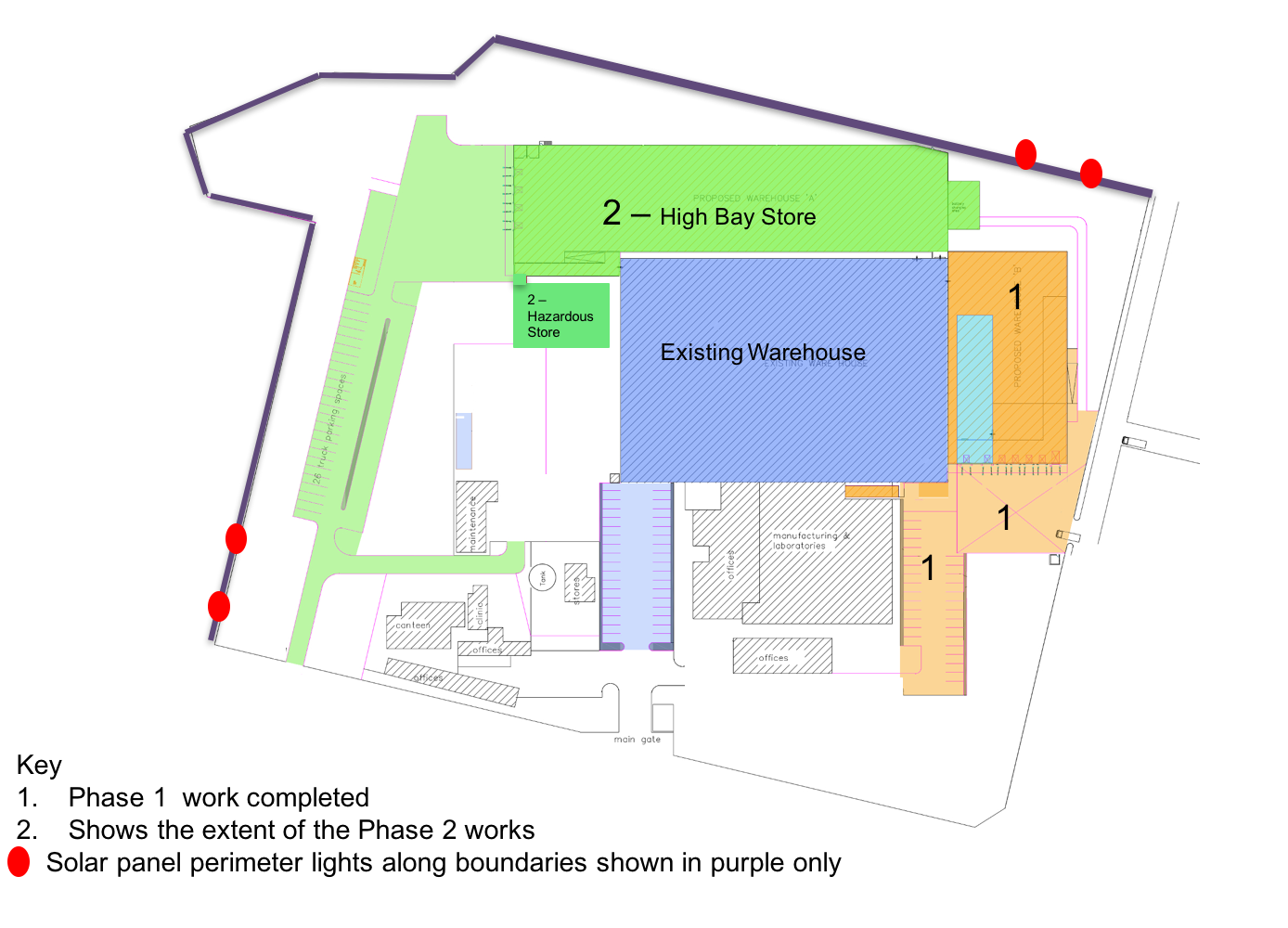
1. **Client Directive**

The objective of this project is to create additional pallet storage space in order to have a total capacity of minimum 32 000 pallets positions, as well as to implement a world-class racking, packing and picking system, which will enable MSL to cope with the increased product quantity that needs to be dealt with on a daily basis. Create a new dangerous store and perimeter solar lighting to increase the security of the site.

(b**) Design Response**

1. Do not compromise efficiency for growth
2. Separate loading from receiving
3. The design needs to control exits for security and prevent pilfering.
4. Warehouse and receiving area to be temperature controlled to pharmaceutical standard (15-25ºC)

**SCOPE OF PHASE 2 DEVELOPMENT**



**1.4 Design Concepts**

**(a) High Bay Warehouse**

* Steel frame with insulated metal panel walls and roof system
* Column placement uses the flue space in the rack system. This makes the structure much less expensive than long span.
* Battery power material handling equipment as standard (not included in tender). The battery charging area as shown on drawings will be extended to accommodate the solar battery storage and racking supports for battery storage. This detail will follow within 7 days as an amendment to the current drawings.
* CCTV and security system
* Resist the entry of vermin and pests
* Emergency shower and eyewash placed in warehouse in close proximity to material handling equipment charging bay
* Euro style pallets (0.8m x 1.2m) with three per rack (not included in tender)
* Rack Dimensions (not included in tender)
* 1.85m operating aisle widths (High Bay VNA bulk warehouse).
* Distribution of product
* Product arrives in shipping container directly from port
* Anticipate a maximum of (4x) containers unloaded at one time
* Containers can arrive at any time
* Product is not always palletized in the containers - hire local labour to hand carry product out to containers
* This makes the receiving areas a kitting and palletizing area
* Product palletized for internal use
* Receiving and shipping staging areas require depth to layout pallets that fit a container
* 32 pallets/container
* Two rows of 16 pallets
* Need 13m for pallet staging
* Use 20m depth for receiving to allow for movement
* Battery Charging Area
* The charging area shown will facilitate the charging of forklift equipment and solar panel batteries.
* Warehouse Personnel
* 45 Persons estimated (phases 1 & 2)
* Personnel organogram to inform
* One shift

**View on Phase 2 Receiving and High Bay**

Dangerous Goods

Store

High Bay

Warehouse

Receiving

Area



**(b) Exterior Design - Warehouse**

The design team and client have discussed the requirement for placement of insulation in the walls and roof enclosure system. The design uses HVAC cooling that flushes cooled circulated air through the facility for cooling.

The building enclosed with a 75mm EPS insulated metal panel system. A plinth wall of concrete masonry units CMU protects the metal siding at the base on both the building interior and exterior. Single width CMU typical to construction in Zambia.

External building envelope consists of 75mm thick Isowall insulation sandwiched EPS panels consisting of 75mm thick standard density expanded polystyrene and 0.5mm AZ150 pre-painted metal facings, colour frost white both sides, fixed to horizontal purlins

The roof system consists of 75mm thick Isowall IRB panels consisting of 75mm thick standard density expanded polystyrene and 1 x .05mm IRB and 1x 0.5mm AZ150 pre-painted metal facings, colour frost white.

**(c) Interior Design**

The finishes will be compatible quality to the finishes in the existing Lusaka facility

* 1. **Consideration for future expansion**

The current design for the proposed addition to the Lusaka Pharmaceutical Warehouse contains provisions for future horizontal expansion

* 1. **Project bidding/Contract Procedures**

**(a) Contracts**

The project uses the model contract form of JBCC 2000 Principal Building Agreement (July 2007 edition 5.0 – reprint 1), or standard UNDP contract, or FIDIC (to be finalised during Contractor briefing session).

**(b)** The contract will require the tenderer to provide the structural design for the warehouse. This is intended to optimise cost saving by utilising the designs and construct implementation principle.

**PART B2 - DEMOLITIONS AND SITEWORKS**

**2.1** **Contract of scope work**

The works to be executed under this section of the contract for MSL warehouse project involves alterations and associated repair works. The execution methodology shall be provided in the technical proposal by the Contractor

* 1. **Scope of Work**

The expected scope of work for this section of the project involves:

1. Demolitions of: -
   1. refer to figure 2.2 for areas to be demolished
   2. Double story offices and cold stores warehouse section and associated offices on the first floor
   3. Partition block walls and associated windows and roller shutter doors
   4. Reinforced concrete columns and beams
   5. Walls to link to new warehouse
2. Repaint walls internally and externally and repair/replacement of rainwater gutters and flushing
3. Remove existing sliding steel gates and block up existing wall.
4. Demolition of wall and fence on northern and western side of existing MSL facility as separate options..
5. Construction of a wall along the North and west side of the plot as separate options.
   1. **Requirements description**

All demolitions shall be carried out without compromising the current structural and aesthetic integrity of the existing warehouse. Areas and associated building elements to be demolished or removed are shown in drawing No MWT-02 & MWT-03 all trades disturbed due to demolitions shall be made good. These drawings are for reference only, scope of demolition as per this document.

New electrical installation is described and specified under electrical section

**2.4 Demolitions Operation**

All repair work described above and disturbed trades shall be restored to comply with Standards Specifications for Materials and Workmanship for Building Works for the Government of the Republic of Zambia, Interim Metric Education for new works.

1. **Regulations and procedures**

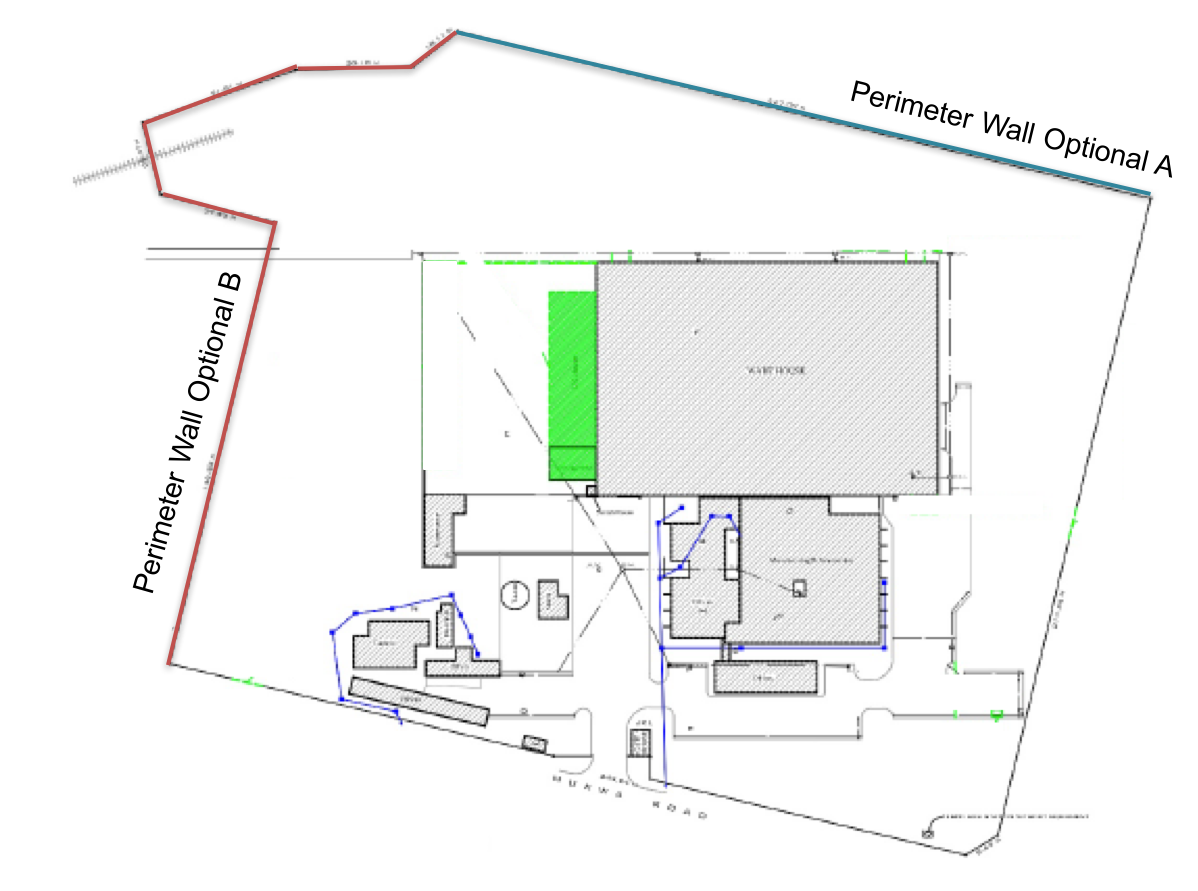
All demolition procedures to comply with structural safety standards for existing building structures and with Zambia Environmental Management Authority requirements.

1. During demolishing works, the contractor shall keep the debris constantly watered to minimise dust arising from the demolition operations.
2. The contractor is to erect dust proof screen to the approval of the Project Manager and remove on completion of works to the Project Manager’s satisfaction
3. Where asbestos containing materials is being handled, the contractor shall comply to requirements stated in the International Asbestos Cement Material Manual
4. All non-reusable debris shall be removed from site immediately after demolition
5. All building material suitable to be used as filling shall be stockpiled separately on site for re-use as filling during construction.
6. **Salvage Material**
7. All salvageable materials shall be dismantled or moved off fixed positions, carefully to reduce damage impact and shall be stored in a suitable environment to mitigate against damage, should the materials and equipment become the property of the client.
8. All salvageable materials arising from demolitions unless specially stated not to, shall become the property of the Client.

**FIGURE 2.2**

**PROPOSED DEMOLISIONS**

Note:- New Despatch Area, already constructed, not shown.



Areas shaded in green to be demolished

**PART B3 - SITE WORKS SPECIFICATIONS IN RESPECT TO DANGEROUS GOODS STORE**

**3.1 Contract scope of work**

The works to be executed under the contract for MSL Central Warehouse – Lusaka project includes, construction of new driveways, parking and paved areas. The designs considering rainwater containment from the new roof surfaces shall be provided in the technical proposal by the Contractor. Topographical Survey drawing No.L 2015/P/01 shall be the reference point for the designs, which shall be the full responsibility of the contractor in all aspects.

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**3.2 Scope of work**

The expected scope of work for the project includes:

1. Design, construction and maintenance (up to issuance of the final certificate of whole works) of new driveways, parking and aprons.
2. Design, construction and maintenance (up to the issuance of the final certificate of the whole works) of drainage structures and retention areas to reduce storm water run-off from the site.
3. Construction of a new wall along the North and west side of the plot (optional)
4. Provide adequate security hoarding prior to new wall fence construction
5. Construct a new 200mm thick concrete block wall fence minimum 2200mm high from existing ground level with intermediate reinforced concrete columns at 6.60 metre centres, with and including concrete copings and plastering both walls to wood float finish. Top most block course to be filled with grade 10 MPA concrete.
6. Bonding Method Statement: Wall to be built first with recesses on the adjoining face, with steel ties to first anchor onto the column reinforcement with and including 50mm concrete nibs into blockwork at 200mm intervals.
7. Demolition works and making good all trades disturbed.
8. Landscaping.

**3.3 Driveways, Parking and Paving (refer to 11.4)**

**(a)** **Evaluation of Parking Pavement.**

To ensure satisfactory performance of new surfacing, the factors that caused deterioration of the existing parking lot need to be recognised in the design proposal. The following factors, generally contributed to the failure of the pavement:

1. **Traffic Loads**

Heavy vehicles contributed to the localised pavement failure concentrated at receiving and despatch areas. These areas require rehabilitation including existing parking lot.

1. **Drainage**

Improper and inadequate drainage which weakens the sub grade soils through water saturation leading to pavement deterioration and failure.

It is prudent to refer to the geotechnical tests to determine the nature and location of the different soil types occurring underneath the existing pavement surface layer. The following subsoil investigation methods are to be used to investigate the depth of the existing soil strata, the nature and properties of the underlying layers:

● California Bearing Ration (CBR)

● Laboratory testing of samples recorded from trial holes.

● Standard DCP tests to determine the bearing capacities.

**(b)** **Pavement Designs**

1. **Requirements description**

The contractor shall be responsible for the re-designing of the existing pavements and designing of new parking lot and roads.

The location and alignment of permanent roads are defined in the conceptual design master plan drawing No.MWT-06 and LG-MSL-001. The road design should be adequate for transportation of all future equipment and supplies and shall be crowned or inclined to ensure run off of precipitation. The main access roads shall at least be 7.00 meters wide. A design period of twenty (20) years should be considered in the design for the parking lots and driveways to be able to carry traffic at a satisfactory level of service, without requiring major rehabilitation. Walkways shall be set as shown on drawings referred to above and be 15cm to 20cm higher than the road or paving lot surface level.

(ii)  **Technical Specifications**

Applicable specifications for geometric and pavement design standards are the Road Design Standards Pavement Design Guide (1994) for the Road Department (Zambia) or the Southern African Transport and Communication Commission (SATCC) code of Practice for Geometric Design of Trunk Road (September, 1998, Reprinted July, 2001). The pavement design should be based on the assumption of cumulative numbers equivalent 80KN standard axles for the main access roads.

The contractor shall provide road surfacing finishing technical proposal for:

* Bituminous surface treatments and surface dressing (road areas)
* Segmented pavings: concrete paving blocks. (areas where turning of trucks will take place – receiving and dispatch areas) Passenger vehicle trafficable areas to be 60mm thick blocks.
* 150 mm thick grade 25 mesh ‘257’ reinforced concrete truck wash bays for 4 No. trucks complete with grease trap and associated drainage works.
  1. **Storm water Drainage**

1. **Status of Existing Drainage System**

The existing car park consists of surface and sub-surface drainage system as shown on drawing No.MWT-01. The current drainage system is inadequate to effectively drain off the storm water from the premises, requiring the need to upgrade the system to the extent that it is practical.

