CHAPTER 6 POWER SUPPLY

CHAPTER 6 POWER SUPPLY

6.1 Outline of the Power Supply System

Electric power will be supplied from the El Abd substation located about 35 km north west of the No. 7 Pumping station through two 66 kV transmission lines on one tower to the Main Power Substation located near by the pumping station.

From the main power substation 11 kV power will be supplied to the Auxiliary Substation in the No. 7 Pumping Station house.

That is, there are four major facilities such as 66 kV transmission lines, 66 kV Main Power Substation, 11 kV underground feeder line and Auxiliary Substations in the power supply system.

Outline of these major facilities is as shown on the drawings (SSE-401 to SSE-410 and PSE-213 to PSE-222) and in the following sections.

6.1.1 66 kV Transmission Lines

All works for construction the transmission lines will be executed by REA (Rural Electrification Authority) by the requirement of NSDO before the beginning operation of the pump station.

Two transmission lines will be fed from El Abd substation with aerial cables of aluminum alloy stranded and transmission capacity of each line will be more than 100 MVA.

6.1.2 Main Power Substation

NSDO will provide the plant site for the main power substation at the location about 100 meter far from the No. 7 pumping station.

The technical requirements of NSDO is as shown on the attached drawings (SSE-401 to SSE-410 and SBW-401 to SBW-426) based on the following conditions of the No. 7 Pumping Station operation, that is,

(1) Three main pumps (13,000 kW per pump motor) will be operated in same time

(2) Main pump auxiliary equipment and building facilities (total demand is about 1,000 kVA) will be operated in the same time with three main pumps.

(3) The substation is indoor open type.

REA will prosecute detail designing, tendering and construction for the substation.

The substation will be indoor open type, and four 25 MVA transformers each two transformer connected in parallel, usually one bank of the parallel transformers will supply power to the pumping station. Other parallel transformer bank used as standby.

6.1.3 11 kV Underground Feeder Lines

Two 11 kV feeders will be installed between secondary terminal of the 11 kV circuit breaker of the main power substation and primary terminal of the 11 kV circuit breaker of the auxiliary substation in the pump house.

For the 11 kV XLPE copper single core cables will be adopted and conductor size is 500 mm^2 (this is maximum conductor size of products in Egypt at the present time).
While the maximum current capacity of the feeder line is 2.630 amp (50,000 kVA/11 kV /1.73) and rating current capacity of 500 mm^2 XLPE is 670 amp then, four conductors is required per each phase line.

All feeder cables are laid in the underground PVC conduits as shown on the attached drawing No. PSE-207 to PSE-210.

All feeder cables will be supplied, installed and maintained by REA and underground conduit lines will be supplied, installed and maintained by NSDO.

6.1.4 Auxiliary Substations

The indoor, metal clad type auxiliary substation will be installed in ground floor level of the No. 7 pumping station as shown on the attached drawings.

The substation consists of the following panels,

a. Two 11 kV feeder cable termination panel
b. Two 11 kV power receiving panel
c. Two 11 kV potential transformer panel
d. Two 11 kV grounding potential transformer panel
e. Eight main motor feeder panel
f. Two station transformer feeder panel
g. Two station transformer panel

The Vacuum Circuit Breaker (VCB) is adopted for all 11 kV feeders and Molded Case Circuit Breaker (MCCB) or Air Circuit Breaker (ACB) is for low voltage circuits.

For 11 kV side double bus-bar system is adopted and ll main pump motors will be able to changeover the feeding bus-bar.

NSDO will execute all of works such as design, tendering, operation and maintenance as a part of the contract package (El Salaam No. 7 Pumping Station).

6.1.5 New design concept of REA

On the final stage of design works, REA informed new design concept of the main power substation as described hereinafter.

(1) New information from REA

The new information of REA is summarized as follows.

a. Until the period of detailed design stage, it had been recognized that the main substation is exclusively use of the No. 7 Pumping Station. However the concept is changed such that the main substation will supply power to not only the No. 7 Pumping Station but also neighboring facilities constructed in future.
b. In accordance with this change of the concept the system diagram shall be composed as same as standard connection of REA, adopted to all other substations to expect a convenience of operation and maintenance works.
c. Two more 66 kV transmission lines will be installed from El Arish substation that is each two 66 kV transmission lines will be fed from both substations of El Abd and El Arish to make linkage of these substations and in expectation high reliability of power supply.
d. These four 66 kV transmission lines will be linked to each other into the main power substation by sectionalized double bus system.

