

PART 6: TECHNICAL CONDITIONS

Section 6-7 CONTROL, METERING AND PROTECTION EQUIPMENT

6-7-1 66 kV CIRCUITS

The operator control board will consist of several panels for the control and metering of the 66 kV circuits while a separate relay board will be supplied for these circuits.

The control switches and the indicating, recording and integrated measuring instruments will be surface flush mounted on the front board and panels.

The control board and protection board will be totally enclosed and construction of sheet steel and painted with a rust resisting paint followed by two coats of heat-treated, light green paint.

All measuring instruments will be of the switchboard square type, having accuracy of class 1.5 % however supply meters will have an accuracy class according to IEC.

The 66 kV circuit breakers and isolating switches shall be remote operated both from the operating control board and from the controlling panels in front of 66 kV bays, as well as manually for emergency purposes.

The control switches on the front of the control board will be incorporated in a mimic diagram with indicating lamps to show the position of circuit breakers and isolating switches.

Name plates and cables for the control switches written in Arabic and English shall be provided.

6-7-2 66 kV MEASURING AND CONTROL INSTRUMENTS

The following instruments shall be at least installed.

A. 66 kV overhead transmission line feeders

- a. Three ammeters (range 0-800 amp)
- b. Voltmeter with selector switch (range 0-80 kV)
- c. Operating switches
- d. Position indicators for disconnecting switches for circuit breakers and isolating switches
- e. All necessary auxiliary relay contactors and other auxiliaries
- f. Watt-hour meter with 15 minutes max demand indicator
- g. Var-hour meter

The instruments shall be designed considering the flow of power in both directions.

B. MAIN TRANSFORMER

- a. Three ammeters (range 0-400 amp)
- b. 3-phase, 4 wires recording wattmeter
- c. 3-phase, 4 wires indicating wattmeter (0-30 MW)
- d. Watt-hour meter with 15 minutes maximum demand indicator
- e. Var meter (0-30 MVar)

- f. Var-hour meter
- g. Winding temperature indicator
- h. Oil temperature indicator
- i. Tap position indicator
- j. Alarm devices for temperature
- k. Position indicator for disconnecting switches for circuit breakers and isolating switches

C. BUS BARS AND BUS BAR COUPLER

- a. Mimic Diagram for the double bus bars and circuits connected to it
- b. Four voltmeters corresponding to each bus bar section a selector switch will be supplied for each voltmeter (0-80 kV)
- c. Three ammeters (0-1000 amp)
- d. Position indication for disconnecting switches for circuit breakers and isolating switches

6-7-3 11 kV CIRCUITS

The 11 kV control circuits, measuring instruments and protective relays shall be provided on 11 kV cubicles.

The instruments and protective relays shall be flush mounted on the front of the 11 kV cubicles.

The measuring instruments shall be of accuracy class 1.5 % and of square shaped, however supply meters will have an accuracy class according to IEC. Each cubicle shall carry on its front a mimic diagram incorporating with the control and operating switches.

6-7-4 11 kV MEASURING AND CONTROL INSTRUMENTS

A. 11 kV OUTGOING FEEDERS

- a. One ammeter
- b. 3-phase kWh meter
- c. Operating switches
- d. Position indication for disconnecting switches for the circuit breaker

B. MAIN TRANSFORMERS

- a. Three ammeters
- b. One voltmeter with selector switch
- c. Operating switches
- d. 3-phase kWh meter

6-7-5 PROTECTIVE EQUIPMENT

(1) GENERAL

In case of failure of DC supply to any of the protections and devices, mentioned hereinafter

irrespective of the reason, an acoustic and visible alarm signals shall be actuated. Provision shall be also made for principal and erection connection diagrams for the said panels.

(2) REQUIREMENTS OF INSTRUMENT TRANSFORMER'S SECONDARY CIRCUIT AND DC TRIPPING CIRCUITS

A. CURRENT TRANSFORMER'S CIRCUITS

All current transformer's (CT's) secondary circuits shall be labeled at the local control panels and control/relay boards to indicate for each wire the equipment or apparatus to which it is connected.

All CT's secondary circuits shall be equipped with bridges at local control panels, control/relay boards such that any secondary current can be measured without open circuiting its circuit. Check zone and discriminating zones of 66 kV bus bar protections shall be connected to different CT's cores.

Main and back up protections of transformers 66/11 kV shall be connected to different CT's cores.

B. POTENTIAL TRANSFORMERS SECONDARY CIRCUITS

All potential transformer's (PT's) secondary circuits shall be labeled at the local control panels and relay boards to indicate for each wire the equipment and numbers to which connected.

AC secondary voltage shall be connected to different protections directly from terminal blocks and bridging between different protections shall be avoided.

Automatic switches placed as near as possible to PT's shall protect the PTs.

The said switches shall be provided with suitable protection elements.

The operating time of this element shall be smaller than basic operating time of distance protections.

The switch shall have contacts for the secondary voltage contacts for DC supply to distance relays and signaling contacts.

The design of the switch shall ensure that when switched off or on, the DC circuit shall be interrupted before the AC circuits and closed after it.

The signaling contacts shall actuate visible and acoustic alarm signal when switched off.

C. DC SUPPLY TO PROTECTION AND TRIPPING CIRCUIT

Every control or protection panel shall be equipped with miniature DC switches having signaling contacts to actuate visible and acoustic alarm signal when switched off.

Not any protections of the same circuit shall be supplied from the same miniature switch.

6-7-6 TYPE OF PROTECTION FOR 66 kV CIRCUITS

A. 66 kV OVERHEAD TRANSMISSION LINE FEEDERS

(1) DISTANCE PROTECTION

The protection shall be with 3-zone distance protection

The protection shall have multi-measuring elements for phase faults and earth faults

The operation characteristics of the protection shall be flexible in order to suit the different selectivity requirements during various system conditions i.e. discrimination between normal load and fault condition, directional measurements.

The distance measurements shall be accurate at high and low source impedance and with small transient overreach.

The current or potential transformer transients shall not materially affect the accuracy of measurements.

The protection shall be cross polarized and incorporates a memory circuit and provision for setting earth factor.

The protection shall be able to carry two times the rated current continuously.

The protection shall be able to correct performance if the current is only 20 % of rated current.

The protection shall be suitable for three phase automatic re-closing.

The protection shall have flag and corresponding signaling open contacts for indication of starting each phase and the step of operation.

The protection shall have provision for blocking the protection in case interruption of AC secondary voltage.

Basic time of operation shall not exceed 30 millisecond.

(2) DIRECTIONAL EARTH FAULT PROTECTION

The protection shall consist of two steps with definite time lag (two Open-Close elements and two timers)

Range of current setting shall cover the range from 5-10 amp

Range of time setting shall be from 0.3 seconds

B. PROTECTION OF THE 66 kV BUS COUPLER

Three phase over current protection with definite time lag relay (0.3-5 sec)

C. 66 kV BUS BARS

The protection shall be of the high-speed differential type, which fulfils the following

a. Selective for each section of the bus bar, having separate zone of protection for each section of bus bars, with directional comparison.

b. Selective to all types of faults at all operating conditions having automatic and manual test facility.

c. Very stable and have no tendency to operate for faults outside the bus zone for values of current up to the interrupting rating of the switchgear.

d. To sound an alarm in case of open circuit in current circuits and to block the tripping order in such case.

e. Static relays for ambient temperature 45°C is preferable and will be taken into consideration.

D. BREAKER FAILURE PROTECTION FOR 66 kV CIRCUIT BREAKERS

Each circuit breaker of the 66 kV circuits shall be equipped with breaker failure relay. The relay shall incorporate three current measuring elements with normally open contacts and a timer.