* **Requirements description**

Culverts shall be constructed to adequately size up with existing municipal council open drains. The discharge from the ESFR system shall be designed to be contained on site. Roadside and car park drains shall be constructed in mesh reinforced concrete and be of adequate flow capacity whether open or covered. The existing serviceable drains shall be unblocked, cleaned and where necessary replaced or diverted.

* **Technical Specifications**

The drainage works including loading and discharge requirements for the culverts shall be in compliance with the design parameters set out in SATCC Code of Practice for Design of Roads, Bridges and Culverts.

* 1. **Site works specifications in respect to dangerous goods store**

Requirements description and specifications

1. **Dangerous Goods Store (1 No)**

A flammable goods store constructed from 150mm blockwork, with plaster and paint finish externally and internally, over a 450mm concrete foundation strip, 150mm thick solid block wall foundation, 75mm thick reinforced slab floor complete with double mild steel door and frame with louvres and no windows. Roof to be white chrodamek on steel beams and min 4mm Alucusion insulation. Structure need to be designed with bun walls to contain any spillage of flammable liquids. Electrical installation and light fitting to be fire proof.

All to comply with the Standard Specification for Materials and Workmanship for Building Works for the Government of the Republic of Zambia, Interim Metric Edition.

* 1. **Driver’s waiting area & ablution (optional)**

Requirements description and specifications

* 1. A driver’s restroom constructed from 150mm block work with plaster and paint finish on internal and external walling over a 450 mm concrete foundations strip, 150mm thick solid block wall foundation, 75 mm thick reinforced slab complete with mild steel doors and aluminium window frames with glazed sliding windows and solid timber door leafs, roofed with IBR Chromadek roof sheeting on steel frames including electrical fittings and plumbing fittings as shown on drawing No. MWT-06 All to comply with the Standard Specification for Materials and Workmanship for Building Works for the Government of the Republic of Zambia, Interim Metric Edition
  2. **Demolition Works**

1. **Requirements description**

A number of structures and services require to be demolished removed or re-routed in order to pave way for construction of the new warehouse. These are:

1. Ablution block and associates soil drainage.
2. Storage sheds.
3. Perimeter wall north face: Demolish existing concrete block wall fence including concrete foundation footings and get out from site. Remove existing electric fence from existing wall fence top, preserve and put back on the new walls if constructed.
4. Any other surface and underground services required to be demolished or re-routed.
5. **Demolitions operations**
6. All demolition procedures to comply with structural safety standards for existing buildings and comply with Zambia Environmental Management Authority requirements.
7. During demolishing works, the contractor shall keep the debris constantly watered to minimise dust arising from the demolition operations.
8. The contractor is to erect dust proof screens to the approval of the Project Manager and remove on completion of work to the Project Manager’s satisfaction.
9. All unrequired debris shall be removed from site immediately after demolition.
10. All building rubbles suitable to be re-used as filling shall be stockpiled separately on site for re-use as filling during construction.
11. **Salvage Materials**

All salvageable materials arising from the demolitions, unless specially otherwise stated, shall become the property of the Client. The Client will inform the Contractor at site handover which salvageable materials they will require for handover to them.

1. **Landscaping**

Disturbed area shall be replanted with indigenous trees requiring limited or no watering. Grass planting on disturbed area would be required and all reasonable care to be taken in order to preserve existing trees were possible.

**PART B4 - STRUCTURAL SYSTEM**

**4.1 General**

The structural steel building frame system selected for the warehouse buildings, to comply with all International Building Code required for gravity and lateral loading. The bays have been sized to keep roof framing and columns to reasonable sizes to avoid complicated shipping or erection procedures. Bays have also been sized to work with new shelving units. Column sizes were minimized to maintain clear flue spaces between adjacent rows of shelving. Maximum column sizing in-between racks to be no more than 500 mm wide.

* 1. **Scope of work**

1. Receiving and bulk storage warehouse.
2. New roadways and parking.
3. Dangerous Goods Store

**Applicable to above**

1. Cast-in-situ concrete footings and floor slab on grade (dependent on Geotechnical Report)
2. Cast-in- situ concrete floor slab on grade and elevated loading/off loading docks
3. Structural steel levelling columns (high level) and trusses, on concrete primary columns, for high level warehouse area.
4. Braced frame lateral load resisting system.
5. Cast-in-situ concrete columns and slabs (offices).
   1. **Design Criteria**

**(a) Codes and standards**

Design criteria for structural analysis and design of this building will be based upon the following codes and standards:

1. Ministry of Works and Supply, Buildings Department’s Specification for Building Methods and Product Building Code of 1973
2. BS8110 Structural Use of Concrete- Part 1: Code of Practice for Design and Construction
3. BS5950 Part 8: Structural Use of Steelwork in Buildings
4. SABS 0160 Structural Use of Steel
5. ALSC Load and Resistance Factor Design-Specification for Structural Steel– (LRFD)
6. AISC Hollow Structural Sections, Connections Manual
7. AISC Specification for Structural Joints Using ASTM A325 OR A490 Bolts
8. **Design Live Loads**

|  |  |
| --- | --- |
| Snow load | 0.00kN/m2 |
| Roofs | 1.50 kNm2 |
| Warehouse floor | 8.00 kN/m2 Storage rack loading or Forklift loading |
| Light Storage Areas | 5.99 kN/m2 |
| Heavy Storage Areas | 8.00 kN/m2 |

1. **Lateral loads**

|  |  |
| --- | --- |
| Basic wind speed | 42m/s |
| Exposure C | To be confirmed |
| Importance Factor | 1 = 0.12 |

1. **Seismic loads**

|  |  |
| --- | --- |
| Occupancy Category | II (two) |
| Seismic Importance factor | Le=1.0 |
| Spectral Response Acceleration | Ss=0.28  S1=0.11 |
| Site class | D – Geotech report to confirm |
| Seismic Design Category | C |
| Seismic Force Resisting system | Steel systems not specifically detailed for Seismic Resistance   * Response Modification factor R=3 * System over strength factor Omega=3 * Deflection Amplification CD=3 |
| Analysis Method used | Equivalent lateral force |

**Note: The seismic loadings are for considerations only as they are not common. The Contractor will take full responsibility for the design and structural integrity of the project design, including all local authority approvals and associated costs. The loads data given above is purely a guideline.**

**Rack Floor Loading for High Bay Area**



**Floor Flatness High Bay Area**

The internal high bay warehouse floor is to be constructed to a DM1 for the area where VNA applications will be used.

‘Allowable values of the properties of flatness for free movement areas’ Concrete Society Technical Report No 34 fourth edition for the particular local area with high bay racking.

* 1. **Structural Materials**

1. **Concrete Materials**
2. Cement: Ordinary Portland cement to ZS 001
3. Coarse Aggregate: To BS 882 and 1201 average specific gravity 2.6
4. Water: Potable
5. Additives required:
6. Fly Ash (N/A)
7. Air Entrain (N/A)
8. **Concrete Mixes**
9. Mix A: 30.00 kN/m2 for all floor slabs
10. Mix B: 25.00 kN/m2 for all foundation concrete
11. Air entrain to all exposed concrete to receive 6% +/- 1.5% by volume unless otherwise noted. Do not air entrain concrete to receive a trowel finish.

**(c) Concrete Reinforcement**

Steel Bar Reinforcing: High Tensile Steel Grade 410 to BS 449

**(d) Structural Steel**

1. Wide Flange Shapes: ASTM A992 or BS EN 100 252 S 355 JR
2. Hollow Structural Sections (HSS): ASTM A500, Grade B, Fy = 317.2 kN/m2/ BS equivalent.
3. Other Structural Shapes: ASTM A36 /BS equivalent or regional applicable.
4. High Strength Bolts: ASTM A325/ BS equivalent or regional applicable.
5. Anchor Bolts: ASTM A1554/ BS equivalent or regional applicable.
   1. **Foundation Systems**

Foundation designs to be submitted by the tenderers and should be based on the geotechnical report

* 1. **Foundation Wall Construction**

At edges of the loading dock or other portions of the slab on grade with significant turned-down edges, the walls will be 200mm thick minimum reinforced with Y12 bars at 300mm centres each way and each face (or alternatively as prescribed by each tenderer’s engineer).

**4.7 Slab on Grade**

1. **Slab on Grade**

A cast-in-situ concrete slab on grade system will bear on grade and support shelving units and forklift loading. In the absence of a geotechnical report, a conservative slab thickness and reinforcement have been selected. An analysis of the slab thickness of 200mm thick and reinforcement will be required once the soils sub grade modulus has been determined. Guidance on the design of a floor as stated in the UK Concrete Society’s Technical Report 34 (TR 34) to be complied with as stated below:

Flexi VNA trucks use ACI 302 flatness and levelness with random traffic floor. The VNA could be considered a defined traffic floor because the reach truck takes the same path.

The Ff/FI requirements mitigate the mast sway and the swing reach manufacturer should provide a recommendation for Ff/FI for their equipment and mast height. There is a new rating for VNA applications. F min Longitudinal and Transverse measures levelness for the aisle. Flexi should provide F min number if required. This new technique approved to date by ACI or BS.

Slab on grade designed as flat. Ff50/FI 30 overall for composite of all measured values. Ff 25 / FI 15 minimum for any individual floor section. Slab tested per ASTM 1155 or BS equivalent.

The Contractor will need to use a highway laser screed. (Levelness of the floor, flatness in the finishing operation). DM1, floor specification is required.

1. Place slab directly in damp proof heavy duty polythene sheeting over compacted sub grade laterite fill. Ant poison to be applied under all floors. (tenderer’s will be required to hand in a certificate in this regard)
2. Support reinforcing on approved chairs that will not puncture the polythene sheet.
3. All warehouse floors should have a dust proof smooth finish and have a minimum strength of 30 MPA. Floor flatness of DM1 will apply (UK Concrete Society Technical Report 34 (TR34).

**4.8 Structural Framing**

1. **Floor Construction**

Mezzanines shown in portions of the architectural floor plan will be constructed using reinforced in-situ concrete columns, beams and slabs with a minimum grade 25 Mpa.

1. **Roof Construction**

A drop in cantilever steel wide flange girder system should be selected to minimize girder framing sizes. Wide flange steel beams will frame between steel girders and support 50mm deep long span metal roof deck.

1. **Lateral Bracing Concept**

The roof diaphragm will span horizontally to lateral braced frames in column lines near the corners of the building foot print. Horizontal structural steel diagonal bracing members may be required at the roof diaphragm to adequately span to the perimeter braced frames. Braced frame foundations will be significantly larger than typical footing sizes to resist overturning forces in the frames.

1. **Wall construction**

Appropriate steel channel and angle sections shall be erected at appropriate centres against steel concrete columns to hold insulated 75mm EPS panel vertical.

1. **Fire Proofing**

BS 5950 Part 8 - Code of Practice for Fire Resistance Design for Steelworks.

BS 8110 Part 2 - Code of Practice for Fire Resistance Design for Concrete Works.

BS 476 Parts 1 and 2 - Code of Practice for Fire Resistance Design Masonry Works.

**4.9 Stair Construction**

Internal Staircase Construction reinforced in-situ concrete treads and landings – grade 25 Mpa.

**4.10 Concrete Finishes**

1. **Formed Surfaces**
2. **Rough Form Finish**

As specified in ACI 301 or BS equivalent, with a cast texture

1. Patch tie holes and defects.
2. Remove fins over 6.4mm in height.
3. **Smooth Form Finish**

As specified in ACI 301or BS equivalent with a smooth, uniform texture and an orderly pattern of form mark.

1. Patch tie holes and defects over 6.4mm in least dimension.
2. Completely remove fins
3. **Hand Rubbed Finish**

Smooth Form Finish as specified above with a perfected and rubbed finish. Using suitable cement paste and abrasive stone, hand rub green surface of concrete to obtain smooth finish of uniform colour and texture.

1. **Horizontal Surfaces**

With exceptions of floor as indicated above. Finish to proper elevation so that water flows to drains; do not allow birdbaths to form. Maintain moisture during finishing by water spraying or fogging.

**(e) Steel Trowel Finish**

Steel trowel finish consisting of a floated finish as specified in ACI 301 Section 11.7.2 or BS equivalent then power trowelled, and finally hand trowelled to smooth, uniform texture free of trowel marks. Apply to concrete slabs unless noted otherwise.

1. **Wood Float Finish**

Hand float or power bladed trowel with float shoes after screeding, as specified in ACI 301 or BS equivalent.

1. **Light Broom Finish**

Consist of a floated finish as specified in ACI 301 or BS equivalent hand trowelled to smooth uniform texture free of trowel marks and finish with a light brooming to a uniform scored texture. Orient the grain perpendicular to the direction of pedestrian traffic. Apply to exterior walks and where scheduled.

1. **Slip- resistant Finish**

Non-Slip aggregated placed just prior to first trowelling. Apply to exterior stairs and ramps, at dock slabs and where scheduled.

**4.11** **Sundries**

**(a)** **Bollards**

All doors and access ways are to be protected with steel bollards standing 1000 mm above ground. For additional strength, outside bollard is to be sank into the ground and keyed into position.

**(b)** **Building Column Protection**

All exposed external/ internal canopy columns are to be protected with a concrete or galvanized steel surronding advised by the Structural Engineer.

**(c)** **Truck wheel Guides**:

2 No. Tubular steel truck guide frames per dock measuring 3000 long shall be installed.

**PART B5 - EXTERIOR ENCLOSURE**

**5.1** **Contract Scope of Works**

The works to be executed under this section involves the architecture building enclosure for the new warehouse facility, with a few offices incorporated internally.

* 1. **Scope of Work for the Building Envelope**

1. Exterior Envelope will have the following components:
2. Concrete blocks sidings.
3. Concrete block walls to 1.50 m high with remaining height, cladded with 75mm thick Iso-wall insulation EPS panels, consisting of 0.5mm pre-painted metal facings, filled in with standard density polystyrene insulative filling.
4. Service Entries / Exits
5. Service doors: 44 mm insulated hollow core doors with metal frames.
6. Dock doors: 75 mm nominal insulated, sectional over-head doors.
7. Roofing System

75mm Thick Iso-wall insulation panels consisting of 0.5mm pre-painted metal facings both sides, filled in with standard density polystyrene insulative filling. External sheet metal facing will have IBR profile.

1. Roof Drainage
2. Roof gutters piped to rain water storage tanks.
3. Over-flow drains
   1. **Technical Specifications (Exterior wall system)**
4. **New Warehouse (Receiving Section)**

Concrete block walls (150 mm thick) to 1.50 m high, (including brickforce & damp proof coarse) with remaining height enclosed with insulated 75mm EPS panels, pre-coated Chromadek finish, on both sides as vertical cladding.

* 1. **Doors and Hardware**

**(a) Overhead Sectional Doors**

75mm Insulated sectional, panel door hinged together with low head-room.

1. Door panels: minimum 22-gauge, ASTM A653, A60 or G60 steel sheet, pre-treated and primed for field applied paint finish with foamed-in-place insulating core.
2. Door panel to battery charging room to have permavents.

**(b) Dock Head seals**

Rite Hite, Frommelt, Rain Guard; furnish with steel channel framing, brackets and fasteners for erection on brick veneer cavity wall.

1. Head Seal: Weighted roller seal behind a fabric curtain that provides a positive weather-seal against the roof of the trailer and the tops of the jambs.

* Width: The full width of the trailer plus the jamb seals.
* Projection: 406 mm to 457 mm.

1. Fabric colour: Black
2. **Dock Bumper**

Fabric-reinforced, laminated rubber pads constructed of multiple rubber piles secured together with 19 mm diameter steel rod and minimum, 6.4 mm thick binder angles with predrilled holes at each end.

1. Size: as indicated.
2. Metal finish: Hot dip galvanized.
3. Acceptable Manufacturers.

* Blue Giant Equipment Corporation.
* Durable Mat Company.
* Kelley Company, Inc.
  1. **Roofing**

1. 75mm thick Iso-wall insulation panels consisting of 0.5mm pre-painted metal facings both sides, filled in with standard density polystyrene insulated filling. External sheet metal facing will have IBR profile.
2. Prefabricated flashings, gutters, downspouts and strip flashing by roofing manufacturer.
3. Fasteners, lap and water-cut-off-sealants, retainer bars and accessories by manufacturer
4. Regulatory Requirements
5. Wind uplift Resistance: FM Class 90 or BS equivalent.

**5.6 Exterior Finish Materials**

**(a)** **Masonry Materials**

1. Concrete Masonry Units (CMU): 200mm and 150mm thick hollow concrete blocks 3.5KN/mm minimum crushing strength, normal weight, plant cured concrete blocks, uniform in colour and texture and free of chips, cracks and imperfections. Mortar: Portland structural cement (Proportion Specification cement and sand 1:4)

**(b) Exterior Painting**

1. To the extent practicable, materials with an exterior exposure will be pre-finished by the manufacturer.
2. Paint System Dulux or Plascon: Semi-gloss, finish for hollow metal service doors and fames. Colour as selected by the Project Manager from the manufacture’s full range of available colour.
3. Paint System Dulux or Plascon: high-performance, opaque urethane finish for structural steel with exterior exposure.