(2) Items to be revised

By the above mentioned recommendations of REA the following items shall be revised.

a. Two more 66 kV power receiving systems shall be added and the main substation will be provided with totally four 66 kV power receiving systems.
b. Double bus system with bus-tie circuit breaker shall be adopted for 66 kV bus for provided with functions to make linkage between El Abd and El Arish transmission lines.
c. 11 kV bus system shall be installed in the main substation because each two main transformers shall be connected to parallel in the main substation.
d. The 11 kV underground feeder cable lines connected from the main substation to the pumping station shall be revised to two lines of 2,600 ampere instead of four lines of 1,300 ampere.
e. Substation building shall be extended to install the additional power receiving equipment and double bus system.

(3) Revised Drawings

At least, the following additional drawings of main power substation are provided and attached as design condition or design data for design works of power supply system of the No.7 Pumping Station.

a. ANNEX – 1: POWER SUPPLY SYSTEM GENERAL DIAGRAM
b. ANNEX – 2: SINGLE LINE DIAGRAM
c. ANNEX – 3: LAYOUT PLAN
d. ANNEX – 4: TYPICAL SECTION
e. ANNEX – 5: MAIN SUBSTATION BUILDING PLAN AND SECTION

(4) Tender Documents for the Main Power Substation

The documents shall be arranged based on the original design (as shown on the DWG. SSE-401 to SSE-410 and SBW-401 to SBW-426) and the above-mentioned new concept (as shown on the ANNEX-1 to ANNEX-5) are not considered.

6.2 Requirement Capacity of the Power Supply System

For the main items required to design works of the power supply system such as capacity of the main and auxiliary transformers, short circuit current and grounding resistance are calculated as shown in the Basic Design Report, and calculated value is as followings.

6.2.1 Numbers and Unit Capacity of Main Transformer

Calculation conditions are as follow.

(1) Main transformer unit capacity is limited as 25 MVA by the standard capacity of REA
(2) Starting capacity of main pump motor is 33 MVA (Active power: 6,527 kW, Reactive power: 31,974 kVar)
(3) Calculate for severest operation condition, that is, 2-Main pumps and auxiliary consumers are full load operation and then the third pump is starting.
(4) Full load capacity of auxiliary consumers is 1,000 kVA (Active: 800 kW, Reactive: 600 kVar)

Calculation method is as shown on the Basic Design Report.
As the result, required transformer capacity is 48 MVA then, parallel operation of two 25 MVA transformer is necessary.

6.2.2 Station Transformer Capacity for Main Power Substation

Power consumers in the main power substation are estimated as follows.

(a) Operation of power supply equipment	100 kVA
(b) Protection relays/Control system	100 kVA
(c) Building facilities	100 kVA
(d) Lighting systems	200 kVA
(e) Others	100 kVA
Total	600 kVA

Take the demand factor of 70 percent into consideration, required capacity is 420-kVA then two 500 kVA transformers (one is for standby) are required.

6.2.3 Auxiliary Transformer Capacity for No. 7 Pumping Station

Connected power consumers of auxiliary transformer is estimated as follows.

(a) Main pump auxiliary equipment	625 kW
(b) Lighting & Socket outlets	250 kW
(c) Outdoor lighting	250 kW
Total	1,1250 kW

The, two 1,000 kVA (one is for standby) transformers are required.

6.2.4 Short Circuit Capacity

The short circuit capacity is calculated by percent impedance method as mentioned in the Basic Design Report and as the result, required short circuit capacity of main pump feeder breaker is 40 kA.

6.2.5 Protection Earth Resistance

The earthing resistance to keep safe of human body from an electric shock shall be less than 5 ohm in the pump station as shown in the Basic Design Report.

6.2.6 Earth Resistance

The compound earthing system of earth grid and earth rod is adopted to power system earth and protection earth of the main substation and pumping station.

The standard earthing resistance of REA and MED is 0.5 ohm, the results of calculation is

satisfied this value, or earthing resistance of the main substation is 0.22 ohm and of pumping station is 0.25 ohm as shown in the Basic Design Report.
Calculation method is as shown in the Basic Design Report.

