

SECTION 45500 CABLING AND PIPING

45501 General

All underground cables shall be installed in PVC pipes encased in reinforced concrete or in cable trench if so directed. All manholes or hand holes shall be equipped with grounding conductors and ground rods.

The Contractor shall submit cable-selection calculations, which are based on sub-calculations for rating of protection device, maximum load, starting currents, voltage drop (max. 4.0% from transformer to ultimate loads, but 2.0% for gantry cranes and reefers), short circuit capacity, earth resistance. Information shall be reported in cable schedules and termination diagrams. Cable schedules shall be in approved format showing for each cable:

- Cable identification number
- "From/to" information showing the location of the two cable ends in separate columns by cubicle designation or device description with, where applicable, the device number as shown on the circuit diagram.
- Brief description of route, listing cable trays, trenches, etc. by identification number of letter.
- Details of cable (type, conductor size, number of cores, route length in meters).
- Type and size of cable glands.

45502 4.16 kV Power Cables

The power cables shall be of single or 3-core copper, cross-linked polyethylene insulated polyvinyl chloride sheathed type (XLPE PVC) with suitable cable terminals. The cables shall have metal shield or have semi-conducting tape and thinned copper wire shield. Chemicals for the protection of cables against termite shall be added to the sheath.

The following power cables shall be used for each circuit:

- Main circuit from 46/4.16 kV transformer
 - 400 mm² single-core x 3 to 4.16 kV switchgear cubicle
- Generator circuit from 4.16 kV switchgear cubicle
 - 100 mm² three-core to No.1 generator
 - 100 mm² three-core to No.2 generator
- Feeder circuit from 4.16 kV switchgear cubicle
 - 100 mm² three-core to gantry crane N0.1
 - 100 mm² three-core to gantry crane N0.2
 - 60 mm² three-core to 4.16/0.48 kV transformer No.1
 - 60 mm² three-core to 4.16/0.48 kV transformer No.2
 - 22 mm² three-core to 4.16/0.208-0.12 kV transformer

For the cables for the gantry-cranes, the connection work of the cables in junction box will be carried out by other Contractor. The joint kit for termination of the fixed cable to the flexible cabling is part of this contractor.

In order to the power cables, the following cable terminals shall be required:

Six (6) sets of single-core, 400 mm

Eight (8) sets of three-core, 100 mm²

Four (4) sets of three-core, 60 mm²

Two (2) sets of three-core, 22 mm²

45503
480 V Power
Cables

The power cables shall be of single or 3-core copper, cross-linked polyethylene insulated polyvinyl chloride sheathed type with suitable cable terminals. The cables shall have metal shield or have semi-conducting tape and thinned copper wire shield. Chemicals for the protection of cables against termite shall be added to the sheath.

The following power cables shall be used for each circuit:

From No. 1 Group

6 x 400 mm² single-core to 1,000 kVA transformer's secondary

100 mm² three-core to service outlet for crane in Container Berth

60 mm² three-core to service outlet for ship in Container Berth

60 mm² three-core to service outlet for crane in Multi-purpose Berth

60 mm² three-core to service outlet for ship in Multi-purpose Berth

100 mm² three-core to service outlet for ship in Passenger Berth

38 mm² three-core to flood light (T1, T2, T3, T4)

60 mm² three-core to flood light (T5, T6, T7, T8)

22 mm² three-core to flood light (T9, T10, T11, T12)

22 mm² three-core to flood light (T13, T14, T15, T16)

For No. 2 Group

6 x 400 mm² single-core for 1,000 kVA transformer's secondary

100 mm² three-core for reefer outlet (R1, R2, R3, R4)

100 mm² three-core for reefer outlet (R5, R6, R7, R8)

22 mm² three-core for street light, essential

22 mm² three-core for street light, non-essential

100 mm² three-core for Port Administration Building

100 mm² three-core for Container Freight Station

In order to the power cables, the following cable terminals shall be required:

Twenty four (24) sets of single-core, 500 mm²

Twelve (12) sets of three-core, 100 mm²

Eight (8) sets of three-core, 60 mm²

Two (2) sets of three-core, 38 mm²

Eight (8) sets of three-core, 22 mm²

45504
208-120 V

The power cables shall be of single or 3-core copper, cross-linked polyethylene insulated polyvinyl chloride sheathed type with suitable cable terminals. The cables shall have metal shield or have semi-conducting tape and thinned copper wire shield.

Power Cables Chemicals for the protection of cables against termite shall be added to the sheath.

The following power cables shall be used for each circuit:

- 6 x 500 mm² single-core to 500 kVA transformer secondary
- 250 mm² single-core to neutral circuit of 500 kVA transformer
- 200 mm² three-core to maintenance and repair shop
- 150 mm² three-core to container gate
- 38 mm² three-core to cargo gate
- 38 mm² three-core to power supply station
- 14 mm² three-core to fuel station

In order to the power cables, the following cable terminals shall be required:

- Twelve (12) sets of single-core, 500 mm
- Two (2) sets of three-core, 250 mm²
- Two (2) sets of three-core, 200 mm²
- Two (2) sets of three-core, 150 mm²
- Four (4) sets of three-core, 38 mm²
- Two (2) sets of three-core, 14 mm²

**45505
Cable
Installation
Materials**

45505.1 Cable Identification Tags

The contractor shall provide and firmly attach identification tags to each cable. Tags will have indelible written the appropriate cable number according the cable schedules.

