

PROTOTYPE DESIGN FOR A PHARMACEUTICAL INTERMEDIATE WAREHOUSE

ELECTRICAL INSTALLATIONS PROJECT DESCRIPTION

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1 INTRODUCTION

1.1 Context

The scope of this descriptive and supporting document refers to the detailed design of establishment of the electrical installations within the prototype design project that will be used to build approximately twenty-five (25) Pharmaceutical Intermediate Warehouse are planned to be built throughout the country, located inter-districts or provinces as suitable), in the most sustainable network to support nationwide health services. The project design in reference comprises the following installations:

- Distribution network and switchboards;
- Normal Lighting;
- Emergency lighting;
- General use outlet socket and equipment feeding;
- UPS sockets
- Telecom network and Data;
- Earthing protection;
- Fire detection and alarm System;
- CCTV;
- Access control

1.2 Feeding

The supply of electricity to the prototype pharmaceutical intermediate warehouse will be carried out in medium voltage 33kV/400V/250V, 11kV/400V/250V or 6,6kV/400/250V, depending on the places that will be chosen for the installation of the warehouses. From the low voltage general distribution Board - QGBT to be installed inside of the substation, through the distribution armed cables buried directly in the soil inside the hospital. Along the route will be established distribution cabinets that will divide the load by existing blocks.

The Power Transformer Substation will be housed type with the power of the 160kVA transformer.

The two generator sets will be of the soundproof type with power of 100kVA. The generator sets will run alternating and will be timed every 12 consecutive hours.

1.2.1 Standards and regulations in force

This project was carried out in accordance with the rules and regulations in force, in particular the "safety regulations of Electrical Energy utilization Facilities, such as:

- IEC, CPI (Portuguese Lighting Center);
- Safety regulations for low voltage distribution networks, (BT) (R.R.D.E.E.B.S.T.)
- Decree-Law Nº 46847/66, of 27 January;
- Safety regulations for electricity use (R.S.I.U.E.E.),
- Decreto-Lei Nº 740/74, de 26 de Novembro.

The Assembly notes, recommendations of suppliers relating to the installation or maintenance of electrical equipment, which will be considered as part of this specification;

- All standards, decrees and regulations of Mozambique and in the absence of these, the international standards or recommendations;
- Standards and recommendations of the Public of Local Power Distributor.
- ASHRAE 90.1- 2010 for energy efficiency;

1.2.2 As built design

The contractor must submit at the end of the work, new designs, in digital format, as well as three complete collections of drawings on paper, with the modifications made.

2 INSTALLATION

2.1 Low Voltage network

The distribution network of this hospital will be established in a radial way, and made up of armed cables, designated distributors (D1 ...) with two 0.6/1kV PVC sheaths. Get your start in the general low voltage DB (QGBT) of a transformation to be installed within the grounds of the hospital. Distribution cabinet are planned, properly installed in order to distribute energy to one or groups of buildings that make up the warehouse.

For forwarding of the distributors of BT to the cabinets and frames of buildings, will be provided for a conduit consists of PVC pipe Ø 100 mm, 6 Kgf/cm², buried in the soil to a depth of not less than 0,60 m, mainly in the streets, crossings interspersed by visiting boxes in changes of direction or near buildings, in order to facilitate the work of threading of electric cables.

2.2 Electric Network Characteristics

2.2.1 Low Voltage

- Rated Voltage : 400/231 V
- Nominal Frequency: 50 Hz
- Protection of Persons: TT Regime

2.3 Extention of the contract

Considered to be included in this contract all the works and supplies needed for the execution of the following facilities:

- Energy distribution network, consisting of distribution cabinet and derivations to connect several switchboards of the warehouse complex, including:
 - Ducts and fuse box;
 - Cabling electric and telecommunications network;
 - Excavations for cable stabliment;
- Earth network
- Tests and checks

The contract includes, all supplies, works and services explicit in parts designed, as well as, all supplies, works and services, which are implicitly considered Add-ons required for the execution of the contract, according to the best rules of art and in perfect technical conditions.

The premises behind indicated will be delivered fully equipped, properly tested, ready to work and conveniently connected to the distribution network.