**(c) Plaster**

One coat - Portland cement plaster built-up to total thickness of 15 mm with a fine-sand, wood float-texture over concrete masonry units. Plaster mix materials, and accessories shall be according to Standard Specification for Materials of the Republic of Zambia, Interim Metric Edition (All exposed blockwork to be plastered).

Materials Mix

Cement:

1. Portland cement
2. Aggregate: Well grade natural sand, clean, sharp and suitable of plastering.
3. Water: potable and free of substances that could damage plaster, lath or accessories

.

**(d) Vehicle guides**

* 1. Provide standard steel vehicle wheel guides to dock bays and 100 mm x 5 mm thick edging to exposed sides of concrete floor slab.

**5.7**  **Exterior Construction Materials**

1. **Masonry Accessories**
2. Wire Reinforcing: SABS galvanized plates and wire assemblies Furnish with fasteners and tiles.
3. Structural Core Fill: may be either of the following, unless the structural drawings expressly indicate otherwise.

* Grade 15, low slump concrete with maximum 5 mm course aggregate.
* ASTM C476 or BS equivalent, fine aggregate grout.

1. Through Wall (Membrane) Flashing (MF-1) 1 mm, nominal, self-adhesive, rubberized asphalt sheeting, nominal 1.5 mm thickness. Acceptable Products: W.R. Grace, Perm barrier.
2. Stainless steel drip flashings
3. Joint Fillers
4. Compressible Joint Filler: ASTM D1056, Type 2, Class A, Grade 1, or BS equivalent Strips of Pre moulded compressible sponge rubber.

* Compressible to at least 35 percent.
* Compatible with joint sealant material specified under elastomeric section.

1. **Elastomeric Sealants**

Select materials for compatibility with joint surface and indicated exposures. Furnish with primers, joint fillers, backer-rods, and other accessories recommended by manufacturer for each condition.

1. Sealant Type 13: Self levelling, two-component, polyurethane sealant for joints subject to foot traffic, meeting Fed. Spec TT-S-00227E, Type 1, class A, with a minimum Shore A hardness of 30 and plus-and-minus 25 percent movement capabilities or BS equivalent.
2. Sealant Type 21: medium modulus silicone, single component, neutral cure sealant for exterior joints meeting Fed. Spec. TT-S-001543, Class A with Plus-and-minus 50-percent movement capabilities or BS equivalent.
3. Sealant Type 24: high-modulus silicone, single component non-acid-curing sealant for joint in structural glazing or BS equivalent.

**(c)** **Glazing Accessories**

Select sealant, tapes, gaskets and other glazing materials that have certified compatibility with the materials they will contact, including glass, insulating glass unit seal, glass coating, and frame materials.

1. Setting Blocks: neoprene, 80 to 90 shore “A” durometer hardness, chemically compatible with glazing sealant or compound, length as recommended by glass manufacturer.
2. Spacers and Shims: neoprene, 40 to 50 shore “A” durometer hardness, chemically compatible with glazing sealant or compound, length as recommended by glass manufacturer.
3. Glazing Tape: butyl or silicone pre-shimmed tape similar to Tremco 440 Tape.
4. Glazing compounds and Gasket for exterior exposure shall be products having a minimum life expectancy of 20 years.

**PART B6 - INTERIOR CONSTRUCTION NEW WAREHOUSES**

**6.1 Interior Wall Partition Type**

1. **Concrete Masonry Unit Wall and Partitions**
2. 150 mm and 200 mm thick hollow concrete blocks

3.50 KN/mm minimum crushing strength, nominal, normal weight, concrete masonry units (CMU).

* Use jamb-blocks at door and borrowed-light openings.
* Use prefabricated lintel and bond-beam blocks.
* Use solid-top block as the last (topmost) course.

1. Reinforce assembly with mesh and ties were necessary at every third course.
2. Waterproof membrane to be installed under walls on floor level
   1. **Interior Door and Frames**
3. **Steel Door Frames –** Furnish in configuration for single doors with or without transom panels or sidelights as scheduled.
4. Unitary frames: one-piece with casing faces welded and ground smooth. Stops shall have hairline-tight butt joints.
5. Fully welded frames; one-piece with casing faces, rebates and stops welded from behind and ground smooth.
6. Fabrication

* Base metal: Cold-rolled, steel sheet, 16-gauge, minimum.
* Sizes: as schedule by manufacturer with AAAMSA compliance.
* Finish: Prime painted for scheduled paint finish.
* Locations: Use Unitary Frames throughout the work unless fully welded frames are expressly indicated.
* Use fully welded frames.

1. **Flush wood particle board doors:** Solid particle board, 22mm, flush doors SANS standards. (To internal ablution partitions).
2. **Flush doors** - to the demountable partitions shall be in accordance with AAAMSA or Pelican standards to the approval of the Project Manager (floor to ceiling height including ironmongery associated with partition systems).
   1. **Interior Finish Materials**.
3. **Concrete Sealer**
4. Type 1 (SL-1): L & M Chemical or equal approved Seal Hard or equal approved penetrating silane, sealer/hardener.
5. Type 2 (SL-2): L & M Construction Chemicals, Fluohard or equal approved fluo-silicates sealer dust-proofer.

**(b)** **Glass**

1. Clear glass as per safety standards.
2. Mirror Glass (GL-91): ASTM C1036, Type I, Class 1 Quality q2, 17 mm thick glass mirror or SABS equivalent with polished bevelled edges; furnish with brushed stainless steel mirror clips with concealed fasteners (above all wash hand basins).
3. Obscure glass for all ablutions.

**(c)** **Acoustic Panel Lay-in Ceilings**

1. Ceiling Suspension Grids: fire rated, double web, exposed tee-grid, fabricated from cold rolled hot-dip galvanized steel.

* Colour: manufacturer’s standard low lustre, white, factory applied.
* Acceptable Products.
* With 14 mm wide cap: USG Interiors, Centricities
* Duty rating: ASTM C635 or BS equivalent intermediate duty.

1. Ceiling Panel Type 1 (ACT-1) use with 14 mm grid and shadow-line moulding.

* Panels: 610 mm x 610 mm – by 19 mm thick panel with reveal edges.
* Colour white
* Acceptable Product: USG Frost

**(d) Painting**

1. Painting Systems for Concrete

* Paint Systems Dulux or Plascon: flat, 100-percent acrylic –resin Latex finish.
* Surface Preparation
* Primer: 1 coat concrete primer
* Finish: 2 coats, minimum, Dulux or Plascon, Speed hide Ultra Interior Flat Latex, finish.
* Paint System Dulux or Plascon: semi-gloss, 100 percent acrylic-resin latex finish.
* Surface Preparation
* Primer: 1 coat concrete primer
* Finish: 2 coats, minimum PPG, 6-500 Series, and Speed hide Interior Latex Enamel finish.

1. Painting Systems for CMU Walls and partitions

* Paint System Dulux or Plascon: Semi-gloss, 100-percent acrylic-resin latex finish.
* Surface Preparation
* Base 1 coat block filler applied to achieve a smooth surface
* Primer 1 coat concrete primer.
* Finish 2 oats, minimum, PPG, 6-500 Series, Speed hide Interior Latex Enamel finish

.

1. Painting Systems for Steel, Interior Exposure

* Paint Systems Dulux or Plascon: semi-gloss, alkyd finish
* Surface preparation.
* Primer - Where finished factory primed, touch-up shop coat at bare metal: 1 coat, interior metal primer.
* Finish: 2 costs, minimum, Dulux Plascon, Speed hide interior Enamel, Semi-Gloss.

**(e)** **Signage**

To provide to all areas where required by building regulation and necessary directional signage to all compact maized areas.

* 1. **Custom Fabrication**

**(a)** Pre-Engineered steel sectioned fire escape staircase. Fire escape staircases manufacturer shall engineer stairs and rails to meet structural and usage requirements.

* 1. **Interior Construction Materials, Concealed**

**(a) Interior Concrete**: Concrete Topping Mix: 2403 kg/m3 standard weight concrete with minimum, 28 day compressive strength of 3000 psi and maximum course aggregate size of 19mm. (30Mpa minimum)

1. Use for stair tread and landing pan fills.

* Use for core-fill in reinforced CMU construction.
* Concrete Mix Equipment Curbs, Pads, and Bases: 2403 kg/m3 standard weight concrete with minimum, 28 day compressive strength of 246kh/cm2 and maximum course aggregate size of 19 mm.

**(b)** **Thin-section Slab Topping:** To build-up slopes to drain, shall be a cementations mixture, designed to be installed to a featheredge from a maximum thickness of 2.54 cm. Product shall be a Portland cement based, factory blended dry mix requiring only adding water at point of use. Furnish with primer.

**(c)** **Masonry**

1. Units (CMU): ASTM C90,or BS equivalent normal weight blocks, uniform in colour and texture and free of chips, cracks and imperfections that would adversely affect appearance of finished work. Where needed, furnish with special face shell thickness required for fire rating.
2. Mortar: 1:3

**(d) Elastomeric Sealants**

Select sealants for compatibility with joint surfaces and exposures indicated.

1. Select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.
2. Colours: as indicated, if not indicated, match adjacent material or paint colour.
3. Movement Joint Sealant: Single-component, polyurethane sealant, meeting Fed. Spec TT-S-00230C, Type II Class A, or BS equivalent with minimum plus-and-minus 25 percent movement capabilities.

* Location: Use for interior joints NOT subject to movement.
* Colour: Custom colours to be determined.

1. Paintable Sealant: general purpose, paintable acrylic- emulsion sealant meeting ASTM C834 or BS equivalent with plus-and-minus 7.5-percent movement capability.

* Location: Use for interior joints NOT subject to movements.

1. Sanitary Sealant: White, mildrew resistant silicone sealant with integral fungicide meeting Fed. Spec. TT-S-001543, Class A or BS equivalent. Formulation shall be specifically recommended by the manufacturer for interior joints in wet areas around plumbing fixtures and in ceramic tile.

* Location: Use for joints in ceramic tile, around equipment, and around plumbing fixtures.

1. Acoustic Sealant: non-skinning, non-drying, non-staining sealant especially designed for concealed use in joints and construction gaps in walls and partitions with an STC rating.

**(e)** **Glazing Accessories**: Select sealants, tapes, gaskets and other glazing materials that have certified compatibility with the materials they contact, including glass, insulating glass unit’s seals, glass coatings, and frame materials.

1. Setting Blocks: Neoprene, 80 to 90 shore “A” durometer hardness, chemically compatible with glazing sealant or compound, length as recommended by glass manufacturer.
2. Spacers and shims: neoprene, 40 to 50 shore “A” durometer hardness, chemically compatible with glazing sealant or compound, length as recommended by glass manufacturer.
3. Glazing Tape: Butyl or silicone pre-shimmed tape similar to Tremco 440 Tape
4. Glazing Compounds and Gaskets for exterior exposure shall be products having a minimum life expectancy of 20 years.

**(f)** **Fire stopping**: Use methods and materials that will, for at least the time period schedule, prevent the spread of fire, and the passage of hot and cold gasses and smoke through penetrations or reductions in the effective thickness of time-rated assemblies. Systems shall be tested and labelled by an independent testing laboratory acceptable to the authorities having jurisdiction. Conditions indicated will include at least the following.

1. Openings for the passage of pipes, ducts, and electrical busways, raceways, and cables through fire-rated vertical and horizontal barrier assemblies.
2. Joint between walls and roofs or floors.
3. Joints between structurally separate sections of walls or floors.
4. Slab edges at perimeter walls.

**6.6 Quality Assurance**

**(a) Submittals**

1. Product Data for the following:

* Each type of concrete
* Masonry reinforcing concrete materials
* Each type of insulation.
* Roofing
* Doors and hardware items
* Each type of glass

1. Shop Drawings for the following:

* Engineered structural steel framing
* Glass curtain walling
* Sheet metal flashing.

1. Record Samples for the following:

* Each type of CMU
* Each type of insulation glass unit
* Each exposed aluminium sheet metal and extraction finish
* Steel face sheet
* Steel back pan

1. Warranties as follows:

* 5-year water-tightness warranty on installed roofing
* 15-year full system warranty from roofing manufacturer
* 1-year glass breakage warranty
* 5-year Seal warranty on insulating glass unit

**6.7 Testing**

1. **Preconstruction Testing**: Submit certified copies of test reports. If testing is more than 6-months old submit certification that products delivered will be identical in performance to tested products.
2. Mortar Tests: Test mortars for conformance to BS requirements for the indicated mortar Types.
3. Concrete Masonry Units: Test each type of concrete masonry unit indicated, for strength, absorption and moisture content using ASTM C140.
4. Windows

* For structural performance use ASTM E 330 or AAAMSA equivalent.
* For water resistance test use ASTM E 331 or AAAMSA equivalent.
* For Air infiltration testing use ASTM E 29 or AAAMSA equivalent.
* For condensation resistance factor use AAMA 1503.1 or AAAMSA equivalent.

1. **Field Testing: Submit certified copies of test reports.**
2. Masonry Test: Test prisms made with delivered materials using ASTM E447, method or BS equivalent.
3. Windows: Conduct at least two ASTM E 29 air leakage tests of installed windows including perimeter caulking. The Project Manager to select test sites. Conduct an additional test for each failed test at site selected by the Project Manager.

**PART B7 - EQUIPMENT AND SPECIALTIES**

**7.1 Overview**

1. **General:** This Part of the Narrative summarizes the investigations and design decisions made to date regarding equipment and specialty items. The purpose of the fixtures, furnishings and equipment is to fit out the facilities with systems for the movement of goods and people between levels, and to permit the occupancy and use of the fully finished spaces.
2. **Scope of Work for Equipment and Specialties**
3. Equipment
   * + - Dock equipment

* Dock-edge, air powered swing lip dock leveller
* Dock-trailer head seal
* Dock bumper

Pallet racks and narrow aisle trucks to be specified and provided under another contract.

1. Specialties

* Fire Extinguisher Cabinets
* Building and Toilet Accessories.

**7.2 Quality assurance**

**(a) Submittals**

1. Product Data for the following:

Dock-edge leveller

Dock-trailer head seal

1. Shop Drawings, including wiring diagrams for the following.

Dock Equipment

1. Operation and Maintenance Manuals for the following.

Dock Equipment

1. Record Documents for the following:
2. Dock Equipment

**(b) Warranty and Acceptance Provisions**

(i) General

(ii) The installers, for each of the following, will provide training for and demonstrations of the manufacturer’s required maintenance and adjustment procedures to User’s personnel.

* Dock Equipment

(iii) Schedule the training / demonstrations for a mutually agreed time near substantial Completion,

(iv) Demonstrate the manufacturer’s recommended procedures for adjusting the system and for replacing parts scheduled as User replaceable.

(v) Provide copies of training materials, including videos, documenting course content, or arrange to have the training recorded. Leave at least two reproducible sets of materials with the User.

(vi) Provide a list of parts the manufacturer recommends be in User’s stock.

**7.3 Equipment**

1. **Technical Specifications Dock Levellers**

Model APL 610 SX

Type Air Powered Swing Lip Dock Leveller

Capacity 15 000kg

Deck Length 2 845mm

Deck Width 1 830mm

Depth 500mm Rear & 500mm Front

Lip 16mm Link plate

Lip Length 400mm

Working Range 350mm Above

300mm Below

Bumpers 1 Set Laminated Bumpers

Operation Dual Airbag Activation

Includes Safety legs

Safety Toe Guards

Maintenance Strut

Electrics 220V with 25A breaker supplied by contractors

Warranty 10 Years Structural

5 Years on Lifting Mechanism

1 Year Remaining Parts

1. **Dock Head Seals:** Rite Hite, Frommelt, Rain Guard furnish with steel channel framing, brackets and fasteners for erection on block work cavity wall.
2. Head Seal: Weighted roller seal behind a fabric curtain that provides a positive weather-seal against the roof of the trailer and the tops of the jambs.

* Width: The full width of the trailer plus the jamb seals
* Projection: 406 mm to 457 mm

1. Fabric colour: Black
2. **Dock Bumper:** Fabric-reinforced, laminated rubber pads constructed of multiple rubber plies secured together with 19 mm diameter steel rod and minimum, 6.4 mm thick binder angles with predrilled holes at each end.
3. Sizes: as indicated
4. Metal finish: Hot dip galvanized
5. Acceptable manufacturers:

* Blue Giant Equipment Corporation
* Durable Mat Company
* Kelley Company, Inc.

**(d) Fire Protection Specialities**

(i) Fire Extinguisher Cabinet (FE-1): steel unit constructed with rolled edges for semi-recessed installation. Steel tub shall have inside dimensions of 267 mm wide by 601 mm high by 152 mm deep with welded joints grind smooth.

* Use rated tub construction where applicable.
* Trim type: Radiused
* Door: solid door with break glass insert and key lock.
* Acceptable Product: J.L. Industries: Ambassador Model 1015B20.

(ii) Fire Extinguisher Bracket (FE-2): Wall mounted bracket sized for each extinguisher. Manufacturer’s standard bracket with strap to secure fire extinguisher.