6.3 Power Supply Equipment

Details of characteristics of the main equipment installed in the main power substation and auxiliary substation is as shown in the Basic Design Report and summarized outline is as follows.

6.3.1 Equipment for the Main Substation

The main substation is an indoor open type and consist of the following main equipment or facilities as shown on the attached drawing No. SSE-403.

(1) Main Transformer

(a) Type: Outdoor, Oil-immersed, double winding and air cooling type
(b) Capacity: 25 MVA per each
(c) Rated voltage: 66 kV/ 11 kV

(2) 66 kV Disconnector

(a) Type: Air disconnector
(b) Rated Voltage: 72.5 kV
(c) Frequency: 50 Hz

(3) 66 kV Earthing switch

(a) Type: Air disconnector
(b) Rated Voltage: 72.5 kV
(c) Frequency: 50 Hz

(4) 66 kV Circuit Breakers

(a) Type: Gas insulated, phase segregated type (GCB)
(b) Rated voltage: 72.5 kV
(c) Frequency: 50 Hz

(5) 66 kV Surge Arresters

(a) Type: Series gap type

(b) Rated voltage: 84 kV
(c) Rated discharge current: 10,000 A

(6) 66 kV Current Transformer

(a) Type: Indoor bushing type
(b) Rated secondary current: 5 A
(c) Ratio of error: ± 1 %

(7) Control Panel for Main Substation

(a) Type: Vertical stand type
(b) Enclosure: Sheet steel unit type
(c) Index of protection: IP 51

(8) 66 kV Bus bar Insulators

(a) Type: Desk type Suspension insulator
(b) Diameter: 250 mm
(c) Composing number: 4 disks
(d) Withstand voltage: 150 kV
(e) Type: Post type line insulator
(f) Dimensions: Diameter: 190 mm, Height: 740 mm
(g) Withstand voltage: 135 kV

(9) Station Transformer for Main Substation

(a) Type: H Class dry type (allowable coil temperature :140℃)
(b) Cooling system: AN (Dry type natural air-cooling)
(c) Capacity: 500 kVA

6.3.2 Auxiliary Substations (for No. 7 Pumping Station)

The auxiliary substation is indoor metal clad type and installed in the ground floor of the pump station.
Composition of the metal clad is as shown on the attached drawing PSE-203.
The major equipment used to the auxiliary substation is as follows.

(1) 11 kV Circuit Breaker

(a) Type: Vacuum Circuit Breaker (VCB)
(b) Rated voltage: 12 kV

(c) Frequency: 50 Hz
(d) Rated short circuit breaking current: 40 kA

(2) 11 kV Current Transformer

(a) Molded type current transformer is adopted.
(b) Rated Secondary Current: 5 A
(c) Ratio of Error: ± 1 %

(3) 11 kV Voltage Transformer

(a) Rated primary voltage: 11 kV
(b) Rated secondary voltage: 110 V
(c) Ratio of error: ± 1.0 %

(4) Metal clad for auxiliary substation

All equipment and devices of the auxiliary will be installed in the steel clad as specified as follows.

(a) Type: Vertical stand type
(b) Enclosure: Sheet steel unit type
(c) Index of protection: IP 51
(d) Separation of unit: Unit enclosed
(e) Doors: Front and Rear of each unit