45505.2 Cable glands

Cable glands shall be of the weatherproof compression type.

45505.3 Cable Ladders

Cable ladder systems shall be completed with horizontal bends, trees, inside and outside risers and all the necessities including splices, support brackets, hanger and clamps. Double hanger rods and rail support are acceptable. Cable ladders and accessories shall be preferably manufactured from aluminum. If manufactured from steel they shall be hot dip galvanized after forming and shall have rungs at a spacing not greater than 300 mm. Cable ladder rungs shall have slotted holes suitable for fixing cable with cable ties. The side rails of the cable ladders and all bends, risers, tees and similar fittings shall have a rolled or double return top edge of at least 10 mm diameter or width. Supports to be installed in a way that span deflection of cable ladders shall not exceed the ratio of 1 : 200.

45505.4 Perforated Cable Trays and Trench

Perforated cable trays shall be hot dip galvanized trays with edges, made from not less than 1.5 mm thick sheet steel. Cable tray/trenching systems shall be completed with horizontal bends, tees, inside and outside risers and all the necessary accessories including splices, support brackets, hangers, and clamps. Double hanger rods and rail support are acceptable. Weak-current-cabling, telephone/data cabling and power cabling shall be installed in separate compartments by means of galvanized sheet steel partition walls.

45505.5 Cable Ties

Nylon cable ties with a minimum tensile strength of 530 N are permitted.

45505.6 Trefoil Cable Cleats

Trefoil cable cleats shall be of non-magnetic materials, fitting the contours of the cable and securely anchoring the cable in the position. The cleats shall be capable of withstanding bursting forces of 4 kN to fault current in the cable.

45505.7 Cable Markers of Underground Cabling

All underground cabling shall be marked with yellow polythene warning tape, laid in the ground along the cables at a depth of approximately 100 mm above the cables.

45505.8 Supporting Steel Work

All supporting steel works shall be of adequate strength and hot dipped galvanized after manufacture.

45505.9 Cable Supports for Single Core Transformer Cables

Single core cables from transformer to 4.16 kV switchgear cubicle and emergency power generator to 4.16 kV switchgear cubicle must be supported by wooden blocks. Wooden blocks are installed in the concrete trenches and fixed to a metal frame for the riser cabling to the transformer. Distances and configuration of phase and neutral cabling shall be optimized for reducing magnetic fields.

45505.10 Bending Radius of Cabling

The bending radius of cables shall not be less than recommended by the manufacturer and in no case be less than 10 times the outside diameter of the cable.

45505.11 Fire Resistant Finishing

Where the cables cross fire resisting walls and floors, cabling, conduits and trays shall be finished with fire resistant compound with duration of 60 minutes. Specifications of compound shall be submitted for approval.

45505.12 Cable Entries Into Buildings

Where cables pass in or out of duct entries into or within buildings, these entries together with any spare ducts shall be effectively sealed against the ingress of moisture.

45506 Cable Installation

Installation of electrical cables in underground PVC pipes shall be as follows

45506.1 Cleaning

Ducts suspected or found to contain particles of soil, sand, gravel or other obstacles shall be cleaned by pulling a stiff bristled wire brush through the pipes.

45506.2 Pulling Work

All cables assigned for any pipe shall be pulled through simultaneously.

45506.3 Pulling Tension

Pulling tension of any cable shall be kept to be not more than the value in kilograms calculated by multiplying the conductor cross-sectional area in sq. mm by 0.0036.

45506.4 Care

Care shall be taken to avoid damage of the cable sheath.

45506.5 Cable Bending Radius

Radius of bend of the cable, during and after installation, shall not be less than 12 times of the cable outside diameter.

45506.6 Extra Cable Length

The Contractor shall allow enough extra cable length for termination and for cable training in manhole, if any.

45506.7 Cable End

Cable ends shall be kept sealed at all time during installation.

45506.8 Termination

Termination of high voltage cables shall be done as instructed by the terminator manufacturer.

45506.9 Cable Termination

No splice is allowed between electrical cable terminations.

SECTION 45600 AREA LIGHTING AND POWER OULETS

45601 General

Type of Lighting, position and length of masts and poles are indicated on the drawings. All outdoor lighting units shall be weather proof and saline pollution proof type. All lighting fixtures shall be furnished completely with ballast and capacitors for high power factor operation.

45602 Flood Light Mast

45602.1 Light Mast Structure

Structures shall be manufactured from structural steel to ASTM A-36, BS4360 or equivalent standard. All joints shall be securely welded. The masts shall be connected to the foundations by means of a base flange and holding down bolts with lockouts. The bolts and nuts shall be galvanized steel or cadmium plated steel to resist corrosion. Foundations are parts of this contract.

The masts and base flanges shall be protected against corrosion by hot dipped galvanizing. The mast shall be designed to withstand the design wind load and a maximum bending of 6%. Mast shall be equipped with an electric operated raising and lowering head frame (lighting on 360°). Dimension to be based on 6 floodlighting luminaries. The mast shall include an inside mounted distribution panel and switch panel. The mast shall be manufactured by Holophane-USA, Concrete Utilities--Great Britain, Petitjean-France, Hapulico-Vietnam or equivalent.

45602.2 Lightning Protection

Each mast shall be provided with a lightning protection system including air terminal, grounding conductor from the mast earth point, inspection with test joint, and a 3 meter copper clad ground stick.