* Provide bracket at each mechanical and electrical room.
* Acceptable product: J.L. Industries: Model MB846, for ABC Dry Chemical

(iii) Fire Extinguishers: Provide hand held fire extinguishers as per approved fir plan/design

**(e) Building and toilet accessories**

Will be commercial quality units fabricated from Type 304 stainless steel with brushed (satin) finish.

Acceptable manufacturers of Regional equivalent

* Franke
* Kimberley-Clarke Professional
* Bidvest Steiner
* TCS Hygiene Products & Services
* Toilet Paper Holders: Franke no CHRX 672
* Combination paper towel dispenser/waste receptacle: Franke no. RODX 602
* Liquid soap dispenser: Franke no. RODX 619
* Touch-free electric hand dryer: Frank no. RODX 310
* Grab bars (paraplegic toilet): Frank no. CNTX 300, CNTX 700A; CNTX 70B
* Mirrors without shelves
* Coat hook: Franke no. STRX 692

**PART B8 - PLUMBING SYSTEMS**

* 1. **Plumbing codes and standards**

1. International Building Code
2. British Standard BS 6700
3. Leadership in Effective Energy Design (LEED) principles
4. Relevant Local Regulations
   1. **Building service piping**
5. **Domestic Water**

The system comprises of domestic water storage tanks (2x10 000L), pressure pump and bladder vessel for cold water supply, and equivalent equipment necessary for acceptable operation and maintenance of the plumbing fixtures which includes taps, cocks, valves, etc. Water would be sourced from the existing water supply piping and borehole into the newly adequately sized tanks for use in the offices and ablution block. Domestic water tanks are to be strategically positioned on the site for ease of distribution into the building. All domestic taps to be supplied from borehole water tanks, but all toilets, urinals, garden taps and vehicle washing taps to be supplied from rain water storage tanks to two pipe system. Rainwater storage system also to be supplied with pressure pump, bladder vessel, solids filter and ancillary equipment to render it operational. Rainwater tanks to be supplied with a backup municipal water connection & float valve to replenish water supply when no rainwater is available.

Weather sensitive equipment to be housed in a basic pump room structure with roof, which is lockable.

1. **Rain Water Usage**
2. Supply and install 10 No. x 10000 liters’ storage water tanks including electric pump and pressure vessel on concrete plinth. Rainwater tanks to be linked with bore hole domestic line, with ball valve installed. (once water levels in the tanks drops below 20% capacity, borehole water to top-up to 30%).
3. an Emergency backup water supply line to be installed from domestic supply to be linked to grey water supply lines in case of dysfunctional rain water supply system.
4. All external taps for watering garden and washing of vehicles to be connected to rain water supplies and each tap outlet clearly marked “NOT FOR HUMAN CONSUMPTION”
5. Weather sensitive equipment to be housed in a basic pump room structure with roof, which is lockable.
6. **Plumbing Fixtures**

All plumbing fixtures would be of standard quality with features of:

1. Durability
2. Water saving in line with LEED, for instance, water closet with 6 liters to 6.5 liters’ flush cisterns, aerators for minimal usage of water on taps, press demand taps, electronically operated taps, electronic flushing urinals, emergency shower and wash hand basin outside the battery charging room.
3. **Manufacturers for basis of design are:**
4. Cobra Standard fixtures
5. Cobra Electronic Faucets (Fixtures)
6. **Sanitary Waste and Vent System**

A complete sanitary drainage and vent system to be provided in accordance with SABS 1200 and SABS 0400. Sanitary drainage and vent system would consist of a network of piping connected to fixtures, drains, and equipment that drains by gravity to the site sanitary sewer. The sanitary drainage and vent system would be sized using the drainage fixture unit method. Sanitary waste pipes would have minimum slopes of 1:60 and 1:100 in 40mm diameter and 100mm diameter waste pipes, respectively. Vent pipes and vent valves shall be considered for every zone of waste pipes. Floor drains would be provided in all rest rooms and emergency shower. Inspection bends in waste pipes and inspection chambers in the sewer system shall be included in the installations for ease of maintenance.

1. **Storm Water System**

A storm water system would be provided and designed to accommodate a rainfall rate as required by Code and geographic area. The building storm water drainage system would consist of gutters. The gutters would be drained by exterior rain down pipes, channeled to rain water storage tanks. Tank overflow water to be channeled to site attenuation pond and municipal storm water system.

**PART B9 - ELECTRICAL SYSTEMS**

|  |  |  |
| --- | --- | --- |
|  |  |  |

**9.1 Contract scope of work**

The electrical specification relates to the supply, installation, testing and commissioning of the electrical engineering services that will be included in the design for Medical Stores Warehouses. The purpose of the Electrical design is to provide power, energy efficient lighting, fire alarm/smoke detection, telecommunication, data and security systems for buildings Electrical Services for internal and external services.

* + 1. **Normal Services and Standby Supply**

The normal service for the New Warehouse shall be on Solar Supply and the Utility Supply (ZESCO) shall be to supply any shortfall electricity demand. The existing Generator Supply shall be connected to provide emergency electrical supply to operate items such as domestic water pump and fire equipment, chillers and any other.

Solar Mains Supply shall consist of Photovoltaic Solar Panels on the Roofs of the Warehouses (separate tender). The Solar Power Supply shall be connected through the Battery Packs (Separate tender), Invertors for converting DC (Direct Current) Supply to sinusoidal AC (Alternating Current) Supply and Charge Controllers. The Solar Power Supply and ZESCO Utility supply shall be connected to an emergency Automatic Transfer Switch at 380/220 Volts supply at the main Switchboard. The coordinated application of the Transfer Switch shall switch mains solar to Utility Zesco Supply in case of a problem with the Solar Supply source and should be connected in such a way as to take up all the load on the facility. The Transfer Switch will be electrically operated, mechanically held, continuous rated, four (4) pole, double throw, front accessible, in NEMA 1 enclosure. Additional features shall include

* Voltage Dip time delay
* Normal to Emergency and emergency to normal time delays.
* Load Dump Control on equipment branches
* Phase Failure (In Phase) Monitor
* Panel mounted pilot lights and auxiliary contacts for remote pilot light status panel.

**Note: The complete PV installation of possible battery installation will be dealt with through a separate tender process. The facilities electrical system should be compatible for the PV installation and battery system to link/connect into.**

**Storage of solar batteries have been allowed for in the battery charging bay used by forklift trucks**

* + 1. **Main Earthing of Supply**

The Ground conductive raceways and enclosures for enclosures shall comply with the National Electrical Code (USA), IEE Regulations, IEC and form a continuous and permanent grounding system connected to the Ground. The Service Earthing shall be connected to the Earth electrodes and to the buildings steel columns for the new Warehouses and Offices Buildings.

* 1. **Scope of works**

The electrical works will cover supply, installation, testing and commissioning of electrical engineering services for the new buildings, efficient lighting, alterations on the Low Tension Main Panel, reconfiguring the Low Tension Panel to operate in such a way that the Mains will be solar, Utility Supply to supply power to equipment that has high in-rust starting currents only and connection re- configuration of the Standby Diesel Generator to supply power to specified units. Electrical engineering services should include:

1. Electricity supply for lighting, Computers, Data Equipment, Fire Alarm and CCTV,
2. Co-ordinate with Local Electricity Utility/Authority for Fire Pump and any other high in-rush current electrical loads.
3. Meter & LT (Low Tension) panel with arc-guard protection so suit modern safety trends.
4. Distribution Boards, cables including cable trenching, cable trays and routes.
5. Internal lighting that will all be energy efficient low consumption fittings.
6. Power installation for general purpose including skirting and under-floor tubing system.
7. Power installation (supply only) related to other building services HVAC, water supply, and external lighting installation that will all be LED suit modern trends.
8. Earthing System.
9. Lightning Protection System that will be early streamer emission technology to replace the conventional faraday cage.
10. LOTO (Lock-Out and Tag Out) System for enhanced HSEQ modern trends
11. Illuminated signage for HSEQ Standards
    1. **Low voltage distribution boards**
12. **General**

The scope of this specification covers the supply of indoor/outdoor metal enclosed compartmented switchgear for rated maximum voltage 500V, rated symmetrical braking capacity, rated current and degree of protection.

1. **Low tension panel, energy meter & distribution boards**

The non-essential and essential switch board shall be front access, wall mounted. Incoming standby cable(s) shall enter the panel from below.

Cable exits shall be from above and below as appropriate. The distribution panels shall comprise the following:

1. Supply from local Solar Installation and local Electricity Supply Utility (ZESCO), to new buildings and the existing warehouse.

It is a requirement that space be allowed for the accommodation of the statutory undertaking’s metering equipment in the panel.

All cables shall be effectively bonded by means of separate copper earth conductors to the items of equipment to which they are connected. The earth conductor shall be connected to the cable sheath by means of a suitable clamp securely and effectively bonded to the cable sheath or armoring and to the main earth bar as later described.

The gland plates for PVC/PVC/SWA/PVC cables shall be arranged and located to give good access to the cable termination and to the connections to the bus bar after installation and connection of all cables. The gland plates for single core armored cables shall be of non-magnetic materials.

**9.4 General design – construction**

Construction to BS 5486 or equivalent. IP 65 Enclosure suitable for external mounting exposed to external environment and IP 54 Enclosures suitable for internal mounting.

The termination of conductors shall be by sweated cable lugs.

The Distribution Board shall comply with BS 159 or equivalent and the terminations to BS 91 or equivalent.

Delivered to site already assembled the results obtained from testing in accordance with BS 5486 or equivalent are still applicable.

Incorporate miniature circuit breakers and surge protection to the current BS and IEC standards or equivalent as applicable.

Fitted with circuit breakers and surge arrestors of the required rating and short circuit capacity; all to be detailed on the drawings in the detailed design.

Constructed such that gland plates can be removed and drilled to facilitate the connection of PVC/PVC/SWA/PVC cables.

The current rating, number of poles and breaking arrangement are indicated on the detailed LT panel drawing.

Be delivered to site complete with labeling to indicate the function, current rating and phase arrangement of each item of equipment. Labels shall also be supplied and installed to indicate equipment mounted behind access doors and to describe the sequence of isolating the changeover contactors to be described on the drawings when the designs are done.

Each switchgear cubicle shall be completely assembled in the works and dispatched in minimum number of component parts to ensure that erection on site shall be as quick and easy as possible.

1. **Busbar system**

The horizontal bus-bars shall be of rectangular copper conductors and be placed in a safe position in a separate compartment at the top of the cubicles. The vertical bus-bars shall be of copper section and well screened off. Apparatus groups shall easily be connected to the bus-bars, anywhere throughout the entire height of the cubicle. At delivery, the bus-bars shall already be installed in the cubicles. The horizontal bus-bar shall be provided with jointing pieces to facilitate connection to those in adjacent cubicles.

1. **Ventilation**

Each operating unit shall be ventilated separately via an opening between panels and frame.

1. **Interlocks**

All mechanical interlocks shall be of the preventive type and shall be arranged to prevent mal operation as close as possible to the point at interlocks by distortion of linkages. Electrical interlocks shall also function so as to prevent the closing of the circuit breaker before the interlocking demands are fulfilled. Mechanical interlocks shall be provided which are designed to prevent:

A closed circuit breaker from being withdrawn or inserted into the isolating contacts.

Tripping by attempted isolation.

The closing of a circuit breaker except when correctly located in connected or test positions.

1. **Personnel safety**

The front doors of each cubicle shall be fully personnel safe and full scale arcing test of the complete cubicle shall have been performed. LOTO (Lock-Out and Tag-Out) facilities so suit HSEQ practices.

1. **Secondary wiring**

The secondary wiring on all equipment shall be with PVC insulated wires and protected from mechanical damage and other hazards.

All wiring shall be installed in a neat and systematic manner. Each connection shall be terminated on a terminal board mounted in a readily accessible position.

**9.5 Distribution boards**

1. **General**

The Distribution board shall be constructed from mild sheet steel and include the number of ways to be indicated on the drawings, and be adequately secured to prevent tampering by unauthorized staff.

Distribution boards shall incorporate single pole and triple pole miniature circuit breakers, isolators and bus bars together with all internal wiring and connections, and shall be flush or surface mounted as shown on the drawings.

The main protecting CB shall be mounted with bus-bars in a separate section of the board segregated from the MCB’s by the steel partition.

All circuit breakers on distribution boards must be numbered with suitably engraved printed plastic or Ivorian plates indicating the number of circuits controlled. A legend card covered by a removable glass or 1.5 mm “PERSPEX” label shall be installed in the inside of the door of the distribution boards and these circuits shall be designated in detail on this card. The terms “LIGHT” , “PLUGS”, “WATER HEATER”, ETC. , are not acceptable. All equipment is to be individually labeled, indicating function. Engraved plates shall be fixed on panel by means of screws or channeling. Glued on plates and embossed plastic tape labels are not acceptable.

Self-tapping screws are not acceptable for any form of fixing.

Earthing of the sub-circuit wiring shall be by means of an earth bar fitted and bonded to the inside of the distribution board and of a sufficient number of ways and sizes to permit individual earthing connections for each outgoing circuit, each connection being provided with two pinching screws for the clamping of earth wires to ensure continuous earthing. These earth conductors shall be the same size as the conductors of the respective supply and sub-main cables and shall be connected to the earth connection points on each distribution board by means of cable sockets and bolts welded to the lower surface of the board by the manufacturer.

1. **Drawings and approval**

Drawings showing the layout and physical sizes of the distribution boards and meter boxes shall be submitted to the Electrical Engineer for written approval before being manufactured.

All electrical components shall be of same manufacture - All parts shall be interchangeable wherever possible.

The manufacturer’s switchgear, fabrication, builders work and installation drawings shall show, all significant details of each switchboard including:

* Equipment incorporated in the switchboard
* Circuit-breaker and switch ratings.
* Position of switches, and details of function.

All internal connections, with markings. (Note that circuit diagrams shall show all switches, relays, contactors, etc. in the open or de-energized conditions).

* Arrangement of terminal boards.
* All plug contacts.
* Wire numbers.
* Size, type and colour of secondary wiring.

Principal physical dimensions, including clearances required for removing covers, operating handles, withdrawing equipment, or gaining admission for maintenance.

* Identification of all panel fascia equipment, including dimensions of all projecting apparatus.
* Position of all equipment, with reference, and the appropriate label inscriptions.
* Cable entry details including gland plate provisions.

1. **Standards**

Each switchboard shall conform to the requirements of BS 5486 except where more onerous conditions are specified herein in which case the Specification shall prevail.

Each board shall provide a degree of protection against contact with live or moving parts, and against the entry of solid foreign bodies and liquid, to the IP standard specified in the schedules in accordance with the definitions contained in BS 5420 and BS 5490.

Cable terminations and space for terminations shall be suitable for the sizes of cable called for in the design and shall not be limited to mere compliance with BS 5486.

Circuit breakers in boards shall comply with BS 4752 : Part 1.

Miniature circuit breaker boards shall comply with BS 5486 : Part 12.

Disconnections and switch-disconnections shall be to BS 5419 and shall be of ratings suitable for the equipment served and with fault capacities compatible with the remainder of the equipment on the switchboard.

The British Standards applicable to this section of the Specification include, but are not restricted to the following:

BS 88 Cartridge fuses for voltages up to and including 1000 V a.c. and 1500 V d.c.

BS 142 Electrical protection relays

BS 159 Bus-bars and bus-bar connections

BS 3871 Specification for miniature and molded case circuit-breakers

BS 4099 Colors of indicator lights, push buttons, annunciators and digital readouts

BS 4727 Glossary of electro-technical, power telecommunication, electronics, lighting and color terms.

Part 2 Group 06 : Switchgear and control gear terminology (including fuse terminology)

BS 4752 Specification for switchgear and control gear for voltages up to and including 1000 V.a.c. and 1200 V d.c.

BS 5419 Specified for air-break switches, air-break disconnections, air-break switch disconnections and fuse-combination units for voltages up to and including1000 V .a.c. and 1200 V d.c.

BS 5240 Specification for degrees of protection of enclosures of switchgear and control gear for voltages up to and including 1000 V .a.c. and 1200 V.d.c.

BS 5490 Specification for classification of degrees of protection provided by enclosures.

BS 5992 Electrical relays. BS 6121 Mechanical cable glands.

BS 6231 Specification for PVC-insulated cables for switchgear and control gear wiring.

CP 1013 Earthing.

1. **Type tests**

Low voltage switchgear assemblies shall be certified by an approved Testing Authority as having passed short circuit testing in accordance with IEC 439 or BS 5486. Details of testing procedures not covered in the above Specifications shall be submitted by the Sub-Contractor.

The board shall be so designed and constructed that it will withstand for the specified time period without damage, the thermal and mechanical and stresses which might rise under short circuit conditions up to the prospective bus bar short circuit current given in the schedules.

No switch or breaker in boards will be accepted unless it has type test certification to the requirements of the relevant British Standard, IEC Standards or NEC (USA) from an independent testing authority.

A high voltage pressure test shall be carried out with all isolators closed and power fuses fitted, but having all control circuits disconnected. The panels shall withstand for one minute a pressure of 2 kV across the following points.

* Phase to phase
* Phase to neutral
* Phase to earth
* Neutral to earth

An insulation resistance test shall be made immediately following the pressure test and using a 500V testing instrument. This test shall be made with all isolators closed and power fuses fitted by having all electronic components, time switches, and control equipment likely to suffer damage under test, removed. An insulation resistance of not less than 20 mega ohms shall be obtained between each of the following points.