2.4 Electrical loads

For the determination of load installed, was considered the plant of architecture and the consumption of each buildings of the project. The following table shows its escalation by bloc (building) inside the warehouse complex:

EDIFÍCIOS	TIPO DE CARGAS			
	NORMAL	EMERGÊNCIA	SOLAR	REDE DE UPS
Pharmaceutical Warehouse	33.238W	49.300W		7.400W
Toxic and Flammable Products Warehouse	4.300W	5.160W		
Workshop and Maintenance	2.663W	2.160W		

Power Substation		1.330W		
Guard House		2.275W		
Waste Disposal	1.500			
Outdoor lighting		5.000W		
Water pump		30.000W		

Installed Power 120826,00W

Taking into account the simultaneity Factor normally used in these case according to the safety regulations of collective installations of buildings and entrances . 64%, as mentioned above, we obtain:

Consumed Simultâneos Power 86.895,60W
Aparent power for $\cos \phi = 0.8$ 108619,50VA

3 NETWORKS

3.1 Distribution Network

The distribution network planned for this project will be developed in a radial way, and will be powered by two energy sources:

- Normal, supplied by the power transformer - PT;
- Emergency, provided by two generator groups in "standby", going into operation in cases of failure of the normal power supply system. These generator sets should run alternately every 12 hours, so the ATS will have a component programmed at the factory to start a generator in case of power failure of the network and work up to 12 hours. After 12 hours of operation, the ATS will send a stop signal of the first generator and start of the other generator that will operate in the next 12 hours and vice versa.

If a generator does not start, due to a problem, the other generator immediately starts operating.

There will be secured interlocks through ATS network switching units that will determine the input times of each type of energy

Within the warehouse facilities the network will be distributed in horizontal upright columns, all starting from the QGBT (the distributors) and its distribution cabinet - (ARM01). These in turn will receive power from the low voltage output at the transformation station and generator sets, observing the normal and emergency (generator) network exchanges through an ATS in cases of EDM's public network failure.

Distributors will be established on VAV-type cables and distributed on standard (EDM), emergency (GG) and stabilized (UPS) busbars.

The distribution network of the hospital it is broken down into:

SOURCES OF ENERGY

Código	Destino	Comprimento	Tipo e Secção	Origem
D0	QGBT-N	15m	VAV(3X95+70 mm2)	TRAFO
D02	ATS	15m	VAV(3X50+35 mm2)	QGBT
D02.1	ATS	15m	VAV(3X50+35 mm2)	GERADOR
D02.1	QGBT-E	15m	VAV(3X50+35 mm2)	ATS

MAIN DISTRIBUTORS NETWORK - NORMAL

Código	Destino	Comprimento	Tipo e Secção	Origem
D01	ARM01-N	70m	VAV3X50+35mm2	Do QGBT-N
E01	ARM01-E	70m	VAV3X50+35mm2	Do QGBT-E

3.2 Distribution network dimensioning

Distributors Cables from the QGBT-n/e

D1 . Supply power for distribution cabinet ARM01-N

Outlet type D1 . Cable to be used VAV 3X50+35mm2

Power be cosiderate 44.6kW / 55.7kVA

Power after introducing factor of simultaneity 28.5kW

Service Current Is 54.3 A

Worst Situation

Iz/cable 125 A

Type of core Cu

Maxime admissible Intensity 160 A

Circuit breaker (Fuse) DPXi (200A)

$u = L/S.I$ $u\%_{max} = 5\%$ $u_{max} = 11V$ $u = 0.017 \times (70/50) \times 54.3 = 1.29V$ satisfy the conditions of power drops ^a u

E01 . Supply power for distribution cabinet ARM01-E

Output type E01 . Cable to used VAV 3X50+35mm²

Power to be considerate 73.6kW / 92.0kVA

Power after allocation of factor of simultaneity 44.2kW

Servisse rated Current Is 84.2 A

Worst situation

I_z/cable 125 A

Type of core Cu

Maxime admissible Intensity 160 A

Circuit breaker (Fuse) DPXi (200A)

$u = \frac{L}{S} \cdot I$ $u_{\%max} = 5\%$ $u_{max} = 11V$ $u = 0.017 \times (70/50) \times 84.2 = 2.01V$ satisfy the conditions of power drops ^a u

Switchboards and Frames (distribution Boards)

Switchboards envisaged by the project for the floors and compartments, shall be carried out in steel sheet metal, 1 mm minimum thickness. Will be embedded ou external mounting and have explicit magazines drawn parts.