6.4 Building Works

6.4.1 Architectural Design

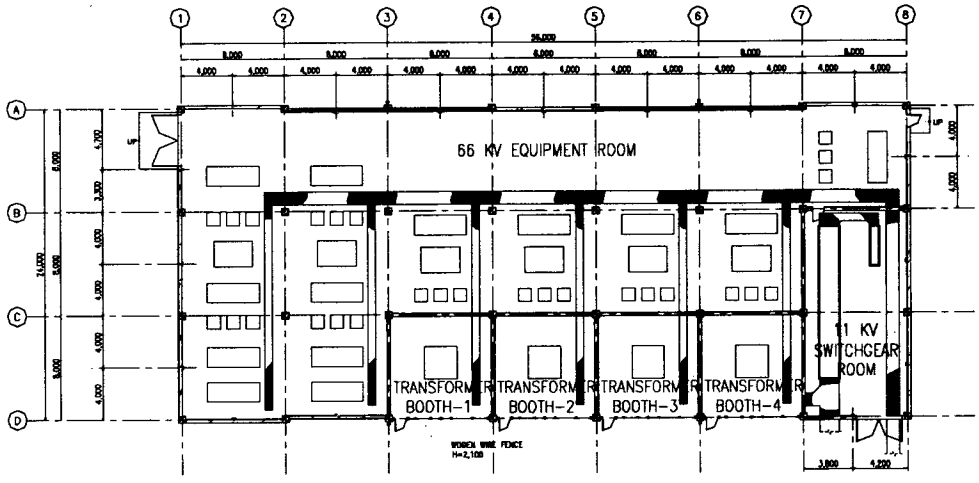
(1) Background

Detailed design of Main Substation (indoor type) and Administration Building has been carried out based on the design concepts and criteria mentioned in the Interim Report (2) Clause 6.4. Detailed data and information required for the Power Supply and Sub-station equipment has been provided and considered in the design of the Main Substation and Administration Building.

(2) Function and Layout

Site for Main Substation and Administration Building shall be located to the north of Pump House at elevation EL+25.00 m in accordance with the site plan. Floor plans, sections and elevations for the Main Substation and Administration Building are defined in the drawings and the following facilities are provided in order to provide adequate spaces for operation and maintenance of all equipment and to allow reasonable working conditions for staff and workers in compliance with the laws and regulations in Egypt.

(a) Main Substation (Total Area: 1,344 m^2)



(i) 66 KV Equipment Room (960 m^2)

Main large access door provided at axis 1 for the delivery and maintenance of the equipment. One ordinary door shall be provided at axis 8. Space for future expansion (Stage II) shall be reserved next to axis 8.

(ii) 11KV Switchgear Room (128 m^2)

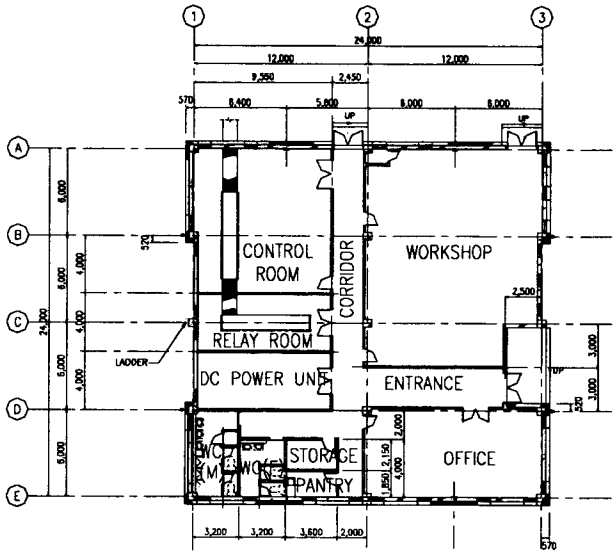
Main large access door shall be provided at axisD.

(iii) Transformer Booths 1-4 (256 m^2)

Four Nos. transformer shall be installed in the booths respectively. Each booth shall

be partitioned by brick wall construction, however front side at axis D shall be fenced for better natural ventilation.

(b) Administration Building (Total Area : 576 m^2)



(i) Control Room (95.5 m^2)

One large main and one ordinary size doors shall provided for the equipment and staff's access from corridor.

(ii) Relay Room (38.2 m^2)

One large main door shall be provided for the equipment and staff's access from corridor. The room is located between Control Room and DC Power Unit.

(iii) DC Power Unit (38.2 m^2)

One large main door shall be provided for the equipment and staff's access from corridor.

(iv) Workshop (172.5 m^2)

One external large entrance door shall be provided for the equipment's access and two ordinary doors are provided for staff's access from corridor.

(v) Office (72 m^2)

One main large door shall be located near to the main entrance door for staff's easy access. Another door provided to access utility area (toilets, pantry).

(vi) Toilets, Storage and Pantry (46.4 m^2)

Male and female toilets shall be located separately and Storage and Pantry shall be located adjacently.

(vii) Entrance and Corridor (113.2 m^2)

Adequate width to deliver equipment is provided for the corridor. Large size door shall be provided at axis A considering access of equipment.