The measuring elements shall be three and measures continuously 2 phase current of the circuit.

The timer shall be started by tripping signals of circuit protection and if the three measuring elements do not reset after a preset time higher than the tripping time of circuit breaker.

The relay shall transmit tripping signal to all circuit breakers connected to the same bus bar to which the faulty breaker is connected.

If the faulty circuit breaker is one of transformer circuit breaker the relay shall transmit tripping signals to other transformer circuit breaker.

The current measuring elements shall have very short pick-up and reset times.

The timer shall have excellent measuring accuracy and very short over-short time.

Operating time of protection shall not exceed 150 milliseconds.

E. PROTECTION OF MAIN TRANSFORMERS

(1) DIFFERENTIAL PROTECTION

The protection shall be high speed, percentage restraint (Biased) type, to trip both 66 kV and 11 kV circuit breakers, including the connection from the transformer to the 66 kV bus bars. The protection shall respond to short circuit and earth faults occurring within the transformer or on the connecting leads cables between the transformer and 66 kV, and 11 kV current transformers.

The protection scheme shall include 2nd harmonic restraint circuitry that provides effective inrush suppression and 5th harmonic restraint to prevent relay operation due to excess exciting currents during transformer over excitation.

The percentage restraint shall be adjustable over a range 20 % to 40 % of rate current.

Protection operating speed not exceed 20 milliseconds

The protection scheme shall include flag indicators for each phase normal open signaling contacts and test facilities

The test facilities shall include provision of in service measuring of through current and differential current for each phase.

(2) RESTRICTED EARTH FAULT PROTECTION (11 kV ONLY)

The protection shall respond to earth faults occurring within the transformer or on the connecting lead cables between the transformer and 66 kV and 11 kV current transformers and must give, tripping to the circuit breaker of the both sides 66 kV and 11 kV.

(3) BUCHOLZ PROTECTION FOR TRANSFORMER

The protection shall respond to all types of faults, which occur inside the transformer tank.

The protection shall have two elements one for alarm and the second for tripping

(4) BUCHOLZ PROTECTION FOR TAP CHANGERS

The protection shall be as specified under the Section 6-5 "Main Transformer" of this specification.

(5) DIRECTIONAL OVER CURRENT PROTECTION (11 kV SIDE)

The protection shall have definite time lag

The range of current setting shall cover the range of 0 to 3 times rate current.

The time setting shall be 0.5 to 5 seconds

The protection shall be installed at both the 66 kV and 11 kV sides

(6) OVER LOAD PROTECTION

The over load relay shall be equipped on phase (s), and to give signal on the control board with time relay of range of 0 to 10 seconds

(7) OVER CURRENT PROTECTION (66 kV SIDE)

The protection shall be two phases over current relay system with definite time relay of 0 to 3 seconds.

(8) PROTECTION AGAINST EXCESSIVE WINDING TEMPERATURE

The protection shall determine the winding hot spot temperature.

The protection shall have two adjustable steps, one for alarm and the second for tripping.

(9) PROTECTION AGAINST LOW OIL LEVEL

The protection shall actuate audible and visible alarm signals when the oil level drops below permissible limit.

6-7-7 TYPE OF PROTECTION FOR 11 kV CIRCUITS

(1) 11 kV OUTGOING FEEDERS

a. Non-directional over current protection

For the 3-phase, range of current setting shall covers 0.2 to 3 times rate current.

b. Earth Fault Protection

Range of current setting shall be of 0.2 to 0.8 of rated current

Range of time setting shall be 0 to 3 seconds

(2) 11 kV BUS BAR SECTIONALIZER

a. 3-phase non-directional over current protection

b. Relays used for load shedding schemes for the 11 kV feeders of the main substation. The substation shall be equipped with load shedding relays one for each bus bar. The output of each relay shall trip any or all feeders connected to that bus. Each feeder panel shall be fitted with an auxiliary selector switch to allow for the tripping of the feeder at the frequency relay or to prevent tripping.

The frequency relays technical specifications shall be as follows.

- a. Static highly accurate frequency relays
- b. Accuracy of the frequency measurements shall be less than, plus and minus 0.03 Hz at 50 Hz.
- c. Range of setting shall cover the 40 to 65 Hz in 0.1 Hz increments
- d. Under voltage relay to prevent tripping at voltage below 0.6 UN or equivalent.
- e. Allowable voltage fluctuations shall be between about 0.6 to 1.2 UN
- f. Simple testing facility
- g. Free from transient effects with using harmonic filters or equivalent
- h. The frequency relay shall be equipped with multi outputs for each step at least 3 outputs
- i. Timer setting range shall cover the range from 0.1 to 1.0 second
- j. The frequency setting shall not be effected by variation of ambient temperature from -5°C to 55°C.
- k. Using a stable oscillator for the measuring of the period of successive cycles to be compared with a known timing period, which generated with precisely stable crystal oscillator, shall effect the method of measurements.
- l. Rated AC voltage and rated DC voltage shall comply with the substation voltages.

(3) AUXILIARY TRANSFORMER

3-Phase non directional over current protection with current setting of 50 to 200 % rated current and time setting of to 3 seconds.

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Section 6-8 AUXILIARY EQUIPMENT

6-8-1 AUXILIARY TRANSFORMERS

These transformers are intended to be used as auxiliary supply for the Main Power Substation (66/11 kV, 4 Banks of 20/25 MVA transformers).

A. TYPE

The transformer shall be of the three phases, dry, natural cooled, indoor type.

B. NUMBER AND MAXIMUM CONTINUOUS RATING

Two steps down transformers shall be installed for the substation.
The maximum continuous rating of each transformer shall be 500 kVA.

C. RATIO OF TRANSFORMATION AND CONNECTIONS

The ratio of transformation of the auxiliary transformers shall be 11,000/400-231 V, 50 Hz. The connections shall be delta/star (DYN11), with earthed low voltage neutral.

D. VOLTAGE CONTROL

The transformer shall be equipped with an off-load tap-changer installed on the high voltage side for $\pm 5\%$ of transformation ratio adjusted in 2 x 2.5 equal steps.

E. LIMITS OF TEMPERATURE RISE

The transformer shall be able to deliver its maximum continuous ratings with the tap changer set at the middle tapping of the primary winding, without exceeding the temperature rise limits.

a. Ambient temperature	45°C
b. Oil temperature at top level	40°C
c. Winding temperature by resistance method	50°C
d. Core temperature	50°C

F. OVERLOAD CAPACITY

The transformer shall be capable of withstanding an overload capacity of 10 (Ten) percent of its maximum continuous rating for a period of two hours after continuous full running without injury.

G. CONSTRUCTION

The Tenderers shall submit full detailed specifications, design, drawings, maintenance and

operating catalogues of the offered transformers.

The constructional features of the auxiliary transformers shall meet the requirements stated for the main transformers.

H. BUSHINGS

The 11 kV and 0.4 kV sides shall be completely insulated. All bushings shall be designed that there will be no excessive stressing of any parts due to temperature changes and adequate means shall be provided to accommodate conductor expansion.

I. ACCESSORIES AND FITTINGS

The auxiliary transformers shall be supplied with all the necessary accessories and fittings.

6-8-2 0.4 kV SWITCHGEAR

A. TYPE

The switchgear shall be of the indoor, metal withdrawable floor mounted enclosed type assembled in one homogeneous steel structure.

The doors shall be hinged types.

The operation devices for switches and control switches shall be operated from the front of the boards without the doors being opened.

All cables shall be connected to the board with terminal blocks of approved type located near the cable entry.

The expanding gases developed in case of a short circuit shall be directed in a safe direction in order to prevent injury to persons standing near the board.

B. STANDARDS

The switchgear shall be manufactured and tested according to IEC standards.