45602.3 Foundation

Foundation shall be designed to withstand a wind load on mast of 120 Km/h (69 Kg/m²) and for which the Contractor shall submit calculations to the Engineer for approval. Piling shall be provided as necessary to suit the foundations proposed. Cable pipe entry must be included.

45602.4 Floodlight Fixtures

Fixture shall be 1,000W high-pressure sodium type and they shall be corrosion-resistant die cast aluminum alloy body with gray enameled finish or similar to the approval of the Engineer. They shall have hinged and removable clear, impact resistant UV-resistant covers with ozone-resistant gasket, weather proof type IP55; high purity polished anodized aluminum reflector; and preferable built in high power factor control gear, mounted on detachable interior reflector. The floodlight fixture shall deliver either a narrow beam or medium wide beam for the required light distribution and intensity as specified light level.

45602.5 Computer Calculations

The Contractor shall submit computer calculations with photometric data of the proposed floodlights, giving full calculations on the following to the Engineer for approval.

- Average of horizontal illumination on the container terminals and multipurpose areas: 25 – 40 lux
- Uniformity's in E(min)/E(av): $\square 0.4$

**45603
Road Lighting**

45603.1 Street Pole Structure

Street pole structures shall be manufactured from structural steel to BS4360 or equivalent standard. All joints shall be securely welded. Each column shall be provided with a weatherproof service door with a tamper proof lock. All locks shall be of the same pattern and 6 keys shall be provided for all units. Cabling shall be terminated on fixed terminal blocks. Luminaries shall be protected by means of fuses in phase and neutral. The columns and brackets shall be protected against corrosion by hot dipped galvanizing, according to ANSI/ASTMA 525-76. The columns shall be coated with an approved bituminous paint to a level of 250 mm above the base plate. The remainder of the exterior is coated with tropical grade red lead paint and zinc sprayed or silver bronze paint, to a total thickness of 540 microns.

The lighting poles shall have anchor base plates bolted to reinforced concrete bases and shall be able to withstand a design wind load as specified. The foundations are part of this contract.

45603.2 Street light fixture

Street light fixtures shall be 250 W high-pressure sodium type and they shall be corrosion-resistance die cast aluminum alloy body with gray enameled finish or similar to the approval of the Engineer. They shall have hinged and removable clear, impact resistance UV-resistance covers with ozone-resistant gasket, weather proof type IP54; high purity polished anodized aluminum reflectors; and built in high power factor control gear, mounted on detachable interior reflector.

45603.3 Computer calculations

The contractor must submit computer-calculations to show that installation will be accordingly the following design specifications.

- Lighting of access roads and parking : 10 – 15 lux
- Lighting of maintenance areas : 100 lux

**45604
Lighting Control
System**

The Contractor shall design and install a lighting control system that operates the flood lightings and the road lighting. The system shall consist of contactors and relays in lighting panels, multi-core control cabling to the power supply station. A control panel with pushbuttons and indicator lamps shall be installed in the station. The following automatic and manual switching possibilities shall be at least incorporated:

- Flood lighting: 3 levels (33%, 66%, 100%)
- Road lighting: 2 levels (50%, 100%)

Lighting contactors for use as main contactors for feeders or branch circuit, or each lighting fixture shall be mechanically held type with coil clearing contact, or electrically held type, as specified. The lighting contactor shall be rated to handle mixed loads consisting of a combination of lighting, resistance and motor loads. Voltage rating shall be 120 volts for single-phase unit and 208 or 480 volts for three phase units. Maximum continuous current rating shall be at least as specified on the Drawings. Coil voltage rating shall be as specified.

**45605
Photo-electric
Switches/Automatic
Time Switch (If**

Photoelectric switches shall be plug-in type with socket suitable for outdoor operation. Switches shall use highly sensitive CdS cells or phototransistors with quick-switching thermal relays or magnetic relays. They shall reliably and automatically switch on at sunset or when the level of illumination, fall below

Needed)

the desired standard during daylight hours and switch off at sunrise. The switch rating shall be at least 10 A at 480 volts for direct control of the flood light loads 6 or at least 3 A at 120 volts for use to control the contractor.

Automatic Time Switch shall have the following features.

- The time switch shall be quartz crystal oscillator synchronous motor drive operation suitable for 120 V AC +15-10%, 60 Hz, +10 degrees C. to 50 degrees C.
- The setting dial of this time switch shall complete one revolution in a 24 hour period. The minimum time setting is at 15 minute intervals over a 24 hour day. 48 ON operations and 48 OFF operations can be carried out in one 24 hour revolution.
- The time switch shall continue operation for 8 days after power failure occurs using a nickel cadmium storage battery back up. The precision during power failure shall be about +/- 4 seconds/8 days.
- There shall be an alarm buzzer when the time motor operation stop and pilot lamp will light for power supply confirmation.
- There shall be a test switch which can be turned ON and OFF for testing the wiring circuit regardless of the set time.
- The output contact shall be sp/st 20 A resistive load.
- Suitable for use in outdoor conditions.

45606

Power Outlet

45606.1 Reefer outlet

Reefer outlets shall be designed as the type described herein. They shall be of structured steel frame type with marine sockets for refrigerated containers. They shall be designed for outdoor use and all equipment shall be waterproof and watertight.