(3) Building Materials and Architectural Finishes

Based on the criteria mentioned in the Interim Report (2), building materials and architectural finish shall be designed and selected as described hereafter in order to avoid

unreasonable heat accumulation in the buildings from natural sun-light, adequate number of openings shall be provided for natural ventilation and insulation will be provided on the roof slab.

(a) Building Materials

Building framing will be of reinforced concrete. Building enclosures will be of masonry brick or block wall construction. Based on the existing main sub-station buildings and where practical, the similar materials, proprietary products and architectural appearance shall be used in order to ensure satisfactory aesthetic design and the use of standard products and dimensions. The interior and external architectural finish for Main Sub-station Building and Administration Building are as defined on the drawings.

(i) External finishes:

- Roof: Bituminous membrane waterproofing with heat insulation material (50 mm thick.) and covered by mortar with tiles.
- Wall: Cement brick (120 x 240 x 60 mm) walling with plastered and painted or sand lime brick (115 x 250 x 60 mm) faced.

(ii) Floors: Unglazed ceramic tiles (150 mm x 150 mm or 200 mm x 200mm with 10mm thick) for all electrical rooms, toilets and pantry. Terrazzo tiles (250 mm x 250 mm with 25mm thick) for office, entrance and corridors.

(iii) Walls: Glazed ceramic tiles (150 mm x 150 mm or 200mm x 200mm with 6mm thick) up to 2 m height from the finished floor level and paint for the area above 2 m on plastered wall for all electrical rooms (except for transformer booths), toilets and pantry. Paint on plastered masonry or RC structure walls for the remaining rooms.

(iv) Ceiling: Generally paint on plastered RC structure. Suspended acoustic ceiling will be applied for Office and Control room.

(v) Doors: Steel doors with paint finish shall be used for mechanical, electrical and workshop rooms. Wooden door with paint finish shall be used for office, toilets and pantry rooms. Sizes of doors are as defined on the drawings.

(vi) Windows: Aluminum framed bottom-hinged glazed windows are generally used and fixed windows are combined where necessary in the rooms of Administration Building. Sizes of windows are as defined on the drawings.

(vii) Gallery Works: Handrails and ladders where required shall be of fabricated steel and painted.

(4) Drawings

The following drawings are prepared for the architectural design.:

(a) General notes, symbols, abbreviations, floor area and finishing schedule.

(b) Floor plans, sections and elevations

(c) Standard and special details

6.4.2 Structural Design

(1) Background

Design has been carried out based on the design criteria and considerations mentioned in the Interim Report (2). Structural design includes structural calculation, general notes, framing plans and standard details and so on for Main Substation and Administration Building. Design coordination with electrical equipment has been carried out and loading data and size of equipment to ensure space and design of supporting structure were provided. Loading data of architectural finish has also been coordinated. The buildings are single storied and the structure shall be of reinforced concrete framing with masonry brick wall construction. Elevated water tank (4t capacity) will be installed on the roof of Administration Building and the loading shall be considered for the design of the buildings.

(2) Codes and Standards

Structural design for buildings shall be carried out in accordance with the latest edition of Egyptian Code of Practice (E.S.S). Any authorized national or local standards and codes in Egypt are considered in the design of the building. Structural calculation will be carried out in accordance with the latest edition of E.S.S with the aid of ACI 318.

(3) Materials

As mentioned in item (1) above, building will be by reinforced concrete framing and materials used for the building structure are summarized as follows:.

(a) Concrete
- Foundation, slab on grade: Fcu=250kg/cm^2
- All other concrete: Fcu=300kg/cm^2

(Fcu: 28days cube compressive strength)

(b) Reinforcing steel
- Round bar: Normal mild steel 24/35 Fy=2400kg/cm^2
- Deformed bar: High grade steel 36/52 Fy=3600kg/cm^2

(c) Other materials
- Other materials are as defined on the drawing No. SBW-411.

(4) Frame Analysis

The Main Substation and Administration Building are both single-story reinforced concrete frame structure. Lateral loads are resisted by bending action in both lateral and longitudinal directions.