C. ARRANGEMENT

It shall be a single - sectionalized bus - bar, each bus bar section shall be fed from one 0.4 kV incoming cable to supply power for 10 outgoing 0.4 kV feeders.

There must be possibility to connect each bus - bar section to temporary earth device which have relevant short - circuit capacity in case of maintenance.

D. BUS-BAR

The bus bars shall be made of high electrolyte copper, of 1000 A current rating. The neutral bus - bar shall have full insulation against earth.

E. CIRCUIT BREAKERS

Circuit breakers shall be of 3 - pole and (1-pole) moulded case or air break type provided with magnetic and thermal adjustable over current and short circuit relays. With breaking current = 20 kA for 3 - pole.

= 10 kA for 1 - pole.

F. METERING

- a. Each Bus-bar section shall be equipped with voltmeter (0 - 500 V), and a selector switch.
- b. Each incoming feeder shall be equipped with 3 ammeters (0 - 600 A)
- c. Two outgoing feeders each of them shall be equipped with ammeter (0 - 100 A)

G. MODE OF OPERATION

The contractor should supply the necessary devices to fulfil the following:

- a. The parallel operation of the two auxiliary transformers shall not be permitted.
- b. In case of failure of the operating auxiliary transformer, the other shall be automatically put into service.
- c. In case of A. C. supply failure, the D. C. supply shall be put into service automatically.

6-8-3 EARTHING SYSTEM

An effective earthing shall be made for the whole substation site, and shall be designed to obtain earthing resistance not exceeding 0.5 ohm.

The earth connection shall be made of several heavy gauge galvanized rods of size 40 mm² x 4 m length as a minimum, buried to a sufficient depth in the ground and connected in parallel to obtain low resistance values.

All metallic doors and metallic fences in the substation shall be earthed by connect to the earth system by flexible conductors.

The Tenderer is responsible to supply the material sufficient to reach and obtain low resistance values.

The strip connections to the galvanized rods shall be bolted and not welded.

Earthing strips connecting the various equipment to be earthed to the earthing pit, shall be of copper stranded cable and shall be arranged in an orderly manner around the station equipment.

The cross section of the earthing conductor shall be more than 120 mm² to carry the maximum short circuit current of the system.

6-8-4 DIRECT CURRENT SYSTEM

DC power supply system shall be installed for the operation and protection of the substation, as well as for substation emergency lighting.

The system consists of battery, charging rectifier set and a complete supervision and control board.

A. BATTERY

Accumulator battery of Nickel-Cadmium Alkaline type 220 volt, 500 Ah rating, for tropical weather condition, 45°C ambient temperature and 5 hours discharging time.

The supply shall include painted wooden frames to accommodate the battery and all necessary accessories, vessels for wasted and mixing alkaline.

Density meter and test voltmeter shall be supplied too.

B. RECTIFIERS

Two solid state thyristor rectifier sets (one is for stand by) are used to feed the battery system, and to maintain the DC voltage as approximately constant enabling the full floating manner with the batteries.

Each rectifier shall be used for trickle charging. It shall be housed in a self-ventilated sheet steel cabinet. It shall be automatically or manually operated by means of a change over switch for normal trickle charging or quick charging.

The rectifier shall be equipped with instruments, voltmeter and ammeter in the DC side, with accuracy class 1.5 %, indication lamps and necessary switches.

Particular specification of the rectifier shall be as follows.

- a. Input power: 3-phase, 380 V, $\pm 10\%$ and 50 Hz
- b. Output capacity: 60 amp DC rating
Able to restore the capacity of a discharged batter within period of 5 hours by (Rapid charging mode).
- c. Output voltage: 220 V DC $\pm 0.5\%$

C. DC PANEL BOARD

The DC panel board shall be of totally enclosed type, complete with copper bus bars and all other accessories. In case of AC supply failure, the DC supply unit shall be put into service automatically.

The panel board shall house all breakers and measuring instruments.

6-8-5 SUBSTATION LIGHTING SYSTEM

A. GENERAL

The contractor shall supply the interior, the exterior lighting, and the emergency lighting for whole substation.

The main lighting circuit shall be fed from the low voltage A. C. supply.

A separate emergency lighting circuit shall be fed from the D. C. supply and shall be automatically connected in case of failure of the A. C. supply.

Emergency lighting lamps shall be located in appropriate positions to ensure continuity of operation and control.

Both circuits shall be installed in all parts of the substation building.

Fluorescent (120 cm) lamps or high-pressure sodium lamps shall be installed in all parts of the building, and the intensity of illumination shall be as follows:

- a. Offices, meeting room and control room: Not less than 200 LUX

- | | |
|---------------------------------|-----------------------|
| b. Other parts of the building: | Not less than 100 LUX |
| c. External lighting: | Not less than 50 LUX |
| d. Emergency lighting: | Not less than 20 LUX |

Emergency lights shall be installed in the buildings, which will turn on at normal AC power interrupted.

B. LIGHTING DISTRIBUTION PANELS

The lighting distribution board shall be provided for feeding the different parts of the building. It shall be completed with the necessary switches, contactors, fuses, however thermal protection should be provided.

C. LIGHTING CONNECTIONS AND APPLIANCES

The wiring shall be carried out by P.V.C insulated copper conductor cables.

Separate systems shall be used for the AC and DC circuits.

Power sockets of suitable capacities shall be provided in appropriate positions in all parts of the building, as well as in the switchyard.

6-8-6 VENTILATION OF THE SUBSTATION BUILDING

The whole indoor part of the substation will be kept under pressure to prevent any dust from outside entering the building. The pressure recommend by the Tenderer should be given.

Fresh air shall pass through filters and ducts to distribute the fresh pressurized air in all parts of the substation and administration building. However, provision shall be made for sufficient ventilation for the battery room by extra fans.

The ratings of the ventilators and the motors and dimensions of the ducts the type of filters should be submitted in the tender.

The control room shall be provided with air - conditioning system.

Full details drawings and catalogues of the system shall be provided with the tender.

6-8-7 FIRE FIGHTING

A. FOR POWER TRANSFORMERS:

The transformer booths shall be equipped with an efficient fire fighting equipment, complete with thermal elements, containers, spray nozzles, valves, piping, Co-cylinders all other necessary fittings and accessories.

As soon as fire starts in any transformer, the fire fighting equipment shall instantaneously come into action and trip the transformer circuit breakers and isolate the transformer, at the same time the transformer shall be sprayed with an extinguishing medium to extinguish the fire in the shortest possible time.

Full details of the offered type of fire fighting equipment, operation maintenance, design and test data shall be submitted with the tender. The fire protection system shall be suitable for manual and automatic operation.

B. FOR THE SUBSTATION

In addition to the fire fighting equipment stated above two mobile fire fighting trailers should be equipped with the following for the substation.

- a. Two Co-steel cylinders each contain 60 kg of Co with quick opening and closing valves.
- b. High-pressure rubber hose of 12 meter long.

Trailers should have two wheels with pneumatic rubber tires and all necessary accessories.

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Section 6-9 CABLES

A. MEDIUM VOLTAGE CABLES

The medium voltage cables feeding 11 kV switchgear from the main transformer, and those feeding the No. 7 Pumping Station and auxiliary transformers from 11 kV switchgear shall be of cross-linked polyethylene (XLPE) insulated type with copper screen and PVC outer jacket.

Class of insulation shall be 12/20 kV according to IEC 502.

Cables feeding the 11 kV switchgear from the main transformers shall be three-single core copper conductor cable of 400 mm² cross section per phase or aluminum conductor with equivalent cross-section.

Cables feeding the Auxiliary Substation in the No. 7 Pumping Station from the 11 kV switchgear shall be four-single core copper conductor cables of 500 mm² cross section per phase or in aluminum conductor with equivalent cross-section.