* Phase to phase
* Phase to neutral
* Phase to earth
* Neutral to earth

Works tests on bus bars in accordance with the requirements for routine tests to Section 6 of BS 159 shall be included.

Work test on air circuit-breakers in accordance with the requirements for routine tests to Section 8 of BS 4752 : Part 1 shall be included.

1. **Electrical characteristics**

All of the switchgear described herein shall be suitable for connection to a 400/230V, 3 phase, 50 Hz, 4-wire supply system or as indicated on the drawings.

All disconnectors, switch-disconnectors and circuit-breakers shall be provided with the means to enable them to be locked in the ‘off’ position. When used as earthing switches they shall be capable of being locked ‘on’ when closed to the earth connection.

Four-pole air insulated bus-bars of uniform cross-section throughout their length, with a continuous current rating not less than that indicated in the schedules and/or drawings shall be arranged horizontally and vertically through each switchboard. Current ratings shall take account of reduction in section caused by drilling for connections and supports.

The bus-bars and the connections from them to the various items of switchgear shall be manufactured from tin plated hard drawn high conductivity copper, and whole bus-bar assembly shall comply with BS 159.

Bus-bars shall be supported on non-hygroscopic, non-tracking insulators sufficient to withstand, without damage, the forces set up, either by thermal effects during normal operation or by electromagnetic effects under short circuit fault conditions.

Bus-bars shall be housed in separate compartments, which shall not contain any wiring or apparatus other than that for connecting to the bus-bars.

Access to bus-bar connections shall be possible only after the removal of covers secured by bolts or studs. Such covers shall be identified externally by Formica engraving laminate labels bearing the inscription ‘BUSBARS’ in black lettering not less than 20 mm high, on a white background.

The cross-sectional area of the neutral bus-bar shall equal that of a related phase bar.

Each cubicle or box section shall be provided with sufficient bus-bar links to enable cubicle sections to be easily joined. Facilities shall also be provided for extending the bus-bars to extra sections, if required, at some later date.

All equipment which is not specifically earthed separately shall be bonded to the main earth bar by means of copper strip in accordance with CP 1013 with a minimum of 25 mm x 3 mm.

1. **Enclosures**

Unless otherwise indicated on the drawings or in the schedules, all switchboards shall be suitable for installations indoors.

The supporting structure shall be surface wall mounted, flush wall mounted or free standing as indicated on the drawings or in the schedules

The overall dimension of the panels must be checked to fit the space provided.

Each switchboard shall be designed for front access or rear top or bottom entry as given in the schedules or shown on the drawings.

All switchboards shall be capable of extension at both ends. Bus-bar chambers shall be fitted with removable end covers.

Switchboards shall be designed for live working so that cabling of outgoing circuits can be safely carried out without de-energizing the switchboard.

Switchboards shall not be constructed by attaching flat steel plates to a framework of rolled steel angle unless so specified in the schedules or on the drawings.

All switchboards shall be provided with adequate lifting eyes, which shall be removed after the boards are in place and replaced by screw-in plugs.

When a switchboard is sectionalized for assembly on site, the sections shall be provided with adequate means of locating adjacent sections to ensure accurate alignment.

All equipment mounted in switchboards shall be fully accessible for maintenance.

Switchboard compartments shall be fitted with hinged doors, neoprene or foam rubber gasketed, and doors shall be provided with lever type locking handles having integral cylinder locks. All locks shall be openable with a common key, the number of keys supplied being two per lock up to a maximum of 10 per switchboard.

The main earthing terminal shall consist of a copper earth bar sized in accordance with CP 1013 for the prospective short-circuit current stated in the schedules. The earth bar shall be unjointed except between cubicle sections and shall extend through the length of the switchboard. The earth bar shall be connected to the earthing conductor via an external test link.

Earth bar sizes shall be the metric equivalents of the figures in CP 1013 and 25 mm x 5 mm is the smallest acceptable size. Each cubicle and all protective conductors shall be bonded to the earth bar.

1. **Terminations for external conductors**

Each switchboard shall be supplied with removable undrilled steel plates for cable glands and conduit entry. Where single core cables are used, the gland plates shall be brass or non-conducting. All necessary plain and/or threaded holes and bushed entries for conduits, trucking and cables as detailed in the schedules or on the drawings, shall be accurately located and drilled, cut and threaded on site.

The equipment for each outgoing circuit shall be housed in a separate compartment so that it can be maintained without risk of contact with live connections on another circuit.

When the external cables to or from the switchboard are designated in the schedule or on the drawings as being PVC or XLPE insulated twin and multi-core cables, armored or unarmored, the appropriate units of the switchboard shall be supplied with suitable brass compression glands of the correct sizes.

Compression glands for PVC insulated and sheathed twin and multi-core cables shall comply with BS 6121. All component parts of a cable shall be of the same manufacture.

When the main power circuits incorporate plug and socket connectors, interlocks shall be provided to ensure that plugs are fully engaged before the circuit can be switched on and that the circuit is switched off before the plug can be withdrawn.

All terminals shall be marked in accordance with BS 5472.

A bonding conductor shall connect the earth bar to each gland and/or armor clamp where cables terminate at the switchgear.

* 1. **Cables**

1. **General**

All main and sub-main cables shall be provided with the appropriate number of cores of stranded annealed copper, PVC insulation and bedding, a single layer of wire armor and an overall continuous and seamless outer cover of black PVC, to BS 6346.

All PVC insulated single core cables delivered to the site shall be of approved manufacture and shall comply with BS for medium voltage general purpose use. Cables shall be provided with PVC insulation, stranded annealed copper conductors and only one make of cable shall be used in the works covered by the Specification.

The armoring for the multicore cables shall be steel wire armor and for the single core cables, the armoring shall be non-magnetic wire armor.

1. **Jointing of cables**

Cable joints will not be permitted in any cable without the written approval of the Consultant.

1. **Underground cables**

Underground cables required for this contract shall be stranded copper conductors PVC insulated, single wire armored and PVC sheathed overall to BS 6346.

Cables shall be laid 600 mm below finished ground level.

Trenches are to be as narrow as possible consistent with the working space required and should not normally be wider than 0.5 meters where only one cable is to be laid in a trench. Surface material and any hard core is to stored separately for replacing last when the trenches are backfilled and any large stones are to be removed from the remainder of the excavate material so that generally soft fill is available for backfilling immediately on top of the cable.

Care is to be exercised in excavation to ensure that the minimum of damage to the surrounding surfaces and to the buildings, kerb and paving stones, gate and fence foundations etc.

All cable trenches must be inspected by the Consultant before backfilling and the cables to be laid in a bed of sifted soil.

The Sub-Contractor must take all necessary precautions to safeguard all structures, roads sewage works or other property on site from subsidence and damage during excavation of trenches

Trenching in unstable ground shall be adequately supported against collapse.

Cables shall not be laid in ashes, refuse or any other medium liable to damage them chemically. In such cases 300 mm minimum (or as directed) of clean soil shall be laid around the cable.

Cables shall be “snaked” at the foot of lighting poles and junction boxes.

Cables shall be terminated in suitable compression glands of the type which provide anchorage for armor wires. The glands shall be fitted with PVC shrouds which completely encase the gland.

All cable glands shall be bonded to the switchboard/distribution board’s earth terminals using PVC insulated (green) stranded copper conductor via an earth connection. All compression lugs, nuts, bolts and washers shall be supplied and installed as required.

All underground cables shall have cable warning tape laid 150 mm above the cables in the trench.

The warning tape shall be manufactured from a high quality acid and alkaline resistant polythene film. It shall be colored a non-fading yellow and bear the words:

“DANGER ELECTRIC CABLES” throughout its length.

Cable markers shall be supplied and installed by the sub-contractor in accordance with the Specification.

Concrete cable makers shall be fixed:

* At cable entries to buildings.
* At each point where a cable crosses.
* At each change in direction of the cable run.
* At intervals not exceeding 30 meters along straight portions of the cable route

Cable sleeves will be installed by the main building contractor but the sub-contractor shall ensure that the sleeves are properly installed in the position shown on the drawings and accessible for the cable entry and as described in the specification.

* 1. **Small wiring**

1. **General**

For the purpose of this Specification, the description `small wiring` shall apply to all low voltage cables and wiring connected directly or indirectly to the public electricity supply system for the purpose of supplying electricity to general power and lighting circuits, except the following:-

* Telephone, public address, and other communication circuits,
* Fire detection, alarm, and other security circuits operating at a voltage level of 24volts or less between conductors,
* Cables and wiring forming part of a system for the control and/.or supervision of the building engineering services.

All cables to be used for small wiring shall comply with the relevant British Standards. The Sub-Contractor shall submit with his Tender details of any internationally recognized Standards and Codes of Practice he proposes to use in lieu of, or in addition to those stated.

All wiring shall be carried out using one or more of the following wiring systems, as indicated on the drawings.

* Single-core unsheathed cables drawn into metallic / PVC and / or trucking as specified elsewhere.
* Twin and / or multi-core sheathed cables, armored or unarmored, clipped to building surfaces or structures or to cable tray as specified elsewhere.

All cables to be used for small wiring shall comply with the relevant British Standard. PVC cables to BS 6004, and rubber cable to BS 6007, shall not under any circumstances be run underground.

No cables shall be installed unless the ambient temperature of the cables are above 0 degree centigrade, care shall be taken to ensure that they are above that temperature for 24 hours before installation.

The following minimum cable sizes shall be adopted unless otherwise indicated. The detailing of these sizes shall not be held to vitiate the Electrical Sub-Contractor’s responsibility in respect of voltage drop and current densities.

No cables shall be less than 1.5 sq. mm except where otherwise specified.

* 1. **Lighting exterior/interior, socket outlets, motors etc.**

1. **General**

Unless otherwise indicated, cables feeding final lighting sub-circuits rated at not more than 1.000 watts shall be 1.5 sq. mm.

Cables feeding final lighting sub-circuits rated at more than 1.500 watts and not more than 1.500 watts shall be 2.5 sq.mm.

1. **Lighting**

(i) **Internal Lighting**

The Illuminating Engineering Society’s Illuminance Selection Procedure shall be used for establishing target-maintained illumination levels throughout the areas. Specific influence of glare, task complexity, surface reflectance characteristics, ceiling brightness and usage shall be considered.

Individual area illumination levels shall be as below:

|  |  |
| --- | --- |
| **Space** | **Illumination level** |
| Warehouse | 300 LUX |
| Storage/Utility Rooms | 300 LUX |
| Corridors | 100-200 LUX |
| Offices (Standard) | 300-400 LUX |
| Toilets/Ablutions | 200-300 LUX |
| Electrical/Mechanical | 200 LUX |

The Metal Halide lighting in existing warehouses shall be replaced with new efficient low energy consumption lighting. LED interior energy efficient lighting shall be installed in the new offices. All external lighting including the existing shall be replaced with LED energy efficient light fittings

Double parabolic louvers with semi-specular anodized finish shall be used for all fluorescent light fittings.

In the Toilets, LED down lighters shall be used, as well as in the existing and new offices wherever there is ceiling void.

1. **Exterior Lighting**

* In general, exterior lighting will include the lighting for entrances, and exits and will be located so as to compliment the architectural treatment and provide efficient illumination for security purposes all around the buildings.
* The Control of exterior lighting systems will be by means of Contactors connected to time switch or photocells.

1. **Site Lighting**

* In general, site lighting will include the lighting of parking areas, drives and sidewalks.
* External lighting will be individually powered solar lights 40W with 6m poles which will provide lighting to the compound and exterior fence. Lighting to be inclusive of all solar requirements and individual foundations. Will be provided by another party and is not part of phase 2
* Minimum lux levels measured at boundary fence to be 20 lux.

1. **Socket Outlet circuits**

Cables feeding 13 ampere socket sub-circuits, shall be 2.5 sq. mm

Cables feeding 35 A charging sockets sub circuits shall be 6 sq mm

1. **Motors and Other Services**

Cables feeding motors, temperature detectors and controls shall be of the minimum sizes.

Manual Motor Starting Switches, Variable Speed Controllers where applicable, magnetic starters and combination starters for Motor Starting and Control shall be used.

1. Manual Motor Starting Switches: Single or multiple pole, horsepower rated/kW Rated, manual motor starters for Extraction Fans and any motor driven equipment complete with overload protection, under/voltage, over/voltage and phase failure protection shall be used.
2. Magnetic starters: Horsepower rated, magnetic motor starters, 3-Phase, 400V for ¾ HP (0.37kW) and above, NEMA or IEC rated
3. Combination Motor Starters: Fused disconnect switches with externally operated, pad lockable handles shall be used. NEMA 1, 3R or 4 enclosures as applicable with magnetic starters shall be used.
4. **Flexibles**

Where final connection to any fittings, apparatus or motors is by means of flexible cable or cord, then the conductor sizes of such flexible cable or cord shall be those of the same I.E.E. or equivalent current rating as the rest of the circuit.

* + 1. **Single-core cables in conduit or trucking**

Single-core cables for installation in conduit systems and /or trucking shall be one of the following:-

* Single-core 450/750 volt grade PVC insulated non-sheathed general purpose Cables with stranded copper conductors complying with Table 1a of BS6004.
* Single-core 450/750 volt grade 85 degree centigrade rubber insulated, textile braided and compounded cables with stranded copper conductors comply with Table 1 of BS 6007.

All single-core non-sheathed cables shall be drawn into a continuous protective enclosure of metallic or non-metallic conduit and/or trucking, installed in accordance with the requirements of this Specification as set out elsewhere under the appropriate headings. Cables shall be thus protected throughout their entire length, except where they are installed within the enclosures of electrical apparatus or equipment. (Trucking channels for connecting warehouse light fittings to be provided).

PVC cables shall not be installed where the combined conductor and ambient temperature is likely to result in the conductor temperature exceeding 70 degrees centigrade.

85 degrees centigrade rubber insulated cables shall not be installed where the combined conductor and ambient temperature is likely to result in the conductor temperature exceeding 85 degrees centigrade.

Where cables are drawn into a vertical conduit run of length in excess of 5 meters then a suitable means of support shall be provided to prevent undue strain on the cable termination and deformation of the insulation.

Where cables are installed in a vertical run of trucking then suitable cable supports shall be installed at 5 meter intervals.

Cables shall be installed on the ‘loop in’ basis and joints between terminal points will not be permitted. A maximum of three conductors only shall be connected to any one terminal.

Conductors of 25 sq. mm or greater cross-sectional area shall be terminated with the appropriate compression or solder lug. Conductors of 16 sq. mm or less may be terminated with cable lugs or screw clamp terminals. Pinch screw terminals may not be used for conductors larger than 6 sq. mm, unless otherwise specified.

The number of wires drawn in to any one conduit or trucking or underfloor duct shall not exceed the number determined by means of the rules set out in the IEE Wiring Regulations.

1. **PVC Conduits**

PVC conduits shall be heavy gauge, high impact PVC not less than 20 mm diameter external and manufactured to BS 6099, BS 4607 and accessories used shall be obtained from one manufacturer only.

All draw boxes and junction boxes shall be of ample size to permit the cables being drawn in and out. All circular boxes shall be provided with spouts incorporating a shoulder for the proper butting of the conduits. At all lighting and switch points the conduit shall terminate in a suitable box provided with internal lugs to permit back plates or switch grids being attached to them by non-corrosive screws. All lids for draw boxes etc., shall be of PVC. Overlapping lids shall be provided for flush points.

Proprietary steel or brass insert clips shall be fitted where luminaries are suspended from circular boxes to ensure that the weight of the luminaries is carried by the structure rather than the conduit box.

The ends of all conduits shall be cut square and shall butt solidly in the conduit fittings. Where they terminate in switch panels, adaptable boxes or other non-spouted enclosures etc., they shall be connected thereto by means of smooth bore male PVC bushes and sockets.

Where more than one switch is to be mounted, multiple boxes shall be used and not a series of single ones unless single boxes are otherwise specified to provide phase barriers.

All conduits shall be free of mechanical damage and shall be adequately protected from all types of damage, both when being installed in the building structure. It shall be the Sub-Contractor’s responsibility to inspect the conduit and accessories for damage before the final building finishes are applied or erected.

All conduit joints shall be made using push-in types of couplers and accessories assembled with adhesive supplied by the manufacturer, and it shall be ensured that the conduit butts in fully.

The ends of the conduit and conduit fittings shall be cleaned before applying the adhesive according to manufacturer’s instructions.

All bends and sets shall be made on site to suit conduits and not more than two right angle bends will be permitted without interposition of a draw box. Conduits up to and including 25 mm diameter may be bent or manipulated cold by hand or forming machine. Larger sizes may be bent or manipulated by inserting the correct sized spring and bending by application of heat. In any case the installed conduit is to be free of kinks, distortion or damage.

All conduits shall be swabbed through before wiring is commenced, and cables shall not be drawn into any section not fixed in position.

Where conduits are to be chased into brickwork having a plastered finish, or run in the floor screed, the conduit shall be fixed with one hole PVC clips.

Where direct conduit entry is not possible or desirable, as is the case of motor etc., the conduit shall terminate at an agreed point adjacent to the motor etc., and wiring shall be continued in a flexible PVC corrugated conduit cemented to an inspection box at the termination of the fixed conduit installation.