Eight (8) sets of reefer outlets shall be provided for 8 bank x 8 reefer container/bank = 64 reefer containers.

Location of the eight reefer outlets is shown on the drawings.

Each reefer outlets shall be complete with:

- 8 Nos. of 3-phase 480V, 15 A marine socket
- 4 Nos. of 3-phase 240V, 30 A marine socket
- One set of 3-phase 480/240 V, 45 kVA transformer
- One set of circuit breakers and bus-structure
- One set of wiring and piping

45606.2 Service Outlet for Crane

The service outlet shall be of structural steel frame type with one (1) Nos. 3-phase, 480 V, 50 A marine socket, circuit breaker, wiring and piping. They shall be designed for outdoor use, and all equipment shall be waterproof and watertight.

Three (3) sets of service outlet shall be provided and located in electric service

pits at Container Berth and Multi-purpose Berth, shown on the drawings.

45606.3 Service Outlet for Ship

Service outlet for ship shall be designed as the type describe herein. They shall be of structural steel frame type with marine sockets for power supply to ship and light beacons located at port area. They shall be designed for outdoor use, and all equipment shall be waterproof and watertight.

Four (4) sets of service outlets, consist of three kind A, B and C type, shall be provided and located in electric service pits at Container Berth, Multi-purpose Berth and Passenger Berth as shown on the drawings.

Two (2) sets of A type shall complete with:

- One (1) of 3-phase, 440V, 50A marine socket
- One (1) of 2-phase, 240V, 50A marine socket
- Three (3) of 1-phase, 120V, 16A marine socket
- One set of 3-phase 480/440V, 45 kVA transformer
- One set of 3-phase 440/240-120V (3 wire), 10 kVA transformer
- One set of circuit breakers and bus structure
- One set of wiring and piping

One (1) set of B type shall complete with:

- One (1) of 3-phase, 440V, 50A marine socket
- One (1) of 2-phase, 240V, 50A marine socket
- Three (3) of 1-phase, 120V, 16A marine socket
- One 440V connection circuit line
- One set of 3-phase 480/440V, 90 kVA transformer
- One set of 3-phase 440/240-120V (3 wire), 10 kVA transformer
- One set of circuit breakers and bus structure
- One set of wiring and piping

One (1) set of C type shall complete with:

- One (1) of 3-phase, 440V, 50A marine socket
- One (1) of 2-phase, 240V, 50A marine socket
- Three (3) of 1-phase, 120V, 16A marine socket
- One set of 3-phase 440/240-120V (3 wire), 10 kVA transformer
- One set of circuit breakers and bus structure

- One set of wiring and piping

SECTION 45700 FIRE ALARM SYSTEM

45701 Fire Detection System

45701.1 General

An automatically and manual Fire Detection System shall be installed, including: detectors, alarm panels and control panels according National Fire Protection Regulations (NFPA).

45701.2 System design

The contractor shall submit a design based on the following design considerations. The dark marked positions are the functional requirements for the specific rooms.

Description	Fire alarm combination panel	Smoke detector	Heat detector	IR detector	Hand push button
Port Administration Building					
Container Freight Station					
Maintenance and Repair Shop					
Container Gate					
Cargo Gate					
Power Supply Station					
Fuel Station					
Container Berth					
Multi Purpose Berth					
Passenger Berth					

For determination of detection-zones, the followings shall be taken into account:

- Automatic detector and hand push buttons shall be connected to different alarm circuits.
- For office buildings, a maximum of 1,000 m²
- For storage buildings and buildings with large rooms, a maximum of 2,500 m²
- Detection-zones shall not cover more than one floor, except for buildings with total floor area of 500 m² or less.
- Outside-installed hand push buttons shall be considered as one zone per above fire barrier.
- Main Fire Alarm and Monitoring panel shall be designed and equipped for connections of all port facilities at final phase.
- The Fire Alarm panel must activate automatic slow-whoops in relevant fire alarm zones in case of fire alarm.
- In principle, alarm-zone is identical to detection-zones and grouped by each building.
- On several layout drawings, fire alarm panel and detectors, etc are indicated. This information only can be used for contractors design drawings, but is not relevant for the tender documents.

45701.3 Slow-whoops

Slow-whoops installed at walkways and general purpose areas in the building, spacing to determined by contractor. They should have a sound level of at least 105 dB.

45701.4 Hand Push Buttons

Hand push buttons shall be located near fire hose reels/fire hydrants. In buildings where only fire extinguishers are located, this positions are also to be kept on for the hand push buttons. If located outside, a mounting frame has to be taken into account, and the equipment must be water- and weatherproof. They shall be furnished with glass plate, break point and protective foil, housing in a red color.

45701.5 Outside Hand Pushbutton

Hand pushbuttons outside on the berths and yards shall be mounted on the lighting masts and/or poles, or in cable pits for general service outlets. They shall be weather and saline-proof.

45701.6 Monitoring Panel.

A Monitoring panel near main fire alarm panel in Administration Building has to be installed, with a layout of the whole port and alarm/normal operation indicators for each fire zone. Included in this panel is the manual activating of slow-whoop-alarm for each building.

45701.7 Cabling

All cabling must be according the specifications of the manufacturer and selected according the way of installation to prevent damage and distortion. Cabling between buildings shall be equipped with surge-arrestors.