Switchboards the install should ensure all working-disruptive installations and must be prepared to receive food from three sources (normal network, emergency generator and solar group).

Access to equipment is always done through the front door and live parts shall be protected by a barrier of type "mirror".

The feeders of the switchboards will be made up of type H07V-U wires/TW, protected by RV type tubing.

The implementation of the management should be carried out in accordance with the diagrams in attachment.

All general frameworks set out the distribution of energy for the installation will be of type Cabinet, with tour of the front and incorporated in prefabricated boxes of the PRISM type G or similar, zincor steel coated with polyurethane for transparent, ensuring the casing a protection index not less than IP 43.

The scaling of the tables will be made to support all the circuits provided for their area of influence and further 20% booking at least equipped for future enlargements.

The circuits shall have thermal protection and individual, guaranteed by electromagnetic circuit breaker of the MERLIN GERIN marks, GENERAL ELECTRIC or LEGRAND, with power to cut less than 5KA under 380V.

The average differential protection sensitivity is usually guaranteed for groups of circuits, through differential switch, or individually, by means of differential circuit breaker where justified.

The location the switchboard is indicated on the drawing the installation.

All frames are equipped with ground bus, to which are connected the protective conductors, as well as the metallic structure of the framework.

4 FACILITIES INSTALLATIONS

4.1 Lighting

Indoor lighting

The lighting of the compartments is calculated to ensure a lighting level of 500 lux and 200luxes interior corridors, parking lots and 20 lux us 100lux abroad, will be the direct type, provided by armor equipped with lamps with LED/T5 technology of various powers, in sufficient number to ensure the lighting level above regulatory-view drawn parts.

he luminaire calculation provides for the replacement of LED lamps. In the meantime, an alternative of applying an integrated lighting (SOL + LED), consisting of a solar tube + LEDin system is planned. It involves the integration of LED lighting into the solar tubes, allowing efficient lighting 24 H per day. During daytime periods and with sunshine the lighting of space is all coming from the sun. As the night approaches or the day begins to get cloudy, the "Light Controller" console introduces power to the LEDs in order to keep the desired and selected Lux level constant. The implementation of this alternative will depend on the availability of the equipment in the market.

The power supply of lighting circuits will be buses of QE in switching with the emergency-powered buses through the pre-established timing through time switch.

In the context of the observance of the provisions in the ASHRAE 90.1, LEED regulations in the "open space" or in large rooms and compartments near the outer wall, the particularity of the lighting to be commanded by a light-sensitive switch Galax LSS multilevel/to multichannel global the same luminous intensity to desired levels in accordance with the external brightness.

So in these compartments the closest window lamps will light up or extinguish if the external brightness is greater than or less than the regulation . if the external brightness, is equal to or higher than the pre-set, the light-sensitive switch will turn off the lights this range and vice versa. The same will happen in the offices, where the next wall lamps will have a separate conduit with possibility of off site through a double switch.

The lighting installation in magazines will be performed on type V driver of 1.5 mm² section, protected by thermoplastic tube type VD with proper diameter with the exception of the main building where it will be wired on VV3x1,5mm² cable. All circuits must have a protective earth conductor.. All circuits must have driver installation protection (Earth).

The command will be place by means of simple/double switches placed according to the opening direction of the doors the 1.00 m of pavement.

Emergency lighting

The emergency lighting referred to in this draft is only the and security to ensure the movement of people and output indication in case of power failure the network, ensured by blocks autonomous type lamps.

Their feeding will be from the junction boxes of existing outlets on each floor.

Galery and outdoor lighting

Is also planned in this project an outdoor security lighting and movement along the corridors and the internal streets of the area belonging to the werehouse.

In this contest there are two options:

1 Solar - Exterior lighting shall be ensured by public lighting type lamps, equipped with new LED technology lamps over the pedestrian and vehicle circulation corridors of the hospital.

These lamps will be autonomous, receiving electricity from solar panels embedded in them and a photocell (CFE) for the automatic control of lighting.

2 Normal - Exterior lighting shall be ensured by public lighting type lamps, equipped with sodium vapor lamps 125W-250/LEDs along the pedestrian and vehicle circulation corridors of the werehouse.