Cables feeding the auxiliary transformers in the main substation shall be three core cables with copper conductor of cross-section 50 mm² or aluminum conductor with equivalent cross-section.

B. 0.4 kV CABLES

The 380 V cables feeding the 0.4 kV switchgear from the auxiliary transformer, and that feeding different loads in the substation from the 0.4 kV switchgear shall be XLPE or PVC insulation type, with PVC jacket and the class of insulation shall be 0.6 /1 kV according to IEC 502.

C. CONTROL CABLES

Control cables shall be of the PVC insulation type with PVC jacket and the insulation class shall be 0.6/1 kV according to IEC 502.

Control cables shall have insulation of non-inflammable type, wiring shall be labeled, so that different circuit shall have different colours.

The control cables shall be shield type with shielding thickness shall not be less than 0.01 mm to avoid the interference during steady state and transient condition.

- a. Cable trenches should covered with metal covers.
- b. Cabling of protection cables for each main transformer shall be installed in separate cable trenches or separate metallic conduit lay in the trench.

The shield shall be grounded at both ends, then the closed, loop completed in the cable and ground as a mat system, a heavy conductor shall be connected in parallel to the control cable and connected to the shield ground points.

Details of control cables, cross sections, method of wiring and labeling shall be identified in the design stage.

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Section 6-10 SPARE PARTS AND MAINTENANCE TOOLS

6-10-1 SPARE PARTS

The following spare parts are all required as minimum for the substation.

The Tenderer shall include these and additional parts he recommends for five years service on the form provided.

A. SPARE PARTS FOR 66 kV SWITCHGEAR

(1) 66 kV SF6 CIRCUIT BREAKER

- a. One complete three poles circuit breaker with the control mechanism.
- b. Set of gasket.
- c. Set of tripping and closing coils.
- d. Arcing chamber complete.
- e. Set of fixed and moving contacts 1 pole.
- f. Gas filling device.
- g. Motor drive complete.

(2) ISOLATING SWITCH

- a. Two complete three poles bus - bar isolating switch complete with mechanism.
- b. One complete three poles line isolating switch complete with mechanism.
- c. Three complete blades and contacts for bus bar isolating switches.
- d. Three complete blades and contacts for line isolating switches.
- e. Six complete sets of insulators
- f. Two complete earthing blades.

(3) INSTRUMENT TRANSFORMERS

- a. Three single phase potential transformers:
 $66000/\sqrt{3}$ V, $110/\sqrt{3}$ V $110/\sqrt{3}$ V
- b. Three current transformers ratio:
 $2 \times 300 / 1 / 1 / 1 / 1$ A
- c. Six current transformers ratio:
 $2 \times 600 / 1 / 1 / 1 / 1$ A

(4) LIGHTNING ARRESTERS

- a. 3 units of lightning arresters for 66 kV system

(5) INSULATED STICK

- a. One insulated stick with indicating lamp for inspection of the 66 kV system

(6) INSULATORS

- a. Ten complete strings of insulators used for bus bar support
- b. Three complete station post type insulators
- c. Three wall through bushings of each type

B. SPARE PARTS FOR MAIN TRANSFORMERS

- a. Three 66 kV bushings
- b. Four 11 kV bushings
- c. One complete set of tapping switch contacts for tap changing gear switch
- d. One complete mechanism for tap changing gear switch
- e. One dial thermometer
- f. One 11 kV lightning arrester
- g. One complete set of gaskets
- h. Oil equivalent to 25 % of the first filling for every transformer
- i. Detailed itemized prices of the proposed equipment must be stated.

C. SPARE PARTS FOR 11 kV SWITCHGEAR

- a. One transformer feeder circuit breaker rated 3,000 A complete with its truck
- b. One outgoing feeder circuit breaker rated 3,000 A complete with its truck
- c. Two outgoing feeder circuit breakers rated 630 A complete with its truck
- d. One bus section circuit breaker rated 2500 A complete with its truck
- e. Three sets of each of fixed and moving contacts for 2500 A circuit breaker
- f. Three sets of each of fixed and moving contacts for 1600 A circuit breaker
- g. Six sets of each of fixed and moving contacts for 630 A circuit breaker
- h. Two complete circuit breaker mechanisms
- i. Six, closing coils
- j. Six, tripping coils
- k. Three potential transformers with ratio
 $11000/\sqrt{3} \text{ V}, 110/\sqrt{3} \text{ V}, 110/\sqrt{3} \text{ V}$
- k. Three current transformers for 1 600 A circuit breaker unit
 $1500 / 5 / 5 / 5 \text{ A}$
- l. Three current transformers for 3000 A circuit breaker unit
 $2500 / 5 / 5 \text{ A}$
- m. Six current transformers for 630 A circuit breaker unit
 $600 / 5 / 5 \text{ A}$
- n. Two complete earthing blades
- o. 50 units of different type of 11 kV insulators used for bus bars and circuit breakers
- p. 50 units of complete set of indicating lamps (lamp included)
- q. One insulated stick with indicating lamp for inspection of the 11 kV system
- r. One phase sequence meter

D. SPARE PARTS FOR CONTROL, METERING AND PROTECTIVE EQUIPMENT

- a. One ammeter for each scale offered
- b. One voltmeter for each scale offered
- c. One 3 phase watt hour meter
- d. One 3 phase kVarh meter
- e. One relay for each offered type
- f. Two signaling and intermediate relays of each offered type
- g. Three auxiliary switches for each offered type
- h. One recording wattmeter
- i. One indicating watt meter
- j. Recording paper rolls for three years operation of the recording watt meter

E. SPARE PARTS FOR AUXILIARY EQUIPMENT

- a. One complete air circuit breaker of each size offered
- b. Three sets of contacts for each size of air circuit breaker offered
- c. One complete set of high tension and low tension bushings for 11 kV auxiliary transformer
- d. One instrument of each type of the 380 volt switchboard

Notes: Shall be note that one set of contacts means the necessary number of contacts required to completely renew a circuit breaker.

6-10-2 MAINTENANCE TOOLS

- a. One complete set of tools necessary for the maintenance and adjustment of the 66 kV switchgear
- b. One complete set of tools necessary for the maintenance and adjustment of the 11 kV switchgear
- c. One complete set of tools necessary for the maintenance and adjustment of the metering instruments and protection relays.
- d. One complete set of tools necessary for the maintenance and adjustment of the 380 V switchgear
- e. One complete set of tools necessary for the maintenance of the station battery (hydrometers, thermometers, mixings jars, cell voltmeters, etc.)
- f. Five Battery cells
- g. One oil tester
- h. Electrically driven table mounted 3/4" drill, 2 x 6" grinding stones, 6 - Vise portable electric drill
- i. 3-tons travelling crane for workshop

6-10-3 COMMON SPARE PARTS FOR THE SUBSTATION

- a. One relay testing set suitable for testing the station relays by primary and secondary injection method.
- b. One portable, 3000 liter/hour minimum oil purifying set, of centrifugal type mounted on a four rubber wheel truck, for the treatment of the transformer oil, complete with heaters, vacuum

receivers, etc. Necessary spare parts should be delivered

c. One main transformer 66 /11 kV, 20 / 25 MVA

d. One complete on load tap changer for the main transformer 66/ 11 kV

PART 6: TECHNICAL CONDITIONS

Section 6-11 CIVIL WORKS

6-11-1 General

This section covers civil and architectural works of the main substation.

6-11-2 Earth Works

This specification covers the requirements for the execution of excavation, earth filling and back filling works as specified in the project scope of works including work preparation such as preparation for disposal areas, site clearing, grubbing and stripping works, de-watering, etc.