45701.8 Power Batteries

The fire alarm panels shall be provided with emergency power batteries for a duration of 24 hour emergency operation, control outputs, storing of events, modem for communication with an alarm post via telephone lines to the Port Authorities and/or the Municipal Fire Brigade, interface for printer.

45701.9 Smoke/Heat Detectors

Smoke/heat detectors shall have visible alarm indicator on the detector. If they are installed in individual rooms, parallel alarm indicators shall be installed in the corridor.

45701.10 IR Detectors

Infrared beam detectors, consisting of transmitter and receiver, for storage-areas must be selected according the environmental conditions and the limits of the detectors.

SECTION 45800 TELEPHONE/DATA NETWORK

45801

Telephone network

45801.1 General

A telephone network shall be designed, supplied, installed and tested. The installation consist of:

- Connection to public network
- A PABX including programming, programming station and software, operating terminal.
- Main Distribution Frame for connection of public network, connections from PABX and backbone telephone cabling. Over voltage protection must be included.
- Internal Distribution Frames in each patch panel in the several buildings for connection of telephone backbone cabling and cabling to connections.
- Integration of UHF communication.

45801.2 Number of Lines

The number of incoming/outgoing lines : 30

The number of in-house lines on the Site shall be 160 - 180

45801.3 LSA Terminal Block

All incoming/outgoing lines, in house lines and cabling from PABX must be connected on LSA terminal blocks in a Main Distribution Frame. Surge arrestors have to be incorporated.

45801.4 Location of PABX

The location of the PABX exchange is in Telephone Room on third floor of the Port Administration Building.

45801.5 UHF Mobile Phones

In the PABX, a device and further equipment should be incorporated for 20 UHF mobile phones on the site.

45801.6 Cabling

The cabling from the patch panel cabinets in the buildings to the connections shall be in UTP-CAT5 with RJ45 (CAT5) outlets. See the list of connections and patch panel-cabinets in the description of the data network (Sub-section 45802.2). On Communication System drawings, communication outlets are indicated. This information only can be used for contractors design drawings, but is not relevant for the tender documents.

45801.7 Digital Information

The PABX must be able to handle digital information.

45801.8 Telephone Sets

20 standard telephone sets shall be supplied and installed

45801.9 Industrial Type Telephone Sets

20 heavy duty, industrial type telephone sets shall be supplied and installed

45801.10 Alarm Bells

Alarm-bells for attendance of telephone calls in workshops, maintenance area's including 120 V power supply shall be supplied and installed.

45802 Data network

45802.1 Scope of Works

The data network shall be designed, supplied, installed and certified according UTP CAT 5 specifications. The works shall be done by a Certified/Approved Installer, in order to get at least a system guarantee from 5 year from an international recognized supplier.

45802.2 Design Submit

The contractor shall submit designs for:

- Backbone system consisting of fiber optic cable for data-backbone and multi core quad copper cable for telephone system.
- Patch panel-cabinet-layout, including position of horizontal patch panels, vertical patch panels, HUB's, switches and multiple socket power supply, grounding terminal.
- Layout drawings of yard and buildings with cable-routing and location of patch-panels and connections.
- For the contract the following connections and panels have to be taken into account: each UTP connections = 2x data or 2x voice or 1x data/1xvoice

Building	Building Description	Nr. of UTP Outlets	Nr. of Patch panels cabinets
Port Administration Building	First floor	29	2
	Second floor	33	2
	Third floor	20	2
	Fourth floor	2	1
	Fifth floor	9	1
	Sixth floor	10	1
Container Freight Station	First floor	2	1
	Second floor	8	
	Cargo Area	3	
Maintenance & Repair Shop	First floor	3	1
	Second floor	6	
	Equipment Maintenance Area	3	
Container Gate	Gate Offices	6	
	Weigh bridge Offices	4	1
	Duty Staff Room (second floor)	2	
Cargo Gate	Gate Offices	2	
	Weigh bridge Offices	4	1
	Duty Staff Room (second floor)	2	
Power Supply Station	Office, Transformer Rooms	4	1
Service House (Water Purification and Tank)	Office	1	
Service House (Deep Well)	Office	1	
Service House (Waste Water Treatment No1)	Office	1	
Service House (Waste Water Treatment No2)	Office	1	
General	General service outlets – Container Berth, Multipurpose	15	

Building	Building Description	Nr. of UTP Outlets	Nr. of Patch panels cabinets
	Berth and Passenger Berth		
	Total number:	171	14

On Communication System drawings, communication outlets are indicated. This information can be used for contractors design drawings.

45802.3 Patch Panels

The patch panels-cabinets shall include the necessary patch panels, patch cords, Ethernet HUB's and switches, multiple power sockets. The cabinets suitable for installation of 19" based equipment, front door must be transparent. Free standing cabinets with a height of maximum 2m, to install on a base frame.

45802.4 Wall Outlets

The connections must be RJ 45 according TIA/EIA 568 A installed in wall outlets next to wall outlet for power supply.

45802.5 Server Equipment

The following server equipment, workstation and UPS shall be installed:

- LAN server according Compaq Proliant 6000 specs or equivalent, including net card UTP controller, array controller, DAT drive, CD-ROM drive, 1.44 Mb FDD, monitor, keyboard, mouse and glass filter.
- Workstation according Compaq Deskpro EP specs or equivalent, including monitor, keyboard, mouse and glass filter.
- UPS 1.000 VA- 120 V/1 phase/10 minutes
- UPS 2.200 VA- 120 V/1 phase/10 minutes
- Software running on Ethernet, intermediate cabling, power supplies and testing.