Along the streets of access to scarce hospital, will be placed on lighting columns consisting of fiberglass poles with 7 m high useful.

The galleries will be guaranteed outside lighting through lamps of type "bull's-eye" equipped with energy-saving lamp E27/FD 2X9W.

4.2 Socket outlets and equipment feeding.

In previously established sites, single-phase and three-phase sockets are provided with earth pin which will be called the General driver installation protection-that part of the Earth buses in each frame, for General and specific in amounts determined in accordance with local needs. There are three types of circuits for power outlets in particular:

- Taken with a normal power circuits . intended for connection of cleaning equipment and any other service provider-general purpose outlets;
- Taken circuits with emergency power/solar-for the Office areas linking essential equipment:
- Taken with stabilized power circuits (UPS)-designed to connect sensitive electronic equipment-computers and security equipment;

The aforementioned circuits were designed to support loads not exceeding of 1.6 kW each and will be established in the type V of 2.5 mm² or above this value when the load justifies

In areas with risk of explosion or fire the circuits will be set in type VV/VHV cables, even in cases of embedded installation takes should be mounted in the equipment box 0.30 m from the floor except temporarily damp locations or otherwise. The cafeteria food outlets aimed at equipment will be established at 1.20 m of pavement.

The circuits of the single-phase and three-phase outlets in the warehouse area (main building) shall be run on VV / VHV type cables, placed in view and fixed by support brackets and placed on perforated metal mats.

The circuits of the UPS outlets will be run on VV cables, placed on perforated metal mats and on skirting boards and floor boxes.

4.3 Telephone and data network

This project includes the installation of a network of pipes and cables for telephones and Data with possibilities of intercommunication between the various blocks and storage compartments.

The installation will start in the general distribution box located in the guardhouse block, distributing in an upright column interconnecting the partial distribution boxes in each building, interspersed by block boxes.

The pipes that make up the network of pipes and cables are performed in TE1HEAV cable protected by PET polyethylene tube 50 mm, interspersed by crossing boxes 600X600X800mm masonry. Inside these buildings will be established in TVHV cable protected by appropriate diameter VD tubes.

To the data network/computers, was considered a flexible and scalable communications support, able to withstand the current requirements, as well as the new emerging technologies, namely FDDI/CDDI.

The network will have a star topology, whose centerpiece will consist of a rack cabinet, installed equipment, and assets and liabilities shall consist of a structured cabling system of type certificate for category 6e respecting international norms in force.

The extensions from the telephone exchange and hotlines from the splitter installation, General finish on the frame, also in distribution panels RJ45.

In this way the management of voice and data communications will be made through the "patching" on the frame.

The links between the GER and the frame, and between the telephone exchange and the frame shall consist of TVHV cable and the cables from the rack is of type UTP Cat6e of four pairs.

The circuits will be executed embedded in the walls protected by VD tubes and in technical protruding and floor rails, followed by the drawing of the respective drawings.

The telephone exchange, provide and install by the owner of the work, will have the capacity required for the requested network.

The sockets will be double connector type RJ45 e RJ11.

The feeding Telecom lines will be TDM responsibility.

5 ASSEMBLY RULES

5.1 Rectifications

Inside buildings . flush mounting type

The installation will be of fixed type hidden in walls, ceilings and floors, performed on plumbing fixtures consisting of established circuits in drivers of type V (formerly PBT) mechanically protected by thermoplastic tubes of type VD convenient section.

The plumbing of the lighting circuits shall consist of 1.5 mm² conductors of section, with the standard colours for phase conductors, neutral and Earth, protected by RV 20 mm tube, interspersed by embedded mounting junction boxes equipped with mechanical clamping Terminal boards, for the respective circuits derivations.

The boxes of equipment designed to receive the control devices of lighting will be placed according to the opening direction of the doors the 1.00 m from the ground and the 0.15 m of the door frame of the same.

In areas of possible use are provided for General and specific outlets, whose circuits are established in section 2.5 mm² conductors, with the standard colours for phase conductors, neutral and Earth, protected by RV 20 mm tube.

Single-phase outlets should be with earth pin, which is connected the driver protection, General who will go from the connector (ground bus) in electrical switchboards.

The boxes of equipment designed to receive the shots will be placed at 0.30 m of pavement, except those that are placed in areas temporarily wet or on countertops, in these cases will be placed the 1.15 m of pavement.