(1) General Requirements

Prior to starting any excavations or earthworks, the Contractor shall agree with the Engineer on the reference benchmarks and levels and they shall be recorded on a plan by the Contractor and submitted to the Engineer.

All necessary reference pillars and levels shall be constructed as approved by the Engineer and shall be maintained by the Contractor until completion of the respective jobs.

The Contractor shall set-out the works shown on the drawings well in advance and in sufficient time to enable the Engineer to inspect and approve the setting-out prior to commencement of the excavation works.

All excavation and earth fill works shall be properly setout to the true line, curve, level or slope required.

The Contractor shall correct all additional work and over-exertion cause by the Contractor's negligence in setting-out immediately upon the request of the Engineer.

(2) Excavation

Excavation shall include incidental clearing, grading, compacting, leveling, excavation and disposal of excavated materials, protections, sheeting, shoring, bracing and coffer-dams, de-watering of excavations and work areas and preparation of bearing areas as required to properly install and complete the work regardless of portion of the work for which de-watering is required and regardless of nature of materials encountered in excavation, including construction of temporary diversion ditches, culverts, temporary access road etc. where required.

The Contractor shall notify the Engineers in writing at least three working days prior to the start of any excavations to enable the Engineer to verify all necessary levels and cross-sections of the original ground surface. The Contractor shall, prior to starting excavation in any area, submit to the Engineer a plan of operations with complete details of the method of excavation, type of equipment to be used proposed method of diversion of drainage, safety measures to be used, etc.

The Contractor is responsible for all necessary safety measures from the commencement of work until it is complete. This Contractor shall strictly follow safety regulations in order to

prevent accidents.

It will be the Contractor's responsibility to utilize to the fullest extent all materials from excavations, which are approved and deemed suitable by the Engineer as backfill or other construction. The Contractor shall make his best efforts to comply with the above requirements.

Excavated materials, which are not suitable as fill materials shall be hauled and disposed of in the designated spoil area. The materials that are in excess of the fill requirements for the Contractor's work shall be hauled to the designated stockpile area.

The spoil area and the stockpile area shall be leveled, trimmed, and graded to drain as directed by the Engineer.

Excavation shall be performed to the lines and grades shown on the approved drawings or to the depth where suitable foundation conditions are encountered.

No compensation will be given for any over excavation and it shall be replaced by approved back filling material at the Contractor's expense.

In case that earth excavation shall not be carried out to specified levels as indicated on the approved drawings and the natural foundation material is disturbed or loosened for any reason, the foundation shall be improved or replaced with approved fill and compacted, as directed by the Engineer.

(3) Filling

The ground has to be cleared of all vegetation, unacceptable material and other obstructions interfering with the proposed work (removal of foundations, fences etc.).

All material encountered by clearing and grubbing operation has to be removed as specified or directed by the Engineer. The Contractor is fully responsible for any destruction and damage.

All areas where filling is to take place shall be measured jointly with the Engineer before work starts and mutually agreed upon in a protocol/Minutes of Meeting and plan layout.

Excavated materials shall be tested for suitability for reuse. If excavated material is determined unsuitable, remove or stockpile and obtain suitable materials from approved borrow sources.

Do not place material containing brush, roots, peat, sod, or other organic, perishable or deleterious matter.

Fill materials shall be selected from approved sources in accordance with these Specifications, unless directed otherwise by the Engineer.

The type of compaction equipment and number of passes to achieve the required compaction degree have to be specified by the contractor and approved by Engineer.

(4) Finish Grading

The Contractor shall fill, spread, and level the roads and the general site area to elevations; grades and slopes as required and as indicated on approved drawings.

The fill material shall consist of graded crushed stone or sand and gravel for roads.

The Contractor shall perform final grading near the completion of the work or as directed by the Engineer. The Contractor shall grade and level the areas to produce a smooth grade free from debris, foreign materials, objectionable stones, clods, lumps, pockets or high points, properly drained true to the indicated elevations with smooth transition between different

elevations.

6-11-3 CONCRETE

(1) General

This Specification defines the requirements for the materials, equipment, workmanship and services related to the concrete work to be carried out by the Contractor under this Contract. All concrete work shall be made according to the requirements of this Specification and to documents issued and/or approved by the Engineer.

The Contractor shall co-operate with all other contractors and organizations related to the construction of Permanent Works where the material or equipment is to be fixed to, or embedded in, the concrete structures.

The approval given by the Engineer to the Contractor's plants and equipment or to their operation, or to any construction methods shall not relieve the Contractor of his full responsibility for the proper and safe execution of concrete works or any obligations under this Contract.

(2) Cement

Cement shall be supplied from approved sources, The use of different cement types shall be subject to the approval of the Engineer, and each type shall be stored separately.

Cement, which does not comply with the specified requirements or is damaged in consignment, handling or storage, shall be promptly removed from the Site.

Cement shall be transported from the port or mill to the Site in adequately designed weather-tight trucks, or other means where cement will be protected from exposure to moisture.

Bagged cement shall be stored in weatherproof buildings with a raised, well-ventilated wooden floor, and placed so that each consignment can be segregated if required more than 1.50 m high. The bags or packages shall incorporate an impregnated bitumen layer. Cement shall not be stored out of doors, except for immediate use, and in such event shall be protected during storage and handling by waterproof covers and a raised floor. Unused cement must be placed in the storage buildings.

Cement delivered in bulk shall be stored in suitably designed containers and protected from atmospheric moisture and condensation. Excessive storage shall be avoided.

Cement shall be used in approximately chronological order in which it has been received at the Site. Storage of cement shall be limited to 90 days in bags and 150 days in bulk. Cement that has been in storage for longer than these periods or which may have absorbed moisture shall not be used unless it has been re-tested by the Contractor and approved. Cement that has become partially or fully lumpy or caked shall not be used.

The Contractor shall keep and make available to the Engineer records of the date, amount, and storage location of each delivery of cement and of the part of the Works in which it was used and shall provide facilities for checking the stock of cement.

The Contractor is solely responsible for the timely supply of cement meeting the requirements of these specifications and the Works. The delay due to the lack of suitable cement will not give the Contractor any right for the extension of time for the completion of Works, or any claims resulting here from.

(3) Source

Coarse and fine aggregates shall be produced from suitable material obtained from required excavation for Permanent and Temporary Works and from the approved quarry and borrow areas.

The Contractor shall carefully clear the area from which aggregates are to be produced of unsuitable materials and other objectionable matter. The area shall be operated so as not to detract from the usefulness of the area. All materials removed from the area and not used in the work shall be disposed of as directed.

The Engineer shall subject alternative sources developed by the Contractor to approval. The Contractor shall carry out tests to furnish satisfactory evidence that aggregates from such alternative sources comply with the requirements of this Section. He shall supply a report on petrography examination on representative samples taken in the presence of the Engineer.

The approval of the sources shall not be construed as constituting the approval of all materials taken from the deposits. The Engineer reserves the right to reject certain localized areas, strata, or channels within the approved areas and zones, when the material is unsatisfactory for use.

(4) Fine Aggregates (Sand)

Only graded natural sand is used for fine aggregates (sand).

Sand for concrete shall comply with BS 882 Zones 2 or 3. It shall be washed sand and shall not contain more than 5% voided shells.

Fine aggregate shall be stored in such a manner as to avoid the inclusion of any foreign materials in the concrete. The storage piles shall be built up so as to prevent segregation. The deposition of material in storage and its removal therefrom shall be done in such a manner as to result in increasing the uniformity of the grading insofar as this is practicable.

(5) Coarse Aggregate

Only graded crushed stone is used, unless otherwise indicated.

Should the weighted average loss by weight exceed 10 %, when the aggregate is subjected to five cycles of soundness test by use of sodium sulphate, the Engineer may reject the coarse aggregate.