45803

VHF

Communication land

45803.1 Mobile Phones

In the PABX, a device and further equipment shall be incorporated for 20 mobile phones on the site. The contractor shall provide 20 mobile phones. The VHF transmitting radius of communications shall not be less than the fairest point of the site, up to and including final phase. The transceivers to be supplied with battery charger and two batteries. Configuration for transmitters may consist of:

- 2 base stations based on 2 channel system for 10 mobile users
- Each base-station will consist of TX/RX antenna, controller, TX combiner and RX multi-coupler with 2 lines connected to PABX
- Communication must be possible as:
 - From mobile phone to each mobile phone
 - From mobile phone to internal fixed telephone connections
 - From mobile phone to public network for emergency calls

45803.2 Location of Transmitters

Location of transmitters to be determined after measurements, which have to be

submitted for approval.

45803.3 Operating Terminal

Operating terminal nearby telephone operating terminal in the Port Administration Building.

45803.4 Installation

Installation shall include all the necessary cabling, low voltage power supplies, over voltage-protection, cost for licenses.

45803.5 Approval

Equipment and installation must be approved by the SIGET, Department Radio frequency Management. Manufactured by Motorola or equivalent.

SECTION 45900 ELECTRICAL WORK FOR BUILDINGS

45901 Lighting Fixtures

45901.1 Types of Lighting Fixtures

Lighting fixtures shall be supplied and installed as indicated on the Drawings and following fixtures are included:

- a) Type A : Fluorescent fixture 4' x 2', 3 x 32 W, 120 V, recessed in ceiling
- b) Type B : Fluorescent fixture 2' x 2', 2 x 22 W, 120 V, recessed in ceiling
- c) Type C : Fluorescent down-light 2 x 26 W, 120 V, recessed in ceiling
- d) Type D : Fluorescent rounded fixture, 32 W+40 W, 120 V, surface mounted
- e) Type E : Incandescent fixture 1 x 60 W, 120 V, surface mounted
- f) Type F : Fluorescent fixture, industrial, 4 x 32 W, surface mounted
- g) Type G : Metal halide fixture 100 W 120 V, recessed wall light
- h) Type G1 : Metal halide fixture 100 W 120 V, recessed wall light
- i) Type I : Fluorescent 2 x 32 W, 120 V, wall mounted emergency light
- j) Type J : Fluorescent 2 x 32 W, 120 V, high abuse light
- k) Type L : Fluorescent 4 x 32 W, 120 V, wrap around, surface mounted
- l) Type L1 : Fluorescent 3 x 32 W, 120V, wrap around, surface mounted
- m) Type M : Metal halide 400 W, 208V, high bay, industrial
- n) Type N : Metal halide 175 W, 208 V, low bay industrial
- o) Type N1 : High pressure sodium 150 W, 208 V, low bay industrial
- p) Type Q : Metal halide 400 W, 208 V, high mast
- q) Type T : Fluorescent fixture 32 W, 120 V, outdoor, wall mounted
- r) Type X : Light emission diode Exit Light, 120 V

45901.2 Fluorescent Lamp and Accessory

Fluorescent lighting fixtures shall as far as possible be locally made by a manufacturer with at least 5 years experience as approved by the Engineer. The samples of the lighting fixtures shall be submitted for approval before proceeding with the manufacturing. The body of the fluorescent lighting fixture shall be made of steel sheet, which is clean and rust free and the fixture include polished aluminum reflectors. The sheet steel shall be treated against rust and painted with baked enamel or power epoxy paint. The thickness of sheet steel shall be sufficient to provide adequate body strength and so it cannot be easily twisted. Thickness of the sheet steel shall not be less than 0.5 mm for 22 W fixtures and 0.8 mm for 26 W and 32 W fixtures. Wiring inside shall not be smaller than 0.5 sq. mm. Wires and ballast shall be concealed inside the body. Fluorescent ballast shall be high power factor type, by Lithonia, Hubbell, Osram, Bosch, Philips, National or equivalent approved. Fluorescent lamp base and starter base shall be by Lithonia, Hubbell, Osram, National, Philips, Thorn, Toshiba or equal approved. Fluorescent lamps shall be daylight type made for the type of ballast specified. Fluorescent lamps shall be as specified, or energy saving type. Other types of lamps shall be used as specified.

45901.3 High Intensity Discharge (HID) Lamp and Accessory

HID lamps shall be high-pressure sodium or metal halide as specified.

- HID fixture shall use "X" series lamp base with appropriate voltage rating for the

type of lamp used.

- Lighting fixtures used outdoor and in damp or wet locations shall be approved weatherproof type.

45901.4 Computer Calculation

The contractor must submit computer-calculations to show that installation will be accordingly the following design specifications.

Room	Lighting level E (average) lux	Room	Lighting level E(average) lux
ADMINISTRATION BUILDING		OTHER BUILDING	
Office room	500	Cargo check area	50
Auditorium	500	Maintenance area	200
Corridors	200	Inspection area	200
Staircase	200	Gate	100
Entrance	200	Parking area	50
Cafeteria	300		
Toilet	200		
Kitchen	150		
Machine room	150		

45901.5 Emergency lights

The emergency lighting shall consist of lighting luminaries of the self-contained type, fully automatic in operation, providing instant illumination in the event of a mains failure. The battery shall be of the maintenance free, long life (guarantee for 5 years), Ni-Cd type and have capacity for a period of 3 hours for full load operation. Positions are indicated on the Drawings. These shall be additional units for utility rooms so as 4.16 kV switchgear cubicle room, generating room, pump room, computer room and Port communication room.