Conduits shall be run in a symmetrical manner and for surface runs shall be secured by PVC spacer bar saddles using non-corrosive screws at intervals not exceeding 1.3 meters.`

All conduits and fittings shall be fixed to concrete or brick structure by 35 mm No 8 cadmium plated steel screws in plastic expansion plugs. Fixing into steel work shall be affected with sherardized or cadmium plated set screws, brackets and clips.

Should conduit be dislodged from boxes during the pouring of concrete it shall be the sub-contractor’s responsibility to repair the joint to ensure continuity throughout and repair any damage to the wall, floor or ceiling caused by rectifying the joint.

Straight surface runs without bends shall have a flexible adhesive bonded expansion joint every 6 meters.

A separate continuous PVC insulated earth wire shall be installed within the entire conduit system. This wire to be sized in accordance with Section 543 of the I.E.E. Wiring Regulations.

Holes shall not be drilled in any structural steelwork or pre-stressed concrete without first obtaining the permission of the Architect/Engineer in writing

1. **Flexible Conduits**

Flexible connections shall be made to equipment subject to movement or vibration. In all cases where these form an extension of the conduit system, a special flexible PVC covered conduit shall be used connected to an inspection box at the end of the termination of the fixed conduit installation.

All flexible conduits shall be watertight, PVC sheathed, spiraled metal type approved manufacture. The conduit shall be terminated at boxes and equipment by means of approved compression glands.

A suitably sized, PVC insulated, stranded tinned copper earthing conductor shall be drawn into the flexible conduit and connected to the earth terminal at both ends of the flexible run.

1. **Cable Trucking**

Trucking shall be used in the Offices for running power, Data and Telephone Cables (Two compartment power skirting). It may be used in place of conduit if prior Approval and permission is obtained from the Engineer, and shall be manufactured to BS 4678.

Trucking shall be powder coated metal, affording protection against corrosion in accordance with Class 3.

All steel cable trucking (cable trays) shall be manufactured to BS 4678, Part 1, of a thickness not less than 1.2 mm corrosion resistant steel and shall be rigidly fixed.

All draw boxes and junction boxes shall be of ample size to permit the cables being drawn in and out. All circular boxes shall be provided with spouts incorporating a shoulder for the proper butting of the conduits. Conduits to all lighting and switch points shall terminate in a suitable box provided with internal lugs to permit back plates or switch grids being attached to them by non-corrosive screws. All lids for draw boxes etc., shall be of PVC. Overlapping lids shall be provided for flush points.

Proprietary steel or brass insert clips shall be fitted where luminaries are suspended from circular boxes to ensure that the weight of the luminaries is carried by the structure rather than the conduit box.

The ends of all conduits shall be cut square and shall butt solidly in the conduit fittings. Where they terminate in switch panels, trucking, adaptable boxes or other non-spouted enclosures etc., they shall be connected thereto by means of smooth bore male PVC bushes and sockets.

Where more than one switch is to be mounted, multiple boxes shall be used and not a series of single ones unless single boxes are otherwise specified to provide phase barriers.

All conduits shall be free of mechanical damage and shall be adequately protected from all types of damage, both when being installed in the building structure. It shall be the Sub-Contractor’s responsibility to inspect the conduit and accessories for damage before the final building finishes are applied or erected.

All conduit joints shall be made using push-in types of couplers and accessories assembled with adhesive supplied by the manufacturer, and it shall be ensured that the conduit butts in fully.

The ends of the conduit fittings shall be cleaned before applying the adhesive according to manufacturer’s instructions.

All bends and sets shall be made on site to suit conduits and not more than two right angle bends will be permitted without interposition of a draw box. Conduits up to and including 25 mm diameter may be bent or manipulated cold by hand or forming machine. Larger sizes may be bent or manipulated by inserting the correct sized spring and bending by application of heat. In any case the installed conduit is to be free of kinks, distortion or damage.

All conduits shall be swabbed through before wiring is commenced, and cables shall not be drawn into any section not fixed in position.

Where conduits are to be chased into brickwork having a plastered finish, or run in the floor screed, the conduit shall be fixed with one hole PVC clips.

Where direct conduit entry is not possible or desirable, as is the case of motor etc., the conduit shall terminate at an agreed point adjacent to the motor and wiring shall be continued in a flexible PVC corrugated conduit to cemented to an inspection box at the termination of the fixed conduit installation.

Where necessary the trucking shall be internally reinforced in such a manner that distortion will not occur during or after the installation of cables. It shall have a removable lid throughout its length. Trucking of all sizes shall be secured at intervals of not more than 1200 mm and joints shall not overhang a fixing by more than 600 mm. The metal trucking shall be positioned and fixed as indicated on the drawings or in accordance with the Engineer instructions. Openings for conduit connections etc., shall be provided as required.

Manufacturer’s standard accessories, e.g. bends, tees etc., shall be employed throughout. Bends, tees, etc., shall be of the gusset or radius type. Cable leaving or entering the trucking shall be suitably supported to prevent damage or undue pressure on the insulation.

Where partitioned trucking is used, the partitioning shall be maintained at intersections and angle pieces.

Where trucking passes through walls and ceilings, the cover shall be solidly fixed at 75 mm either side of the walls and 150 mm either side of the floors and ceilings. Internal fire resisting barriers shall also be fitted.

No metal trunking shall be installed with the cover on the inaccessible side.

Where switchboards are connected to metal trunking, such connections shall be made by necks and not by multiple conduit couplings.

Where metal trunking is slotted to receive connecting necks, gaskets made from a synthetic resin fabric (to BS 2572) 10 mm smaller than the metal trunking aperture shall be fixed in position to prevent abrasion of cables on sharp edges. Alternatively, a PVC molding shall be securely fixed around all such apertures.

Vertical sections of metal trunking over 900 mm in length shall have staggered insulated tie off studs to support the weight of the cables.

All trunking shall be fixed to concrete or brick structure by 35 mm No 8 cadmium plated steel screws in plastic expansion plugs.

Cable retaining stripes shall be provided at no more than 600 mm spacing.

All trunking systems shall be painted with a complete finish to that of the original where any abrasions to the original have occurred.

Electrical continuity shall be ensured by the provision of approved copper continuity straps al all bolted joints in the trunking. All bends and tees shall be prepared and welded at the manufacturer’s works and shall not be constructed on site. In addition, a continuous earth wire shall be installed throughout the system rated in accordance with Section 543 of the I.E.E. Wiring Regulations/NEC Codes.

Joints in metal trunking shall be kept to a minimum and shall be sealed with an approved cover strip shaped to the contour of the trunking. All metal trunking fittings shall leave the main through completely clear of obstruction and continuously open, except into switchgear equipment and floors at which point suitable fire resistant barriers shall be provided as may be necessary to prevent the spread of fire.

Screws and bolts securing covers to metal trunking or sections of metal trunking together shall be arranged to have countersunk bushes/nuts so that damage of the cables cannot occur when fixing covers or when cables are installed. Self-tapping screws shall not be allowed.

All cable covers, dividing plates and intersection units shall be installed prior to the cable installation, and this loss of space shall be taken into consideration when sizing the trunking.

Trunking shall be sized in accordance with I.E.E. Wiring Regulations/ NEC Codes with an additional allowance of 20% spare capacity for future installation.

All measurements shall be taken on site and the exact trunking lengths shall not be taken from the drawing unless specific dimensional details are given. The positions and arrangements of bends and tees shall also be agreed on site, and particular attention paid to routing the trunking to be clear of other services.

Where trunking is specified to support luminaries, then this shall be installed as indicated on the drawings. The general principle of the installation shall be as above, and particular attention shall be paid to earthing the trunking to the building conduit system. Adequate fixing shall be provided at no more than the centers recommended by the manufacturers and allowance shall be made also for the operating loads imposed by pull cord switches etc.

Manufacturer’s accessories shall be used to fix luminaries and wiring accessories to the trunking. All trunking shall be complete with manufacturer’s supply of covering.

1. **Underfloor conduits, sleeves and service boxes**

Only the approved accessories and service outlets shall be incorporated unless prior approval of the Engineer is obtained.

All components shall be constructed of materials adequate in strength and performance, and shall be protected against corrosion. The interior of the components shall be free from sharp projections and be formed with intersections, bends junctions and elbows that permit cables to be laid or drawn in without damage.

Fitted covers and other forms available for use during the installation stage to prevent the ingress of site material into compartment.

Services layout boxes shall be adjustable in height independently of the conduits to take account of differences in floor finish thickness.

Allowance for alignment between components shall be incorporated into all details.

Service outlet boxes and junction boxes shall be installed in the positions shown on the drawings and at all other positions necessary for the ease of installation of cables.

Draw wires shall be installed for cables which shall be installed later by others, e.g. telecommunications cables.

Where possible all drilling and cutting shall be carried out prior to installation, and care should be taken to ensure that particles are not left in Conduits after such operations.

All conduits, sleeves and boxes shall be mechanically fixed to one another adequately, secured to the structure and all covers replaced before any screeding or floor finishing work take place.

Care shall be taken to prevent water or concrete from entering the conduits, services boxes and sleeves during screeding. At bolted joints and bends etc., the conduits & sleeves shall be wrapped in PVC tape or equal and approved immediately after installation of that section.

Adequate protection shall be provided to the installation against damage during screeding and until all site works have been completed. The electrical sub-contractor shall provide attendance to the main contractor during the pouring of floor screens.

Conduits and sleeves that are intended for the accommodation of cables for various services shall be separate from each other in order that complete segregation of the different service cables occurs.

Where it is stated that future demountable partitions are to be accommodated in the building construction, then it shall be ensured that service outlets and junction boxes are clear of these partitions.

All components shall be effectively earth bonded to one another by mechanical means, utilizing the manufacturer’s approved earth bonding straps. In addition, a continuous earth wire shall be installed throughout the system rated in accordance with the current edition of the I.E.E. Wiring Regulations.

An earth wire from each final sub-circuit shall be connected with the main earthing conductor via an appropriately sized brass earth stud to the junction boxes and service outlet boxes.

Adequate cable segregation shall be provided between service runs throughout the system and be maintained at intersections and junctions.

Cables emerging from service outlet boxes shall be protected against damage as required by safety Standards and telecommunications requirements.

* 1. **Data and Telephone System**

1. **Communication and LAN (Local Area Network) Systems** Communications for the Medical Stores Warehouses and Office in Lusaka, Zambia will be designed to support voice and data communication required for the facility. The core purpose for voice and data communication systems shall be to provide occupants the ability to communicate with other personnel within the facility and by providing tie-ins to the public voice and networks via the local service provider. The Zamtel Fiber Optic connection shall be allowed for so that the LAN at the facility is able to communicate with any other relevant facilities remote from the facility.
2. **Network Cabling Horizontal Distribution**

Communications supporting the non-office areas, except as designated shall be designed to support voice only. Communication junction boxes supporting Office Areas within the buildings shall be designed as follows:

1. The Communications outlets will be configured with 2 ports for Voice and Data networks
2. All networking cabling for Voice and Data within the building will be plenum rated Category (CAT.) 6, 4-Pair, 24 AWG (American Wire Gauge or equivalent British Cable size. The Cooler of the jacket shall be Blue for Voice and White for Data.
3. Copper cable terminations in the Telecommunications Room will be done on Multi-pair BIX block for voice and on RJ45 patch panel for Data.
4. Copper Cable terminations at the Workstation will be RJ45
5. Horizontal distribution cable for both Voice and Data may be routed within metallic or plastic cable raceways within the Office.
6. **Network Backbone Cable**

The cable used to link the Warehouse and Office Buildings for voice network shall be Cat 6, Multi-Pair, 24 AWG, and plenum rate cable with number of pairs to be determined during design. The color of the Jacket hall be black. Cat 5 terminations shall be done on a multi-pair 110 punch down block.

1. The Fiber cables used to tie the Office Buildings to the Warehouse Buildings for Data network shall be multi strand 50/125 (OM3 OFNP with color of the jacket to be magenta) The actual number of fiber strand shall count will be determined later in the project. Fiber optic cable terminations (jacks and plugs) with be SC-Duplex. The SC-Duplex shall be installed in a rack mounted patch panel
2. **Cable Cross-Connects**

The Fiber optic cross-connects shall use a SC-Duplex to SC-Duplex patch cable from the backbone patch panel to distribution switch

* + 1. Cat 5 cross connects shall use cross-connect wire between BIX blocks
    2. Cat 6 (Patch/Workstation) RJ45 to RJ45, stranded 24 AWG copper cable for cross-connects between the patch panel and switch and from the communications outlet to the workstation and/or telephone hand device.

**9.10 General wiring accessories**

1. **General**

All switches, socket outlets, ceiling roses, lamp holders and other wiring accessories shall be of robust construction of high grade electrical porcelain with leadless glaze or of high grade bakelite or other approved thermosetting plastic of heavy section. All contacts and terminal plates shall be of heavy section with large contact area of cast formed sheet brass or electrical quality copper.

1. **Lighting Switches**

Lighting switches shall be of the grid switch modular pattern manufactured in accordance with BS 3676.

All lighting switches shall be fully rated at 10A or 20 A and suitable for fluorescent loads.

All lighting switches shall be suitable for conduit installation. Where more than one phase, or dissimilar voltages are present, then these shall be permanently separated by earthed metal barriers within the switch box.

The switch plates of phase barrier boxes shall be set square to the vertical and horizontal access.

Where wall mounted switches are installed on special wall finishes, for example tiles, marble, timber cladding, fair faced brickwork, then special care must be taken to ensure that the final positions of all switch plates are set symmetrically within the pattern of the wall finish and in the correct position as required by the Engineer.

Switches used in external locations shall be of the weatherproof pattern.

Where more than one switch is indicated in a position, then these shall be ganged in the same box and a multi-gang switch plate used.

The arrangement of switches in a ganged box shall as far as possible be similar to the plan of lighting points which they control. Switches not so arranged shall have engraved labels to indicate switches controlled.

Pull cord ceiling switches shall be mounted in a standard circular conduit box with a matching “plaster break” ring between.

An earth terminal shall be provided at every lighting switch or adjustable grid by means of a “Fly Lead” of PVC insulated cable of yellow/green.

1. **Socket outlets and plug tops**

All socket outlets and plugs shall be supplied and installed in accordance with the manufacturer, type, size and finish as indicated in the schedule of fittings on the Contract drawings.

Unless otherwise specified, all general socket outlets shall be switched, rated at 13 amps and be of the three rectangular pin type to BS 1363.

The pin apparatus shall have insulated inserts and shall be shuttered on the live and neutral outlets. The shuttering to be arranged such that the entry of the earth pin of the plug top into the earth outlet shall open the shutter.

Plugs tops shall be of the finer shield type to BS 1363. They shall be equipped with fuses rated according to the equipment connected. Where no equipment is connected 3 amp fuses shall be fitted.

Earth leakage circuit protection shall be applied to socket outlet circuits where necessary (i.e. plant room, external to building).

Spur units shall be of 13A rating complying with BS 5733 and shall be fitted with correctly rated fuses according to the equipment connected.

Where the flex outlet type is specified, these shall have a manufactured outlet and be complete with internal grip cord.

Where wall socket outlets are installed on special wall finishes, for example tiles, marble, timber cladding, fair faced brickwork, and then special care must be taken to ensure that the final positions of all plates are set symmetrically with the pattern of the wall finish and in the correct position as required by the Engineer.

All socket outlets and spur units shall be set square to the vertical and horizontal axes.

Where metal plates are specified, fixing screws shall be of the identical finish.

Boxes shall be fixed by means of 2 No.35 mm No. 8 cadmium plated steel screws and plastic expansion plugs as a minimum requirement.

Boxes shall be cleaned out and free from debris prior to wiring. The knockouts shall not be used as a method of grouting boxes into walls etc.

All plate fixing holes in boxes shall be cleaned and tapped prior to the fixing of screws.

All necessary boxes shall be fitted with earth terminals and adjustable fixing lugs.

Three phase sockets (10x) should be provided in charging bay area, where MHE equipment will be re-charged.

1. **Mounting heights**

Unless otherwise specified in the particular Specification and/or associated drawings, all units shall be mounted at the following heights from finished floor level taken to the center of the units:

* Lighting switches 1400 mm
* Socket outlets - general areas 300 mm
* Above work units etc. 1200 mm
* Fused spur boxes 300 mm
* Clocks 2250 mm
* Telephone outlets 400 mm
* Wall mounted telephone outlets 1400 mm
* Individual items of switchgear 1400 mm
* Motor control units 1400 mm

Generally, switchboards and distribution boards shall be installed so that any item to which easy access is required, such as fuse, circuit breaker, instrument etc., is not more than 2150 mm above finished floor level. In all cases care must be taken to ensure that adequate space is left below and above the equipment for manipulating incoming and outgoing cables and conduits.

The appropriate position of main switchboards, distribution boards, fittings and accessories shall be as indicated on the drawings. Actual positions shall be determined on site in conjunction with the Engineer before the work is commenced. The Electrical Domestic Sub-Contractor shall check with the latest Architectural drawings on site to determine door swings before commencing the installation of lighting switch drops.

The right is reserved to make minor alterations (up to 900 mm in route) to positions prior to the work being carried out without incurring extra charges.

Where suspended ceilings are installed the Sub-Contractor shall liaise with the ceiling contractor to ensure that the layout and installation of lighting points suit the ceiling panel arrangement.