Apparatus boxes will be normal except when the point of discharge is to shunt the continuation of the circuit, which in this case should be a deep box.

The plumbing of the lighting circuits and outlets should be laid down as much as possible outside of the enclosures, junction boxes and passage, placed to 0.40 m ceilings.

Amendments shall not be permitted for drivers on the inside of the tubes-these should be carried out in places own or be in the junction boxes and passing, or tight turns with less than 90 degrees.

In sections with more than nine metres in length or after two consecutive bends must be interspersed junction boxes/passage to facilitate the threading/defilade for drivers.

Inside buildings – Surface mounting type

The installation will be fixed to the type seen in walls, ceilings, performed on pipes made of circuits established in drivers of type VV/VHV (former NYY/PBMR) mechanically protected by thermoplastic tubes of type VD convenient section on courses less than 1.15 m of pavement.

The plumbing of the lighting circuits shall consist of VV3X conductors 1.5/2.5 mm² cross section, with the standard colours for phase conductors, neutral and Earth, interspersed by embedded mounting junction boxes equipped with mechanical clamping Terminal boards, for the respective derivations of circuits and

fixed by means of clamp properly separated horizontally and vertically as well as before any control device or connection, in conformity with the rules in force.

The system intended for control of lighting will be placed according to the opening direction of the doors the 1.15 m of pavement and 0.15 m of the door frame of the same.

In areas of possible use are provided for General and specific outlets, whose circuits are established in section 2.5 mm² conductors or top section according to the respective circuit power, with the standard colours for phase conductors, neutral and Earth.

Underground reticulation

The plumbing fixtures outdoor lighting circuits and distributors will be made up of two cables underground sheaths and armour in steel type VAV. These pipes are to be laid down in ditches with 0.60 m depth based directly on the ground will be interspersed by underground 600X600X800mm crossing boxes and removable cover concrete.

Paths crossings areas with transit of vehicles, as well as on the route between the box and the column box in the building, the cables should be protected with concrete manholes, asbestos-cement or thermoplastic material of appropriate section so as not to be damaged by the pressure and land subsidence.

In the case of vehicle crossings areas the depth of burial should be 1.00 m.

In the trenches when based directly on the ground the first cables must be covered with "pillow" consisting of a layer of fine sand, on which is placed a sign by a warning device of wires made of metal mesh, plastic strips or slabs of concrete. On this layer will introduce the last layer of rubble formed by sand previously removed from the ditch.

6 PEOPLE AND PROPERTY SECURITY

All metal parts, lamps, armor and bolts of power equipment and general purpose that can accidentally come into contact with conductive surfaces must be properly earthed (grounded) power.

The electrodes must be of galvanized steel, copper or copper in the form of steel plates, rods or tubes.

Metallic elements simply dipped in water cannot be used with Earth electrodes. The metallic elements that serve as ground electrodes shall be buried in seats as wet as possible, preferably in soil outside the concourses and a considerable distance of deposits of corrosive substances that may infiltrate into the soil.

The electrodes should be placed vertically so that there is a difference of 0.80 m from the top of the electrode on the surface of the ground. The surface of electrode contact with the ground, whatever the manufacturing metal should not be less than 2 metres, so:

- If they are used in the form of plates, should be copper or galvanized steel of 2 or 3 mm.
- If they are in the form of bar should be 15 mm outside diameter r 1 meter long.

- If using copper tubing or galvanized steel, must have 25 mm outside diameter, 3 mm wall thickness and 3 meters long.

It will be installed the following earth system:

- General building earth protection;
- Telecom central earthing protection;
- Equipment earthing protection connected to the UPS and other active equipment;

For further informations see the technical specifications . Earthing System.

7 ELECTRONIC SECURITY INSTALATIONS

As part of this project, was provided for the active protection of the Pharmaceutical Intermediate Warehouse, a security system consisting of an alarm, CCTV and the input control system.

Supply and connection of the equipment shall be carried out by the Security contractor, and the contractor for electrical installations to ensure the coordination of the installation with this.

Maputo, November 24th de 2017

(Alexandre Mutemba, Eng.^o)



8 ANNEXES

8.1 Annex 1 – Substation Project Description



8.2 Annex 2 – Technical Specifications and brochures