(a) Dead Loads

- Weight of reinforced concrete: $2500kg/m^3$
- Weight of steel: $7850kg/m^3$

(b) Live Loads:

- Roof: $100kg/m^2$

(c) Seismic loads

Seismic load will be calculated as follows:

$Kh=0.4K\ C\ I$

Where, Kh: Seismic horizontal acceleration for design,

K: 1.0 for structural system contains both ductile space frames and shear walls, both to resist the effect of horizontal forces.

C: Factor calculated from following equation:

$C=1/15 \times \sqrt{T}$

T: Fundamental period of vibration of the structure under consideration in seconds.

I: Degree of importance for the structure. 1.5 for structure with special importance.

(d) Soil Condition

Allowable bearing capacity of soil: $20\ t/m^2$

(e) Frame analysis

Three dimensional frame analysis was carried out for the design of structures, using the STAAD III structural analysis software. The frame models, including joint numbers, member numbers, member properties and analysis results for Main Substation and Administration Building are shown in the APPENDIX C.6.4-1 and C.6.4-2 respectively.

6.4.3 Building Services Design:

(1) Ventilation and Air Conditioning

(a) Description of the System

Ventilation and air conditioning system will be provided for the rooms where required at the Main Substation and Administration Building in order to maintain proper working condition for the equipment and O/M personnel. The 66 KV Equipment Room in the Main Substation building shall be ventilated naturally by providing sufficient number of windows on the wall. The 11 KV Switchgear Room in the Main Sub-staion shall be ventilated by the axial flow exhaust fan and outside fresh air shall be introduced to the space through the intake wall louvers. Workshop in the Administration Building shall be ventilated by the axial flow supply fan and supplied outside air shall be exhausted through the wall louvers. The Control Room, Relay

Room and Office in the Administration Building shall be air conditioned by the window type air conditioners or split type air conditioners. Following type of the ventilation and air conditioning equipment shall be adopted as shown on the Table below.

Building	**Room**	**Ventilation/Airconditioning Equipment**
Main Substation	11KV Switchgear Room	Axial type exhaust fan
	66 KV Equipment Room	Natural ventilation by window
Administration Building	Control Room	Split type air conditioner
	Relay Room	Split type air conditioner
	DC Power Unit	Wall mounted exhaust fan
	Work shop	Axial flow supply fan
	Office	Window type air conditioner
	Toilets	Wall mounted exhaust fan
	Pantry	Wall mounted exhaust fan

(b) Design Conditions and Criteria

The design of ventilation and air conditioning system shall be based on the recommendation of ASHRAE handbook, and the following design conditions and design criteria shall be adopted:

Outdoor Design Temperature : 37 °CDB, 23 °CWB
Indoor Design Temperature : 25 ±1 °CDB, 50 ± 10% RH

Ventilation Requirements:

Room		Fresh air changes per hour
Work Shop	;	15
Toilet, Pantry	;	20
11 KV switch gear room	;	15 times air changes or 45 °C whichever larger
DC power unit room	;	30

(2) Plumbing System

The water supply and plumbing system shall be designed in accordance with the rules and regulations of Egypt. Plumbing system shall include provisions of water supply including elevated water tank, drainage, plumbing fixture, septic tank and evaporation pit and appurtenances.

(a) Water Supply System

Water distribution piping with the 50mm diameter gate valve shall be provided at the appropriate location within the boundary by the Second Package Contractor. The

water shall be stored in the elevated water tank having a capacity of 4 M^3 , being installed on the roof of the Administration Building, and supplied to sanitary fixtures and pantry wherever water is required by gravity flow. A stub-out with the 40mm diameter gate valve shall also be provided by the Second Package Contractor for supplying water to the Pump House.

(b) Drainage System

Soil and wastewater from the plumbing fixtures and pantry shall be collected to the sewer pipe by gravity flow and connected to the wastewater treatment facility. The septic tank and evaporation pit shall be provided at the appropriate location within the area. The treated water from the septic tank will be evaporated in the air through the evaporation pit.

(c) Plumbing Fixtures

The plumbing fixtures shall be provided as shown on the architectural drawings.

(d) Fire Protection System

A fire extinguisher shall be provided for every 100 m2 of the floor area in the building. A floor area less than 100 m2 shall have at least one fire extinguisher. Fire protection system will be designed in compliance with the local regulations, standards and practices applicable to the facility.