**45902
Switches and
Outlets**

45902.1 Switches

General switches shall be in accordance with NEC Art. 380 for incandescent and gas discharge lamps or small motors. It shall be rated for at least 10 amperes at 120 volts, and 2-pole 240 volts. It shall be silent or low-noise rocker-operated type. General switches shall be of the same make as general receptacles.

45902.2 General Receptacles

General receptacle shall be duplex grounding convenience receptacle rated for 10 amperes at 120 volts.

45902.3 Switch and Receptacle Cover Plate

For grounded switches and receptacles (by using metallic conduit or grounding conductor), anodized aluminum or brushed stainless steel cover plate shall be used unless specified otherwise. If they are ungrounded, unbreakable plastic cover plates shall be used. Cover plate shall be made by the switch and receptacle manufacturer unless specified otherwise by the Engineer. Cover plates for outdoor or wet locations shall be weatherproof type made of cast aluminum or zinc with spring cover and ozone-resistant gasket. For underground type, weatherproof unbreakable plastic cover plate shall be used

**45903
Panel-board**

45903.1 Panel-boards

Panel-board shall be in accordance with NEC Art. 384 or may be in accordance with El Salvador standard. They shall be safety dead front installed as free standing or against the wall. If installed against the wall, they shall be front accessible units only.

The panels may be locally assembled by a firm with at least 5 years continuous experience in the assembly of the switchboards and panel boards, and shall have an approved licensed electrical engineer to supervise the works. The Contractor shall submit the name and experiences of such firm for approval by the Engineer before placing the order. The bus bars shall be rated for 600 volts with current rating at least as specified at the ambient temperature of 40 degrees C. Short circuit rating shall meet NEMA or VDE, but not less than as specified. The bus bars shall be color coded with suitable paints. Sheet steel used for the enclosure shall be at least 1.6 mm in thickness and shall be treated against corrosion then finished with baked enamel. The front panels shall be equipped with hidden hinges and suitable flush mounted latches. Instruments as specified shall be installed in a separate chamber. For panel-boards, the circuit breakers shall be plugged-in or bolted-on directly to the bus bars. A minimum of 20%, of total, spare circuits shall be available at the time for approval of final Shop-drawings.

45903.2 Circuit Breakers

The circuit breakers used in the panel-board or at other place such as at the main of the load center, shall have fixed or adjustable over current trips as specified. They shall have instantaneous short circuit trips with at least 10 kA interrupting capacity at the rated system voltage but shall not be less than rating specified and shall be able to withstand the short circuit current at the point installed. The frame size of the circuit breaker shall not be smaller than the specified size. Disconnecting switches, if used, shall be Molded Case Switch (MCS) without automatic tripping or load-break switch using spring assisted mechanism. Where necessary, earth-leakage devices shall be installed according international regulations.

45903.3 Instruments

Instruments shall be IES Class 1.5 accuracy or better and shall not be smaller than 72 mm x 72 mm. Fuses for control circuits and protection of instruments shall have interrupting capacity of not less than 50 kA. The fuse shall use E27 bases. Voltmeter selector switch (VS) shall have 7-positions. Ammeter Selector switch (AS) shall have 4-positions. Indicator lights shall be neon lamp using E14 bases or low voltage lamp for 120 volts. Lenses for indicator lights shall be red or clear plastic. The lamps shall be easily replaceable.

45903.4 Protection

Phase and under voltage protection relay shall be solid-state type made by Fanal, Starkstorm, Omron CVP-2-S3 or other approval equipment.

45903.5 Surge Arrester

Surge arrester shall be valve type made by Joslyn, GE, Siemens, Fuji, Starkstorm or other approved equivalent. They shall be selected to suit the system voltage used and shall be properly grounded.

45903.6 Drawings

Before the manufacturing of panel-boards, the Contractor shall submit construction and layout drawings for approval of the Engineer. The manufacturing of the panel-boards shall not start before final approval has been obtained.

45903.7 Circuit List

At time of completion, a type written circuit list shall be fitted in all panel-boards, mounted in transparent envelopers and the list shall indicate which circuit each miniature circuit breaker or fuse controls, the function of the circuit and the size of the fuse or miniature circuit breakers used.

45904
Load Center

45904.1 Construction

Load center shall be circuit breaker type in accordance with NEC Art.384b for use with 208/120 V, 3 phase, 4 wire systems. It shall be equipped with neutral terminals and grounding terminals. The rating of bus-bars shall not be less than 100 amperes for load center with up to 20 spares and not less 200 amperes for load center with more than 20 spares. Short circuit rating shall be at least 10 kA but not less than NEMA standard. Circuit breaker shall be plug-in or bolt-on type installed directly on the bus-bar and shall be easily removable without removing other circuit breakers or disassembling the load center. The frame size shall not be smaller than 50 amperes. It shall have over current trip and instantaneous short circuit trip with interrupting capacity of not less than 3 kA at 120 volts for single pole and at 208 volts or 480 volts for three poles, or as specified otherwise in the Drawings. The front panel shall have doors which can be closed and open easily and robust latches. Main switch, if specified, shall be Main Circuit Breaker (MCB) or disconnecting switch.