Lighting luminaries and accessories shall, where practicable, be sited such that they and water systems cannot be touched simultaneously.

In areas where the walls have glazed wall tiles the Electrical Domestic Sub-Contractor shall note that where the lighting switches or points are mounted in the tiled areas, the switch or socket outlets must be mounted at the intersection of four wall tiles, a large hole shall be left 350 mm x 350 mm approximately with a length of conduit protruding complete with end and coupling. The final connection shall be made with a short length of conduit when the tile centers are known. The Electrical Domestic Sub-Contractor shall allow for this, and also positioning the hole on the brick walls with the Main Contractor.

The Electrical Domestic Sub-Contractor shall co-operate with the Main Contractor and other Sub-Contractors and in particular the heating, ventilation and plumbing Domestic Sub-Contractors in order to achieve the efficient and proper co-ordination of the various services. Extra to contract costs will not be allowed for re-siting equipment due to lack of on-site liaison.

**9.11 Equipment supplied by others**

In addition to isolators for items of equipment to be supplied and installed by the Electrical Domestic Sub-Contractor all other isolators shown on the drawings indicate items of equipment to be supplied and erected by others. Final connections from these isolator positions shall be carried out by others. Where only supply cable is specified to be installed by electrical contractor it shall be glanded to the DB supplied by others.

**9.12 Earthing and bonding**

Provide a complete and effective system of earthing for the LV electrical installation. The system of earthing shall comply with the IEE Wiring Regulations and recommendations stated in CP 1013, except where detailed otherwise in this Specification and drawings. Where the IEE Wiring Regulations and CP 1013 differ then the former shall take precedence.

Metallic services including gas mains, water mains, dry risers, etc., entering or leaving the building or structure shall be effectively bonded to the main earthing terminal at their point of entry or exit. Connections shall be made to the services with purpose-made earthing clamps to BS 951.

The lightning conductor system for the building or structure shall be effectively bonded to the main earthing terminal in accordance with the requirements of CP 1012. The bonding conductors shall not be smaller than 25 mm x 3 mm. A suitable label shall be provided adjacent to this bonding connection at the main earthing terminal.

Where the building is comprised of a steel formed structure or has metallic cladding then these shall be effectively bonded to the main earthing terminal.

The cross-sectional area of all earthing, bonding and protective conductors shall comply with the requirements of the IEE Wiring Regulations. Except where detailed otherwise in this Specification or on the drawings all conductors for earthing shall be copper, manufactured in accordance with BS 1432, for strip and BS 4109, for cables.

Single-core cables forming part of the earthing system shall be of stranded copper, insulated to 450/750 V standards with green/yellow PVC. These cables shall comply with BS 6004, Table 1.

Bare protective conductors in twin and three core cables included in BS 6004, Table 5 will be acceptable.

Mechanical joints between aluminum and copper shall have the joint faces lightly coated with a suitable compound to prevent corrosion before the connection is made.

Where conduits, or small glands for mineral insulated or armored cables, terminate on switchgear, distribution boards, starter panels or other apparatus then brass compression washers shall be used to ensure an effective earth connection.

Where connections are made between sections of trucking then the manufacturer’s earth continuity links shall be installed across the joint. Connections made between trucking sections crossing a building expansion joint shall be made with a flexible copper braid.

Sections of cable tray shall be thoroughly cleaned before overlapping and securing with a minimum of two screwed fixings. The remote ends of the cable tray shall be effectively bonded to the earthing system.

The armoring of plastic sheathed cables shall terminate in a suitable compression gland fitted with a purpose-made earth tag. A suitable protective conductor shall connect the earth tag with the apparatus earthing terminal. The earth tag shall be manufactured from a high conductivity material compatible with the cable gland.

The armoring of metal sheathed cables shall be securely clamped to the gland at the cable termination with a purpose-made bolted clamp.

A protective conductor shall be installed to connect the armor clamp or gland fixing bolts to the apparatus earthing terminal.

For an outdoor termination, the armoring shall be suitably protected to prevent corrosion.

Metal sheaths and/or armoring of multicore cables connected to a cubicle type switchboard shall be effectively connected to 0the switchboard earth bar as described in later clauses.

The earth terminal of all socket outlets shall be connected to the main protective conductor of the final sub-circuit. Where the protective conductor is formed by conduit, trucking or the metal sheath and/or armoring of cables then the earth terminal of the socket outlet shall be connected to an earth terminal in the box or enclosure associated with the conduit, trucking or cable.

Connections between earth bars, equipment frames, etc., and copper strip shall be made with the appropriate bolt, washers, nut and lock nut. Contact surfaces shall be thoroughly cleaned and tinned prior to connection. The washers shall be of sufficient size to prevent any distortion of the copper strip.

The diameter of fixing holes shall not exceed one third the width of the earth bar or strip. Where a larger hole is required in an earth bar then connection shall be made to a suitable copper flag welded to the bar.

Copper strip joints shall be welded using a molecular welding process such as Furse ‘Thermoweld’ or/and equal alternative.

There must be complete EARTH continuity throughout the entire system in accordance with the I.E.E. Wiring Regulations, with all necessary bonding provided and installed by the Electrical Sub-Contractor.

All conduit connections to distribution boards luminaries, trucking etc., shall be properly screwed together so as to ensure mechanical and electrical continuity throughout.

Care is to be taken in bonding and earthing the installation. Tests are to be carried out as the work progresses to check the electrical continuity of all metal work, conduits etc., and protective and bonding conductors.

The Electrical Sub-Contractor shall be responsible for the bonding and earthing to all exposed metalwork, structural and otherwise.

All metal sinks and hot and cold water pipes shall be earth bonded. Where these are within 2 m of an electrical outlet, then they shall be bonded to same. This bonding to be effected with PVC Yellow/Green sheathed earth wire installed flush to plaster. Connections to be carried out before painting of pipework etc.

The whole installation must contain a separate EARTH wire to give a second complete earth continuity path. Testing of earth path will include both this earth path and that provided by the conduit/trucking with any associated EARTH cable.

No earth continuity conductors shall be less than 1.5 mm tinned copper cable, PVC insulated and colored Yellow /Green.

All protective and bonding conductors shall comply with Chapter 54 of the I.E.E. Wiring Regulations.

The steel wire armoring of the sub-main cables shall be efficiently bonded together and to the respective switchboard, distribution boards, sealing chamber and conduits at which they terminate and to all metalwork adjacent.

The incoming water services shall be bonded to the electrical earth, as near as practicable to the point of entry to the building. The incoming electrical supply cable and the telephone cable shall be bonded directly to the lightning protection system at the point outside the structure of the Public Utilities side of the service in accordance with the British Standard.

Earthing and bonding connections shall be provided with warning notices in accordance with I.E.E. Wiring Regulations.

**9.13 Lightning protection system**

The Lightning Protection System shall comprise early emission streamer technology complete with Capture System, Lightning down conductors, ground system, test points, spark gap, ground plate, ground spikes and Quibacsol Composite to improve contact between the ground and plate.

Facility structural steel portal frame should be thoroughly earthed, via earth spikes and ground plate, at reasonable intervals.

The system shall comply with UNE 21186, NFC 17102, EN 50164 and EN 62305 Level IV covering a radius of 113m.

**9.14 Testing and commissioning**

1. **General**

Complete installation covered by this narrative shall, during erection and on completion before being put into service be inspected and tested in order to verify that the requirements of the specifications, regulations and standards have been met. The method of test shall be such that no danger to persons, or property or damage to equipment can occur even if the circuit tested is defective.

The commissioning procedures shall be under the direction of the Engineer. The Electrical Sub-Contractor shall provide a representative who is fully conversant with the operation of the Works and is competent to carry out all Pre-acceptance and Final Acceptance Tests.

The Electrical Sub-Contractor shall also provide such additional assistance, competent labor, materials, lubricants specified by the makers, and such other equipment as may be required and reasonably demanded, to carry out the tests. The Sub-Contractor shall include in his rates for commissioning of the works to the reasonable satisfaction of the Engineer.

1. T**est procedure**

All tests shall be generally in accordance with the current edition of the Regulations for electrical installations 16th edition issued by the Institution of Electrical Engineers (U.K.) and the requirements of local Electricity Supply Authority.

The results of the tests shall satisfy the requirements of the appropriate regulations.

1. **Testing**
2. **Field Tests:** Field Testing of the Electrical Systems will be specified to assure that the equipment is operational and within industry and manufacturer’s tolerances and is installed in accordance with design specifications.
3. **Testing Agency:** For main Electrical Distribution System components, the Electrical Consultant or independent testing agent’s firm shall be engaged for the purpose of performing the tests.
4. **Corrections:** Correct any deficiencies found after and inspection and issuance of snag-list as well as any required retesting.
5. **Short Circuit Study:** A Short circuit study, equipment interruption evaluation (power quality), and a device coordination study for the electrical distribution system will be performed by the successful supplier for their specific equipment. The independent testing agency/Electrical Consultant and the Contractor will be required to verify the proper equipment and adjustable protective device settings.
6. **Electrical Equipment and Systems Tested:** Perform test on equipment and systems listed, tabulate data and submit with equipment submittal (factory) or acceptance checkout by the Contractor including close-out statement.

* Electrical Switchboard/Distribution Boards Factory Certification
* Electrical Equipment including Solar Panels Factory Certification
* Cables (600V) Insulation Resistance and Continuity
* Motors phase, rotation and characteristics
* Automatic Transfer Switches from Solar to Utility (Test all functions)
* Earth Resistance Testing
* Fire Alarm System as per NFPA (USA)
* Earth-loop impedance tests to check the effectiveness of the earthing of each complete system.
* Earth Leakage Circuit Breakers/Residual Current Device Testing
  + - * Verification of polarity to ensure that all fuses and single pole control devices are connected to the live conductor only, and that wiring has been correctly connected to plugs and socket outlets.
* Insulation resistance tests of all circuits between phases or between each phase or pole and earth. Where a main distribution point is 10 Me ohms or above, individual sub-circuits may be omitted at the discretion of the Engineer.

1. **Test certificates**

The Contractor shall provide the Engineer with test certificates to show that equipment, materials, and installations have been tested as set out elsewhere in this Specification.

Site test results e.g. insulation resistance, earth continuity etc. shall be entered on the Sub-Contractor’s own form of tests certificates.

During construction, the Contractor shall provide the Engineer with single copies of all test certificates as they are received from the manufacturer and / or suppliers, and as tests are completed.

**9.15 Quality assurance**

1. **Submittals**

(i) Professional Certifications for the following:

* Grounding System
* Lightning Protection System
* Electrical switch board factory certification.

(ii) Product Data for the following:

* Fire Alarm System
* Power Distribution System
* Lighting Fittings
* Solar Panels
* Lightning Protection
* Automatic Transfer Switches

(iii) Shop Drawings for the following:

* Fire Alarm System
* Power Distribution System
* Lighting Fittings Solar Panels
* Lightning Protection
* Automatic Transfer Switches

(iv) Operation and Maintenance Manuals for the following:

* Fire Alarm System
* Solar Panels
* Automatic Transfer Switches

1. **Special Inspections**
2. Power Distribution System
3. Fire Alarm System
4. Solar Power, Inverters, Batteries and Charge Controllers:
5. **Testing**

**Field Testing Submit certified copies of test reports**

1. Grounding resistance.
2. Fire Alarm System as per NFPA.
3. Solar/Utility Power System
4. Power Distribution System and automatic power transfer switches.
5. **Warranty**

(i) All Electrical work including Fire Alarm and Security System shall have a minimum of one year warranty (Labor and Materials). Warranty period shall start from the date of final acceptance.

**(e)**  **Operations and Maintenance Demonstrations/Training**

1. The Manufacturers and installers, for each of the following, shall provide training and demonstrations of the manufacturer’s required maintenance and adjustment procedures to End User’s personnel
2. Solar, Invertor, Batteries and Charge Controllers
3. Fire Alarm System
4. Automatic Transfer Switches
5. Schedule the training/demonstration for a mutually agreed time near substantial completion
6. Demonstrate the manufacturer’s recommended procedures for adjusting the system and for replacing parts scheduled as End User’s replaceable.
7. Provide copies of training materials, including videos, documenting course content, and arrange to have the training recorded. Leave at least two reproducible sets of materials with the End User.

**(f)** Provide a list of parts the manufacturer recommends to be in the End User’s stock

**9.16 Basic Materials**

**(a)** **Basic Materials:** Includes switches, raceways, wire and cables, boxes, wiring devices, cabinets and enclosures, electrical identification, and other materials required for the electrical system as required by code.

1. **Electrical Identification**:
2. Nameplate to identify equipment on Solar Supply, shall have ¼ inch (6.5mm) tall white letters on black background and equipment on ZESCO power shall have ¼ inch (6.5mm) tall white letters on a red background
3. Provide ¾ inch (19mm) vinyl tape inside normal Solar Power LIGHT switch and receptacle cover plates to identify panel and circuit.
4. Provide adhesive label tape on the outside of the light switch and receptacles cover plates to identify panel and circuit.
5. Conductors: color coded and labeled.

**9.17 Service manual**

One month prior to Final Acceptance Tests, the Contractor shall provide two copies of Service Manuals of the works together with “As Fitted” record drawings called for elsewhere in this Specification.

1. Each manual shall contain the following:-
2. Manufacturer’s operating instructions
3. Manufacturer’s spare parts catalogues and ordering instructions.
4. Schedules of equipment and fittings providing names of manufacturers, serial number, models, types, capacities, locations, quantities and other relevant information.
5. Technical and non-technical operating and maintenance instructions of the Works.
6. Emergency procedures.
7. Copies of all test certificates.

# **PART B10 – MECHANICAL SYSTEMS**

## **10.1 Overview**

This part of the TOR summarizes the design decisions made to date regarding the HVAC design concepts and issues for the MSL Warehouse project. The purpose of the mechanical systems is to provide energy efficient climate control for the building occupants and stored product in a manner that is compatible with the architecture and in accordance with local guidelines, local codes, and ordinances. This documents the equipment types and some order of magnitude sizes for major HVAC systems.

Detailed calculations shall be performed by the offeror during the design development phase of the project when building components are better defined.

All areas of the new warehouse shall be temperature controlled.

Low energy consumption lights shall be used to obtain sufficient lux-levels at ground floor and reduce energy consumption and heat production. (See electrical section)

Photovoltaic solar panels supported by batteries for energy storage shall supply the warehouse with most of the electricity demand throughout the year; though the PV energy supply shall be dimensioned to cover 100% of the maximum demand of electricity (cooling capacity used at maximum). Additional electricity demand must then be supplied from the grid. Surplus production from the solar panels should, if possible, be fed/sold into the grid. It would be interesting to explore this potential with the grid-owner.

The space available for installation of solar panels is limited in view of the existing roof space. The most appropriate space for the installation of panels is on the north facing roof of existing warehouse.