(3) Lighting and socket outlet system

(a) General lighting system

All areas or rooms of the main substation building will be equipped with general lighting and systems as mentioned herein after.

(i) System composition

The system will consist of general lighting fixtures, emergency lighting fixtures, distribution boards, control system and wiring.

(ii) General lighting fixtures

The fixtures are classified into four types such as,

Type-A: Ceiling surface mounted type with metallic low brightness louver, for fluorescent lamp, IP 51.

Type-B: Ceiling surface mounted open type for fluorescent lamp, IP 51.

Type-C: Pipe pendant type with metallic reflector for fluorescent lamp, IP 51.

Type-D: High ceiling mounted type with flood type metallic reflector for high-pressure sodium lamp, IP 51.

Type-E: Flood lighting fixture for high-pressure sodium lamp, IP 65.

Type-F: Pole top mounted type area lighting fixture for sodium lamp, IP 65.

(iii) Lighting intensity

Designed lighting intensity and installed fixture type are as shown on the following table.

Schedule for Lighting intensity and fixture

Type of room/area	Lighting Intensity (lux)	Fixture Type
Office	300	A
Control room	300	A
Workshop	300	B
Relay room	200	B
DC Power unit room	200	B
Storage	200	B
Pantry	250	B
Toilet	200	B
Corridor	200	B
66 kV Equipment room	300	D and B
11 kV Switchgear room	300	B
Transformer booth	100	B
Main substation site	50	F

(b) Emergency lighting system

The emergency lighting fixtures are installed into all interior area or rooms of the building to prevent darkness by the general lighting failure.

The emergency lighting fixture is ceiling or wall surface mounted type for incandescent lamp powered by centrifugal battery system.

Designed lighting intensity of the emergency lighting is 50 lux for every escape root in the building.

(c) Control method of the lighting system

The general lighting fixtures installed into the administration building are turned on or off by the local lighting switch in each room.

The general lighting fixtures installed in the main substation building will be turned on or off by the remote control switches located in suitable locations.

Each remote control switch will control a magnetic contact relay installed in branch circuit for the fixtures in distribution board.

(d) Socket outlet system

All interior rooms or areas are equipped with general use socket outlets to power supply for small electrical consumers.

Additionally two types of special purpose socket outlets are installed into main substation building and workshop room.

The general use socket outlet is 2-pole plus earth pole and 220 V, 15 amp, wall surface flush mounted type.

The special purpose socket outlets are specified as follows.

One is single phase 220 V, 30 amp and the other is three phase 380 V, 20 amp and these outlets is set in wall surface mounted metallic cabinet of IP 51.

(e) Distribution board

For supply power to these lighting fixtures and socket outlet the distribution boards will be installed or two into the main substation building and one is into administration building.

The distribution board is composed with main circuit breaker, branch circuit breakers, earth leakage current relays, magnetic contact relays and voltage indication lamps.

The molded case circuit breaker is adopted for main and branch breakers.

To automatic control of exterior site lighting a photocell switch and time switch will be provided to branch circuits of the site lighting fixtures.