45904.2 Construction and Layout Drawings

Before the manufacturing of the panels, the Contractor shall submit construction and layout drawings for approval of the Engineer. The manufacturing of the panels shall not start before final approval has been obtained.

45904.3 Circuit List

At time of completion, a type written circuit list shall be fitted in all panels, mounted in transparent envelopes and the list shall indicate which circuit each miniature circuit breaker or fuse controls, the function of circuit and the size of fuse or miniature circuit breakers used.

45905
Safety Switch

Safety switch shall conform to NEMA standard with ratings specified at 480 volts or higher, which shall be able to disconnect motor load. NEMA 1 General Duty type shall be used. If specified otherwise, NEMA 3R, 4, 4X, 12 or Heavy Duty type shall be used.

45906
Magnetic Motor Starter and Contactors

If applicable, magnetic motor starter and contactor shall be silent or low-noise type conforming to IEC 158, Class AC3 for standard motor operations or Class AC4 for motor control with inching and plugging operations and shall be equipped ambient compensated thermal overload relays for all poles. Maximum voltage rating shall be at least 120 volts for single-phase unit and 208 or 400 volts for three phase unit.

45907
Wiring and Conduit

45907.1 General

All surface wiring shall be twin flat PVC insulated jacketed copper conductor with one additional 2.5 sq. mm grounding conductor if not otherwise indicated on the Drawings.

45907.2 Metal Conduit

All exposed conduits installed at a height of 2,500 mm or higher shall be galvanized steel Electrical Metallic Tubing (EMT), those below such height shall be galvanized steel Intermediate Metal Conduit (IMC) unless otherwise specified on the Drawings.

45907.3 Grounding

Lighting fixtures, switches, receptacles and telephone jacks shall be grounded with grounding conductors or conduit running to the panel-board or load centers.

45907.4 Wall Plates

All wall plates for switches and receptacles shall be stainless except for outdoor and damp or wet locations. The wall plates for outdoor and damp or wet location shall be weatherproof type and shall be die cast zinc with spring covers and ozone resistant

gasket unless otherwise specified on the Drawings.

45907.5 Type and Size of Conductors

- Conductors for general branch circuits and those connected to general receptacles shall not be smaller than 2.5 sq. mm or as otherwise specified.
- Conductors 10 sq. mm or larger and branch circuit conductors for general receptacles shall be rated for 75 degrees C.
- Conductors for each lighting fixture and the switch of each lighting fixture shall have sufficient capacity to carry the load but not smaller than 2.5 sq. mm.
- Conductors used inside general lighting fixtures shall be at least 0.5 sq. mm. Conductors with high temperature rating shall be used for connection to high wattage lighting fixtures.
- Conductors exposed to sunlight shall have black ozone resistant insulation.
- Conductors in raceway above grade shall be single insulated conductors except grounding conductors, which may be bare conductors.
- Non-metallic sheathed cable shall be used for exposed works. Conductors installed underground whether in conduits or direct burial in the earth shall be special non metric-sheathed cable suitable for direct burial in the earth.

45907.6 Conduits for Power and Communication

Steel conduits shall be galvanized steel electrical metallic tubing (EMT) as per NEC Art 348, intermediate metal conduit (IMC) as per NEC Art. 345 and rigid metal conduit (RSC) as per NEC Art. 346. Flexible steel conduits shall be liquid-tight flexible metal conduit (galvanized steel) as per NEC Art. 351A, or if used in the plenum space or under raised floor, National Hi-Flex white or approved equal may be substituted. All conduits shall be approved by the testing institution acceptable to the Engineer to ensure that they conform to the relevant standards. Conduit clamps, coupling, connectors, hangers, and other accessories shall be galvanized steel.

45907.7 Boxes and Fittings

Boxes and fittings shall be galvanized steel or aluminum, or non-metallic as per NEC 370. Non-metallic boxes shall be used for non metallic-sheathed cable, or non metallic conduits. If metallic boxes are used, they shall be grounded with appropriately sized grounding conductors. Boxes and fittings installed outdoors or in wet location shall be watertight type approved for use in such locations.

45908 Lightning Protection System

45908.1 General

Lightning air terminals shall be copper or copper clad steel approved for use as lightning air terminals. They shall be mounted on galvanized steel pipe, at the height specified. All lightning air terminals shall be bonded together and to all metric parts on the roof.

45908.2 Down Conductors

Down conductors shall be copper conductor of 50 sq. mm as minimum. Splicing and bonding of conductors shall be done by compression connectors or by thermo-weld. Down conductors shall be connected to the ground grid. Down conductors shall be attached to the building with insulated clamps. From the point 300 mm above ground level downward, the conductor shall be protected by PVC conduit.

45908.3 Structures

The structure shall be able to withstand the design wind velocity.

45908.4 Standard

Lightning protection system shall conform to BS standards or approved equal.

45908.5 Grounding Resistance

Grounding resistance of the system shall be less than 10 ohm.

**45909
Others**

45909.1 Scope of Contract

The Contractor shall include for all facilities and accessories not specified or shown on the Drawings but which are required for commissioning and operation of the facilities.

45909.2 Spare Parts

The Contractor shall provide approved spare parts covering two years operation of all electrical works.