**Note: The photovoltaic system is not a part of this tender*.***

**10.2 Codes and Standards**

(a) International Building Code, IBC (latest edition)

(b) International Mechanical Code, IMC (latest edition)

(c) International Energy Conservation Code (latest edition)

(d) ASHRAE 62.1 (latest edition), Ventilation for Acceptable Indoor Air Quality

(e) ASHRAE 90.1 (latest edition), Energy Standard for Buildings except Low-Rise Residential buildings

(f) NFPA 101 (latest edition), Life Safety Code

(g) American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

(h) National Fire Protection Association (NFPA)

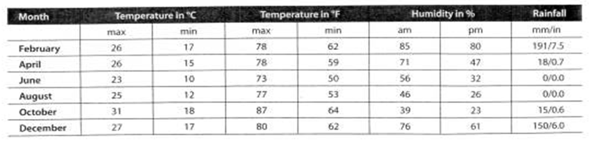
(i) American National Standards Institute (ANSI)

(j) American Society of Mechanical Engineers (ASME)

(k) Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

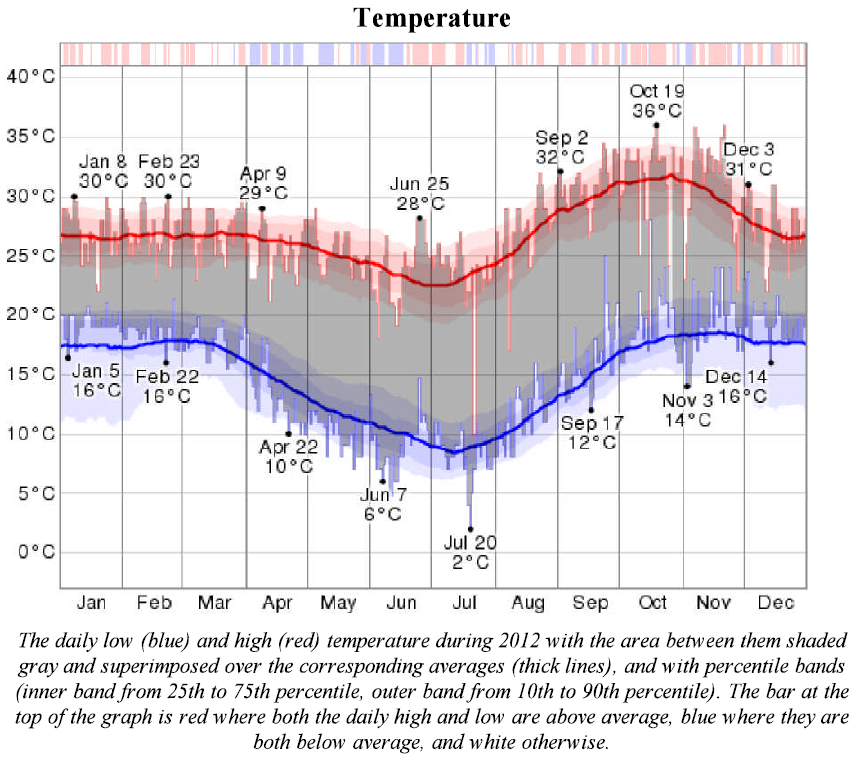
## **Outside Design Conditions**

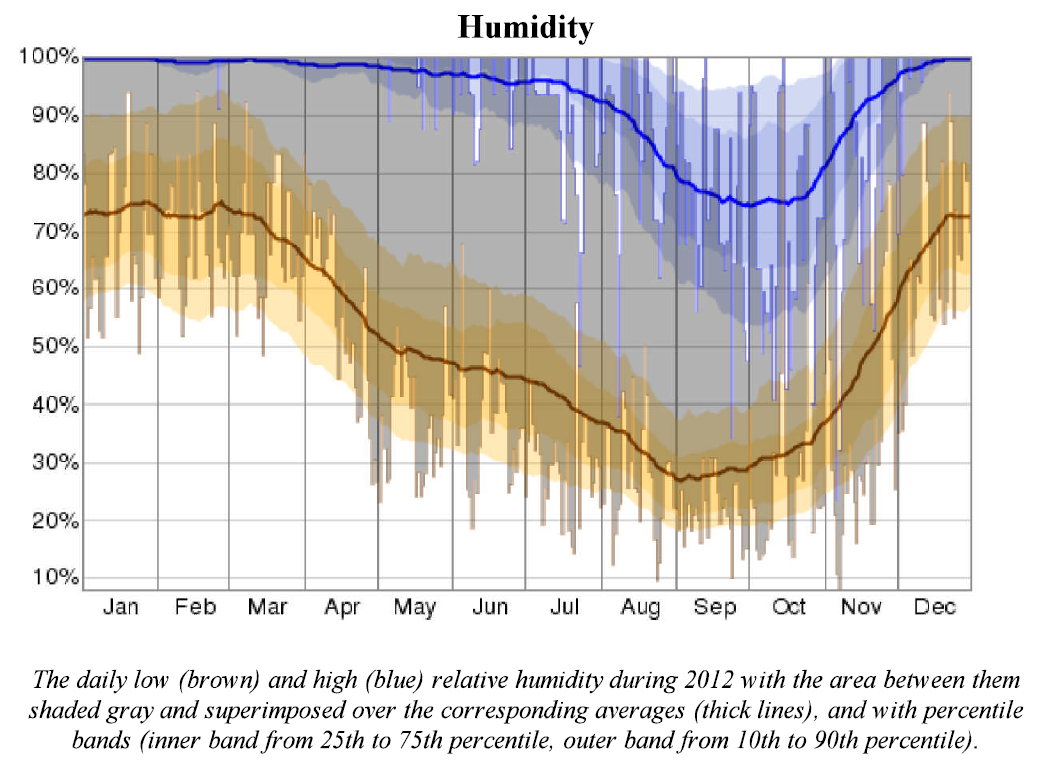
The day and night time temperatures of Lusaka should be used for the calculations of energy requirements.



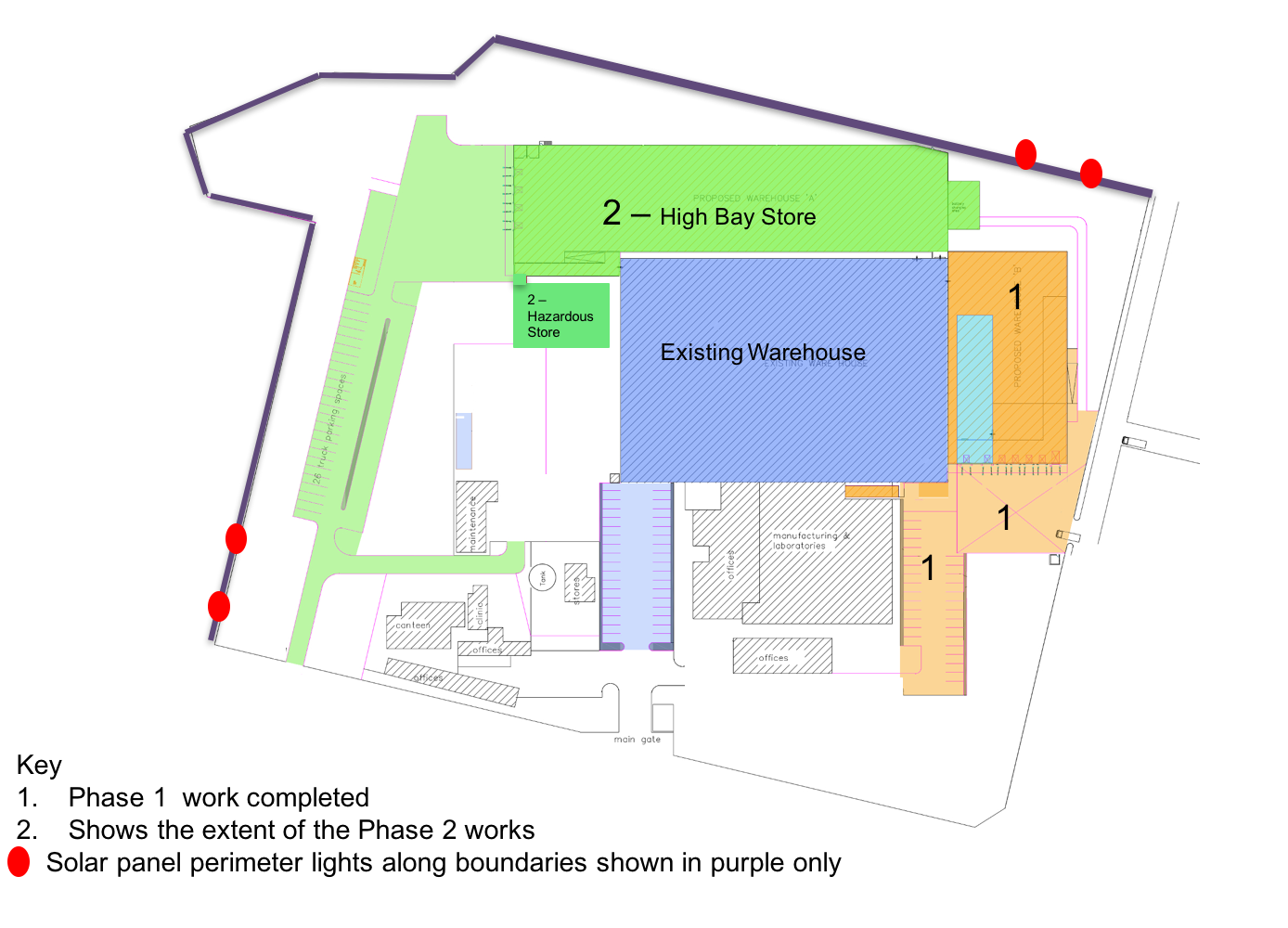
The systems shall handle temperature and humidity variations like those measured at the Kenneth Kauna Int. Airport in 2012 (next page). The high humidity conditions are likely to happen in nighttime, and the low values in daytime.

The proposer shall use an air density of 0,00 kg/m3 when calculating capacities, fan power, etc.





**10.4 Site Plan with proposed new buildings**



|  |  |  |  |
| --- | --- | --- | --- |
| **Building Part** | **Area, m²** | **Height, m** | **Design Conditions** |
| Warehouse and Receiving (new) | 5240 | 15m (high bay warehouse) / 8,8m (receiving area) | 25 °C, dry bulb, at 60 percent relative humidity |
| New internal roadway, parking, gate house and entrance | To be measured from drawing | N/A | External |
| Battery charging area and solar panel storage (new) | 266 | 7m (internal) | 25 °C, dry bulb, at 60 percent relative humidity |

**10.5 Scope of Work for Mechanical Systems**

## **New warehouse building - ventilation and temperature control system to maintain temperature below 25 °C at all times.**

The temperature control system should allow for maintaining the warehouse at temperatures below 30**°**C and this as well for ground and top level areas.

The air conditioning system should prove its energy efficiency:

* System should be able to operate on the grid.
* System should also be able to operate with solar powered generated energy (direct or through batteries/using inverter). The proposed air-conditioning system shall be able to function on solar power generated energy only or working partially on solar power.
* The system should use the potential of the difference between day and night temperatures to use ambient air to cool the warehouse during low temperature periods of the night and day to increase energy efficiency. Note the products to be stored are mainly pharmaceuticals but also some reagents and laboratory commodities.

1. ***Detailed specifications***

Supply, Delivery and Installation of two Air Cooled Rooftop\* units with all Duct work and accessories.

\*Can also be installed on the side at rooftop level.

Per unit:

* Two compressors per unit
* Cooling capacity of 100 kW minimum
* Sensible cooling 80 kW minimum
* Nominal maximum current around 85 Amps
* Freon refrigerant R410A or equivalent
* Air flow: minimum 5500m3/h minimum
* ESP: 500Pa
* With motorized dampers and actuator for automatic switching between free cooling and compressor cooling
* Two stage compressor cooling.
* Direct Fan motor drive
* Epoxy resin coating on aluminum condenser fins
* AC controller on free cooling and compressor cooling.
* Free cooling at 19 degrees to be able for automatic switched on
* The units will be fitted with an air dispersion system using non-inflammable round, fabric, ducts. Ducts must meet ISO standard and fire proof tests
* The ducts system will be fitted through a cable suspension system to the stores roof structure
* The colour of the ducts will be blue
* The ducts will be fitted at the highest point of the store in the lengthy direction of the store which is around 50 meters long.
* Minimum spare parts provided with each unit at installation:
  + - * + Blower: 2
        + Blower motor: 1
        + Nylon Filter: 1

The system shall handle temperature and humidity variations like those measured at the Kenneth Kauna Int. Airport in 2012 (next page). The high humidity conditions are likely to happen in nighttime, and the low values in daytime.

The proposer shall use an air density of 0,99 kg/m³ when calculating capacities, fan power etc.

**Concept View of Air Conditioning Modules**

### **(c) Battery charging area and solar battery storage**

(i) Exhaust fans shall be mounted to extract air from this space. The capacity shall med dimensioned for 10 charging spots. The fans shall be capacity controlled by means of inverter controlled motor. The capacity shall be automatic adjusted depending on how many chargers are active.

**PART B11 – ENVIRONMENTAL MATTERS.**

Zambia’s environmental legislation requires that a separate environmental project brief be prepared for each separate material extraction site and contractors are required to obtain permits from the Zambia Environmental Management Agency (ZEMA) for borrow pits and quarry sites. The project brief is to be submitted to the Zambia Environmental Management Agency (ZEMA) who, upon approval, grants a permit for extraction of materials.

A brief resume of the environmental issues that need to be considered when selecting areas of material extraction is given below: this is given for the purposes of creating awareness of current legislation in Zambia and is given for guidance only.

* 1. **Borrow Pits**

1. Borrow pits should be located in a minimum of 5 km from wetlands.
2. Borrow pits should be located in less vegetated areas.
3. a License to operate must be obtained from the Ministry of Mines prior to excavation.
4. The location of the site must be subject to the approval by the local community in the area they will be located.
5. a Borrow pit rehabilitation plan must be approved by ECZ and the local communities in the area they will be located.
   1. **Quarries**
6. Quarries should be located a minimum of 5 km from surface water sources.
7. Quarries must be located a minimum of 10 km from settlements
8. There must be no quarries in National Parks.
9. a license to operate must be obtained from the Ministry of Mines prior to excavation.
10. An environmental project brief must be submitted to and approved by ZEMA prior to excavation.
11. The location of the quarry must be approved by the local community in the area it will be located.
12. A quarry rehabilitation plan must be approved by ZEMA and the local communities in the area it will be located.
13. Quarries must be surrounded by perimeter drains.
14. Quarries must be fenced in while in use to avoid accidents with animals or children.
15. Top soil removal must be piled in a manner that they are of a benefit to local demand.
    1. **Potential Environmental and Socio-Economic impacts**

From own assessment it can be concluded that there will be a negative impact during the construction phase and move positive impacts in the operational phase. The summary of impacts is detailed as follows:-

Summary of Impacts for Bio-physical Environment.

1. **Preparation Phase**

There are no adverse impacts during this phase as the activities such as road surveying and material mobilization and handling have no impacts. For instance, during the construction phase impacts on the bio-physical environment would be:

1. **Construction Phase**

* Soil destabilization and contamination.
* Localized Air Pollution.
* There will be solid waste generation.

The identified bio-physical environmental and socio-economic negative impacts can easily be mitigated and most of them are in short term in the construction phase while those in the operational phase are minimal. The positive impacts that would occur as a result of the upgrading of the car park would need to be enhanced to minimise the negative aspect. In addition, an Environmental Management Plan has been prepared to monitor and mitigate negative impacts and the monitoring Consultant would ensure that the Contractor engaged complies and address all anticipated negative impacts resulting from the resurfacing works.

The resurfacing works of the car park are intended to bear very minimal impacts on the medical stores environment only in the form of dust and bitumen odour. The Environmental Impact Assessment has concluded that there will be negative impacts during the construction phase and more positive in the operational phase especially the socio-economic benefits. The negative impacts could be easily mitigated in both construction and operation phase to the effect through the Environmental Management Plan.

In addition, the Environmental Plan is meant to guide the Contractor that the identified negative impacts and measures to be undertaken are addressed accordingly minimize and mitigate adverse effects that will rise as the result of the project.

**PART B12 - PRICE/COST**

**12.1 Contract Type**

This is a firm fixed-price contract. For the consideration set forth below, the Contractor shall complete the work, and provide the deliverables or outputs described in this documentand comply with all contract requirements as set out by UNDP.

# **12.2 Schedule of price**

**Design-Build of Lusaka Warehouse - Phase 2**

Offerors shall break down their price proposal by major work elements, such as design, excavation, concrete work, steel frameworks, roofing, electrical systems, mechanical systems, water and sanitation installations etc., as may be applicable, in a logical and sound sequence and work flow. This should take into account the Offerors, intended methodology and schedule to carry out the works.

Assumptions and designs provided in **Appendices** are for illustrative and guidance purposes only. Offers are responsible for proposing and developing their own designs in line with the specifications and site lay out, provided in this document.

The list provided below is for illustrative purposes, therefore Offerors are responsible to include any major elements of work, not listed below, to fully respond to **the scopes of work affirmed in this document and its appendices.**

|  |  |  |
| --- | --- | --- |
|  | **Design-Build of Lusaka Warehouse, including alterations and renovations** |  |
|  |  |  |
|  | **Tender price break-up** |  |
|  |  |  |
| **1.** | **General** | **Price** |
| 1.1 | Design Development and Construction Documentation & Supervision |  |
| 1.2 | Environmental Compliance |  |
| 1.3 | Health & Safety requirements |  |
|  | **Sub total** |  |

|  |  |  |
| --- | --- | --- |
| **2** | **Construction of new Receiving and Bulk storage warehouse, Dangerous Goods Store** | **Price** |
| 2.1 | Preliminaries |  |
| 2.2 | Foundations |  |
| 2.3 | Ground Floor Construction |  |
| 2.4 | External Envelope & External finishes |  |
| 2.5 | Structural Frame |  |
| 2.6 | Roof |  |
| 2.7 | Internal Divisions and internal wall finishes |  |
| 2.8 | Floor Finishes |  |
| 2.9 | Ceilings and Soffits |  |
| 2.10 | Fittings |  |
| 2.11 | Communication & LAN System |  |
| 2.12 | Plumbing & Drainage |  |
| 2.13 | Fire installation & Protection |  |
| 2.14 | Electrical Installation |  |
| 2.15 | Mechanical installations: Warehouse HVAC |  |
|  | **Sub total** |  |

|  |  |  |
| --- | --- | --- |
| **3** | **Site Works/External works** | **Price** |
| 3.1 | Domestic water reticulation & installation |  |
| 3.2 | Sewer reticulation & installation |  |
| 3.3 | Storm water reticulation & installation |  |
| 3.4 | Roadways & Paved areas |  |
| 3.5 | Rainwater storage & reticulation |  |
| 3.6 | Electrical retaliation & Site lighting |  |
| 3.7 | General |  |
|  | **Sub total** |  |

|  |  |  |
| --- | --- | --- |
| **4** | **Construction of Northern and Western Boundary Wall (optional)** | **Price** |
| 4.1 | Preliminaries – Northern Boundary Wall |  |
| 4.2 | All trades – Northern Boundary Wall |  |
| 4.3 | Preliminaries – Western Boundary Wall |  |
| 4.4 | All trades – Western Boundary Wall |  |
|  | **Sub total** |  |

|  |  |  |
| --- | --- | --- |
| **5** | **Cost Summary** |  |
|  | **Total** |  |
|  | **Vat (not applicable)** |  |
|  | **Grand Total** |  |

**.**

**12.3 Insurance**

Contractor shall obtain all types of insurance that is required for the performance of this Contract.

**PART 13 – HIGH LEVEL PROJECT TIMELINE INCLUDING MHE FIT OUT – ANNEXURE A**