Coarse aggregates, upon delivery to the plant, shall have uniform and stable moisture content. Stockpiles of coarse aggregate shall be formed in such manner as to avoid the ingress of any foreign matter and to prevent segregation. Water sprayers shall be used to saturate that portion of the stockpiles from which aggregate is being used to prepare concrete. Sufficient storage shall be maintained at all times to permit continuous placement of concrete.

(6) Water

Water for use in concrete and mortar mixing and curing shall be obtained from an approved source and shall be of such a quality as not to affect (a) the setting time, strength and durability of the concrete or mortar (b) the appearance of hardened concrete or mortar by discolouration or efflorescence and (c) the reinforcement at any age of the concrete or mortar. Water shall be clean, colourless, demineralized and free from deleterious substances such as

salt, oil, alkaline or organic matters, sugar compounds and shall not have brackish. When shaken no permanent foam may be formed. It may be blended or unblended, and shall have a pH between 6.5 and 8.0 and conform to ACI-318 section 3.4.

Water shall be stored in approved, clean, covered containers, which are protected from sun, wind, and dust, and from contamination by any other source. Pipe work for water shall, wherever possible is protected from the sun. The water storage and supply system ensures continuity of the supply of water.

(7) Steel Reinforcement

The Contractor shall furnish, fabricate, and install all reinforcement steel as shown on the Construction Drawings and specified. The work shall further include the furnishing and installation of all tie wires, clips, supports, chairs, spacers, and other appurtenances necessary to fulfil the requirements of these Specifications and produce finished concrete structures.

The Contractor shall submit the mill certificates to the Engineer. The Contractor shall not change manufacturer or source without the prior approval of the Engineer.

(8) Form Work

Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions and grades shown on the drawings. They shall be constructed to be maintained sufficiently rigid to prevent deformation under load and as to enable it to be removed without damage to concrete.

The design of formwork and its construction shall be the sole responsibility of the Contractor. It shall include all moulds for forming concrete and all temporary construction for proper execution of the works. The maximum pouring height shall not exceed 1.50 m if not otherwise agreed by the Engineer. In case the maximum pouring height exceeds 1.50 m special measure shall be taken by the Contractor in order to prevent segregation of the concrete aggregates.

(9) Test

The costs for all tests to be carried out prior to the start of concrete work, whether carried out at Site or elsewhere shall be borne by the Contractor.

Routine tests for the Contractor as specified here in shall carry out quality control during execution of the concrete work and as directed. Approved test laboratories shall carry out other tests required during execution of the work.

The Contractor shall also prepare, store, handle, cure and supply samples to a laboratory designated by the Engineer if so required for additional independent testing.

All cost associated with testing as described above shall be borne by the Contractor, who shall make allowance for such expense in the Unit Price for concrete work.

Should the Contractor fail to adhere to this testing program, all tests deemed necessary by the Engineer to check concrete work will be performed by the Engineer or a laboratory assigned by him, at Contractor's expense.

NORTH SINAI DEVELOPMENT PROJECT

**CONVEYANCE SYSTEM OF
EL SHEIKH GABER EL SABBABH CANAL
MAIN POWER STATION**

TENDER DOCUMENTS

PART 7: BILL OF QUANTITIES

**Conveyance System of El Sheikh Gaber El Sabbah Canal
Main Power Substation (for El Salaam No.7 P.S.)**

SUMMARY AND TOTAL

Pay Item No.	Item of Works	Local Currency Amount Egyptian Pound	Foreign Currency Amount
SE-0400	Main Power Substation (Electrical Works)		
WB-0400	Main Power Substation (Building Works)		
AB-0400	Administration (Building Works)		
Total			

**Conveyance System of El Sheikh Gaber El Sabbah Canal
Main Power Substation (for El Salaam No.7 P.S.)
Bill of Quantities**

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
SE-0400	Main Power Substation (Electrical Works)						
SE-0401	Power Transformer: Outdoor type 66/11 kV, 50 Hz, 3-Phase, 25 MVA	unit	4				
SE-0402	Voltage Detector Rated voltage: 66 kV, 3-Phase, 50 Hz	unit	2				
SE-0403	Earthing switch: 72.5 kV, 1250 A 50 Hz, 3 - pole, Air disconnect Manual operation, indoor type	unit	2				
SE-0404	66 kV Disconnect: 72.5 kV, 1250 A 50 Hz, 3 - pole, Air disconnect Electric Motor driven type	unit	4				
SE-0405	66 kV Disconnect Electric Motor driven type 1000A DS-P1, DS-P2, DS-P3 and DS-P4	unit	4				
SE-0406	66 kV Disconnect Manual operation type 800A	unit	2				
SE-0407	66 kV Circuit Breaker (Indoor type) Gas Insulated Circuit Breaker 3-Phase, 50 Hz, 72.5 kV, 25 kA, 1250 A Hydraulic or Electric motor operation type	unit	2				
SE-0408	Ditto, but rating current: 800 A	unit	4				
SE-0409	66 kV Current transformer (Indoor type) Rated as 66 kV, 3-Phase, 50 Hz, 1250/5A Rated Burden: 60 VA	unit	2				

Bill of Quantities

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
SE-0410	Ditto, but Primary current: 400 A	unit	4				
SE-0411	66kV Capacitance Potential Device 66 kV/110 V	unit	3				
SE-0412	66 kV Lightning Arrestor: Serge gap type 84 kV, 10,000 A with operation time counter	unit	2				
SE-0413	Cubicle type 11kV Switchgears: IP 55 Vertical self standing type, made of sheet steel (See DWG. SSE-404) Neutral Grounding Panel Grounding current transformer, lightning arrestor and neutral line disconnecting switch	unit	4				
SE-0414	Ditto, but 11 kV Cable termination Panel Terminal for 11 kV XLPE 400mm ² x 9	unit	4				
SE-0415	Ditto, but VCB Panel VCB 12 kV, 2000 A, 40 kA, drawable type	unit	4				
SE-0416	Ditto, but 11 kV Feeder Panel VCB 12 kV, 3000 A, 40 kA, drawable type GCT and Grounding over current relay	unit	2				
SE-0417	Ditto, but Lightning Arrestor Panel VCB 12 kV, 1000 A, 40 kA, drawable type and Lightning arrestor	unit	2				
SE-0418	Ditto, but 11 kV Feeder Panel VCB 12 kV, 400A, 40 kA, drawable type	unit	2				
SE-0419	Ditto, but Bus-Tie Panel VCB 12 kV, 3000 A, 40 kA, drawable type and CT x 2	unit	1				

Bill of Quantities

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
SE-0420	Station Transformer Panel Indoor cubicle, vertical self standing, IP 55 (See DWG. SSE-404) Transformer Panel (Dry type transformer) 11 kV/380-220 V, 500 kVA	unit	2				
SE-0421	Ditto, but Transformer feeder Panel VCB: 12.5 kV, 3-Pole, 600 A, 40 kA Drawable, manual operation type	unit	2				
SE-0422	Ditto, but Low Voltage Distribution Panel Main MCCB: 3-Pole+N 800A x 2 Bus-Tie MCCB: 3-Pole +N 800 A Branch MCCB: 3-Pole+N 100A x 10	unit	1				
SE-0423	Relay Panel: Indoor vertical stand type, IP 55	unit	1				
SE-0424	66 kV Substation Control Board Consist of remote operation switches, status indication lamps, alarm indication and mimic diagram.	unit	1				
SE-0425	DC Power Unit: Metal clad type, IP 55 Battery: Alkaline type 220V, 500Ah Charger: Thyristor, AC -Phase, 380V, 50A DC Circuit Breaker: 2-Pole, 100A x 2 and 2-Pole 50A x 8	unit	1				
SE-0426	Cubicle type 11 kV VCB Panel: IP 55 Vertical self standing, unit enclosed type Installed in No.7 Pumping Station Power cable lead-in Panel For 11 kV XLPE '1C-500mm2 x 4) x 3	unit	2				

Bill of Quantities

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
SE-0427	Ditto, but Power receiving panel Draw out type VCB: 12 kV, 3000 A,	unit	2				
SE-0428	Ditto, but PT panel 2-PTs: 11kV/110V, 50VA	unit	2				
SE-0429	66kV aerial busbars (AC1) Heat resistance aluminum alloy stranded wire, Sectional area: 1600mm ²	m	240				
SE-0430	Aerial earthing conductor Hard drawn copper stranded conductor 5mm diameter.	m	40				
SE-0431	66 kV aerial bus bar (AC2) Aluminum Pipe 60 mm diameter	m	200				
SE-0432	66 kV aerial bus bar (AC3) Aluminum Pipe 50 mm diameter	m	300				
SE-0433	Insulators/Bushing Consist of insulator, accessories and fittings 4-Couple of 250 mm diameter. Disk type Insulator	pc.	12				
SE-0434	Ditto, but Line post insulator For 66kV busbars, 190 mm diameter. 740 mm length	pc.	18				
SE-0435	Wall through Bushing (WB1) 66 kV, 2000 A	pc.	6				
SE-0436	Wall through Bushing (WB2) 66 kV, 800 A	pc.	12				
SE-0437	11 kV Feeder cable 11 kV XLPE 1C-400 mm ²	m	470				
SE-0438	Control and Operation cables include with terminals, accessories and fittings Copper tape shielding type SCC 4C-10 mm ²	m	875				

Bill of Quantities

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
SE-0439	Ditto, but SCC 4C-6 mm2	m	385				
SE-0440	Ditto, but SCC-4C-4 mm2	m	2030				
SE-0441	Ditto, but SCC-3C-4 mm2	m	1190				
SE-0442	Underground grounding grid wire Bare stranded copper, 120 mm2	m	1000				
SE-0443	Indoor grounding conductor Bare stranded copper, 70 mm2	m	80				
SE-0444	Grounding rod Copper rod: 14mm diameter, 3m length	unit	34				
SE-0445	Grounding plate Copper plate: 900mm x 900mm, thickness: more than 1.5mm	unit	11				
SE-0446	Grounding conductor in Cable pit Bare stranded copper, 70 mm2	m	330				
SE-0447	Grounding for structure/foundations Bare stranded copper, 120 mm2	unit	300				
SE-0448	Underground feeder cables For No.7 Pumping Station include excavation and backfilling Consist of cables, connectors, fittings, conduits, supporters, accessories and etc. as required. 11 kV XLPE 1-Core, 500 mm2	m	6,000				
SE-0449	Manhole: inside dimension 2 x 2 x 2.5 m Made of reinforced concrete include with cable support brackets, steps, drainage system and heavy weight withstand type cast iron manhole cover	set	6				

Bill of Quantities

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
SE-0450	Cable trench: Width: 1.5 m, Depth: 0.6 m and Width: 1 m, Depth: 0.4 m include excavation and backfilling with sheet steel cover	m	160				
SE-0400	Total						

**Conveyance System of El Sheikh Gaber El Sabbah Canal
Main Power Substation (for El Salaam No.7 P.S.)
Bill of Quantities**

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
WB-0400	Main Power Substation (Building Works)						
WB-0401	Excavation and disposal for building	Cu.m	2,017				
WB-0402	Backfill including supply of material	Cu.m	1,900				
WB-0403	Final grading	Sq.m	7,520				
WB-0404	Lean concrete 75 mm thick.	Cu.m	137				
WB-0405	Reinforced concrete (Fcu=275kg/cm2) for foundation and slab on grade, including reinforcing deformed bars (Grade 36/52) at least 120 kg/m3 and form works, Sulfate Resistant Portland Cement (Type-V)						
WB-0406	Reinforced concrete (Fcu=300kg/cm2) for grade beams, columns, walls beams and slabs, including reinforcing deformed bars (Grade 36/52) at least 130 kg/m3 and form works, Ordinary Portland Cement (Type-I)	Cu.m	360				
WB-0407	Masonry brick wall works (cement bricks) including reinforced concrete lintel and bond beams where necessary, t=240mm	Cu.m	482				
WB-0408	Cement plastering, t=20mm	Sq.m	4,160				
WB-0409	Steel ladders w/painting	Kg	200				
WB-0410	Checked plates, t=4.5mm	Kg	7,144				
WB-0411	Wire mesh fencing, complete	Sq.m	59				

Bill of Quantities

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
WB-0412	Wire mesh doors, complete	Sq.m	9				
WB-0413	Bituminous waterproofing membrane with insulation 500mm, covered with cement mortar 70 mm and cement tiles.	Sq.m	1,425				
WB-0414	Paint on plastered walls, exterior	Sq.m	2,080				
WB-0415	Paint on plastered walls, interior	Sq.m	2,080				
WB-0416	Paint on ceiling	Sq.m	1,344				
WB-0417	Steel door, including painting	Kg	100				
WB-0418	Steel main access door, including glazing and painting	Kg	1,020				
WB-0419	Aluminum window	Sq.m	130				
WB-0420	Fixed aluminum louver	Sq.m	6				
WB-0421	Separate cement floor finishing, with hardener including base (H=100mm)	Sq.m	1,344				
WB-0422	Lighting fixture: Ceiling surface mounted open type IP 51, for fluorescent lamp 32 watt -1 Type:B - FL321	set	36				
WB-0423	Ditto, but for fluorescent lamp 32 watt - 2 Type: B-FL322	set	18				
WB-0424	Lighting fixture: High ceiling mounted type with metallic reflector IP 51, for 400 watt high-pressure sodium lamp Type: D-HPS400	set	15				
WB-0425	Lighting fixture: Wall mounted type with plastic cover IP 65, for fluorescent lamp 32 watt -1 Type: G - FL321	set	3				

Bill of Quantities

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
WB-0426	Emergency lighting fixture: Ceiling or wall mounted open type IP 51, for incandescent lamp 100 watt powered by DC 100 V, Type: H-IL100	set	26				
WB-0427	Socket outlet: Wall surface flush mounted type AC Single Phase 220 V, 2-Pole with earth pole 15 amp double outlet	set	31				
WB-0428	Ditto, but 30 amp single outlet	set	7				
WB-0429	Socket outlet: Wall surface mounted type AC 3-Phase 380 V, 3-Pole with earth pole 30 amp single outlet	set	5				
WB-0430	Lighting switch: Wall surface flush mounted type, one way switch, AC 250 V, 10 amp	set	6				
WB-0431	Ditto, but remote control switch for magnetic contactor installed in distribution board	set	3				
WB-0432	Distribution board: Wall surface mounted metallic cabinet type DB-SS1	set	1				
WB-0433	Ditto, but DB-SS2	set	1				
WB-0434	Lighting main feeder cable from Station Transformer Panel to DB-SS1 600V XLPE 3C+N 25 mm ²	m	20				
WB-0435	Ditto, but to DB-SS2 600V XLPE 3C+N 35 mm ²	m	40				
WB-0436	Wiring for lighting system, consist of PVC wires of 4 mm ² , steel conduit 20 mm, conduit accessories, cable connections, outlet boxes, mounting fittings and necessary devices.	L.S.	1				
WB-0437	Wiring for socket outlet system, consist of PVC wires of 4 mm ² , steel conduit 20 mm, conduit accessories, cable connections, outlet boxes, mounting fittings and necessary devices.	L.S.	1				

Bill of Quantities

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
WB-0438	Grounding conductors for distribution board, lighting fixtures and socket outlets	L.S.	1				
WB-0439	Ventilation, axial flow type supply fan, 600 mm dia. x 250 mm x 2.2kw, with 8 Nos. SAH-HS 750 x 200 34CMM	No.	1				
WB-0440	Roof water down pipes, cast iron diam. 150 mm	m	34				
WB-0441	Portable fire extinguishers	set	18				
WB-0442	Lightning Protection	L.S.	1				
WB-0400	Total						

**Conveyance System of EL.S.heikh Gaber El Sabbah Canal
Main Power Substation (for El Salaam No.7 P.S.)
Bill of Quantities**

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
AB-0400	Administration (Building Works)						
AB-0401	Excavation and disposal for building	Cu.m	1,135				
AB-0402	Backfill including supply of material	Cu.m	1,053				
AB-0403	Lean concrete 75 mm thick.	Cu.m	18				
AB-0404	Reinforced concrete (Fcu=275kg/cm2) for foundation and slab on grade, including reinforcing deformed bars (Grade 36/52) at least 120kg/m3 and form works, Sulfate Resistant Portland Cement (Type-V)						
AB-0405	Reinforced concrete (Fcu=300kg/cm2) for grade beams, columns, walls beams and slabs, including reinforcing deformed bars (Grade 36/52) at least 130kg/m3 and form works, Ordinary Portland Cement (Type-I)	Cu.m	144				
AB-0406	Cinder concrete, using light weight aggregates	Cu.m	234				
AB-0407	Masonry brick wall works (cement bricks) including reinforced concrete lintel and bond beams where necessary, t=240mm	Cu.m	5.4				
AB-0408	Masonry brick wall works (lime sand bricks) including reinforced concrete lintel and bond beam where necessary, t=250mm	Cu.m	235				
AB-0409	Cement plastering, t=20mm	Sq.m	1,960				

Bill of Quantities

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
AB-0411	Checked plates, t=4.5mm	Kg	987				
AB-0412	Bituminous waterproofing membrane with insulation 500mm, covered with cement mortar 70 mm and cement tiles.	Sq.m	625				
AB-0413	Paint on plastered walls, exterior	Sq.m	413				
AB-0414	Paint on plastered walls, interior	Sq.m	1,133				
AB-0415	Paint on ceiling	Sq.m	409				
AB-0416	Steel door, including painting	Kg	700				
AB-0417	Steel door, with glazing, including painting	Kg	300				
AB-0418	Aluminum window	Sq.m	36				
AB-0419	Wooden door, including painting	Sq.m	16				
AB-0420	Mirror, W60cm x H 75cm	set	5				
AB-0421	Separate cement floor finishing, with hardener including base (H=100mm)						
AB-0422	Ceramic floor tiles, 150 x 150 x 10 mm, including cement mortar screeding for adjustment	Sq.m	256				
AB-0423	Ceramic wall tiles, 200 x 200 x 6 mm and skirting (H=100)	Sq.m	39				
AB-0424	Terrazzo floor tiles, 250 x 250 x 25 mm and skirting (H=100) including cement mortar screeding for adjustment	Sq.m	131				
AB-0425	Suspended ceiling, acoustical types	Sq.m	281				
AB-0426	Kitchen unit for pantry	Sq.m	168				
		L.S.	1				

Bill of Quantities

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
AB-0427	Lighting fixture: Ceiling surface mounted type with metallic low brightness louver IP 51, for fluorescent lamp 32 watt -2 Type: A-FL322	set	20				
AB-0428	Lighting fixture: Ceiling surface mounted open type IP 51, for fluorescent lamp 32 watt -3 Type: B - FL321	set	15				
AB-0429	Ditto, but for fluorescent lamp 32 watt - 2 Type: B-FL322	set	35				
AB-0430	Lighting fixture: Pole top mounted type area lighting fixture IP65, for 125 watt sodium lamp Type: F-SON125	set	50				
AB-0431	Emergency lighting fixture: Ceiling or wall mounted open type IP 51, for incandescent lamp 100 watt powered by DC 100 V, Type: H-IL100	set	27				
AB-0432	Socket outlet: Wall surface flush mounted type AC Single Phase 220 V, 2-Pole with earth pole 15 amp double outlet	set	33				
AB-0433	Ditto, but 30 amp single outlet	set	4				
AB-0434	Socket outlet: Wall surface mounted type AC 3-Phase 380 V, 3-Pole with earth pole 30 amp single outlet	set	2				
AB-0435	Lighting switch: Wall surface flush mounted type, switch, AC 250 V, 10 amp	set	13				
AB-0436	Lighting switch, Wall surface flush mounted type, three way switch AC 250 V, 10 amp	set	2				
AB-0437	Distribution board: Wall surface mounted metallic cabinet type DB-SS3	set	1				
AB-0438	Exterior lighting control panel: Wall surface mounted metallic cabinet type ELC	set	1				

Bill of Quantities

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
AB-0439	Lighting main feeder cable from Station Transformer Panel to DB-SS1 600V XLPE 3C+N 25 mm ²	m	75				
AB-0440	Wiring for lighting system, consist of PVC wires of 4 mm ² , steel conduit 20 mm, conduit accessories, cable connections, outlet boxes, mounting fittings and necessary devices.	L.S.	1				
AB-0441	Wiring for socket outlet system, consist of PVC wires of 4 mm ² , steel conduit 20 mm, conduit accessories, cable connections, outlet boxes, mounting fittings and necessary devices.	L.S.	1				
AB-0442	Wiring for exterior lighting system, consist of 600 V XLPE 4c-16 mm ² , 3C-16 mm ² or 2C-8 mm ² in plastic conduit 30 mm	L.S.	1				
AB-0443	Grounding conductors for distribution board, lighting fixtures and socket outlets	L.S.	1				
AB-0444	Ventilation, wall mounted exhaust fan, 250 mm dia. x 18CMM x 25W	No.	2				
AB-0445	Ventilation, wall mounted exhaust fan, 300 mm dia. x 28CMM x 50W	No.	1				
AB-0446	Ventilation, wall mounted exhaust fan, 400 mm dia. x 82CMM x 0.4KW	No.	1				
AB-0447	Ventilation, O.A. (outside air) supply fan, 550 mm dia. x 185 CMM x 2.5KW with SAR 750 x 200 34CMM (6 Nos.)	No.	1				

Bill of Quantities

Pay Item	Description	Unit	Quantity	Local Currency Egyptian Pound		Foreign Currency	
				Unit Price	Amount	Unit Price	Amount
AB-0448	Air conditioners, split type, wall mounted, cooling cap. 4KW	No.	3				
AB-0449	Air conditioners, split type, ceiling suspended, cooling cap. 12KW	No.	2				
AB-0450	Air conditioners, split type, cooling cap. 10KW	No.	1				
AB-0451	Roof water down pipes, cast iron diam. 150 mm	m	18				
AB-0452	Water closet, including flush valves	set	4				
AB-0453	Wall urinals, including flush valves	set	3				
AB-0454	Lavatories	set	5				
AB-0455	Service sink	set	1				
AB-0456	Floor drains 50 mm dia. Including trap as specified.	set	9				
AB-0457	Water supply system including piping works, elevated water tank, isolation valves and all fittings necessary to complete the works as specified and defined on the drawing.	L.S.	1				
AB-0458	Drainage system including piping works, septic tank, evaporation pit, manholes and all fittings necessary to complete the works as specified and defined on the drawing.	L.S.	1				
AB-0459	Portable fire extinguishers	set	10				
AB-0460	Lightning Protection	L.S.	1				
AB-0400	Total						