ANNEX : MAIN POWER STATION

ANNEX 1 : POWER SUPPLY SYSTEM GENERAL DIAGRAM

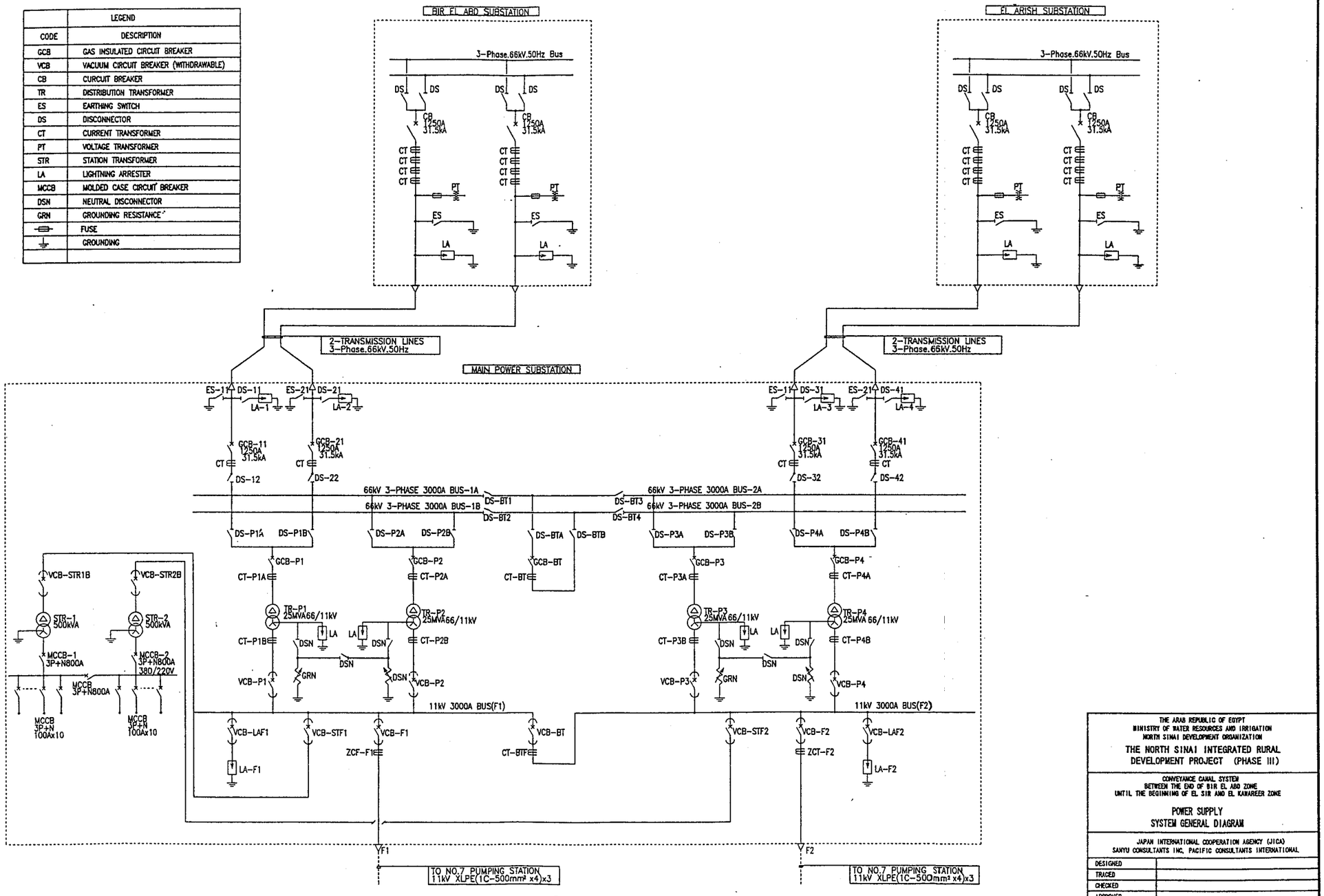
ANNEX 2 : POWER SUPPLY SINGLE LINE DIAGRAM

ANNEX 3 : POWER SUPPLY MAIN POWER SUBSTATION (LAYOUT PLAN)

ANNEX 4 : POWER SUPPLY 66 kV SUBSTATION (TYPICAL SECTIONS)

ANNEX 5 : MAIN SUBSTATION (GROUND FLOOR AND ELEVATION)

	LEGEND
CODE	DESCRIPTION
GCB	GAS INSULATED CIRCUIT BREAKER
VCB	VACUUM CIRCUIT BREAKER (WITHDRAWABLE)
CB	CURCUIT BREAKER
TR	DISTRIBUTION TRANSFORMER
ES	EARTHING SWITCH
DS	DISCONNECTOR
CT	CURRENT TRANSFORMER
PT	VOLTAGE TRANSFORMER
STR	STATION TRANSFORMER
LA	LIGHTNING ARRESTER
MCCB	MOLDED CASE CIRCUIT BREAKER
DSN	NEUTRAL DISCONNECTOR
GRN	GROUNDING RESISTANCE
	FUSE
	GROUNDING



THE ARAB REPUBLIC OF EGYPT
MINISTRY OF WATER RESOURCES AND IRRIGATION
NORTH SINAI DEVELOPMENT ORGANIZATION

THE NORTH SINAI INTEGRATED RURAL DEVELOPMENT PROJECT (PHASE III)

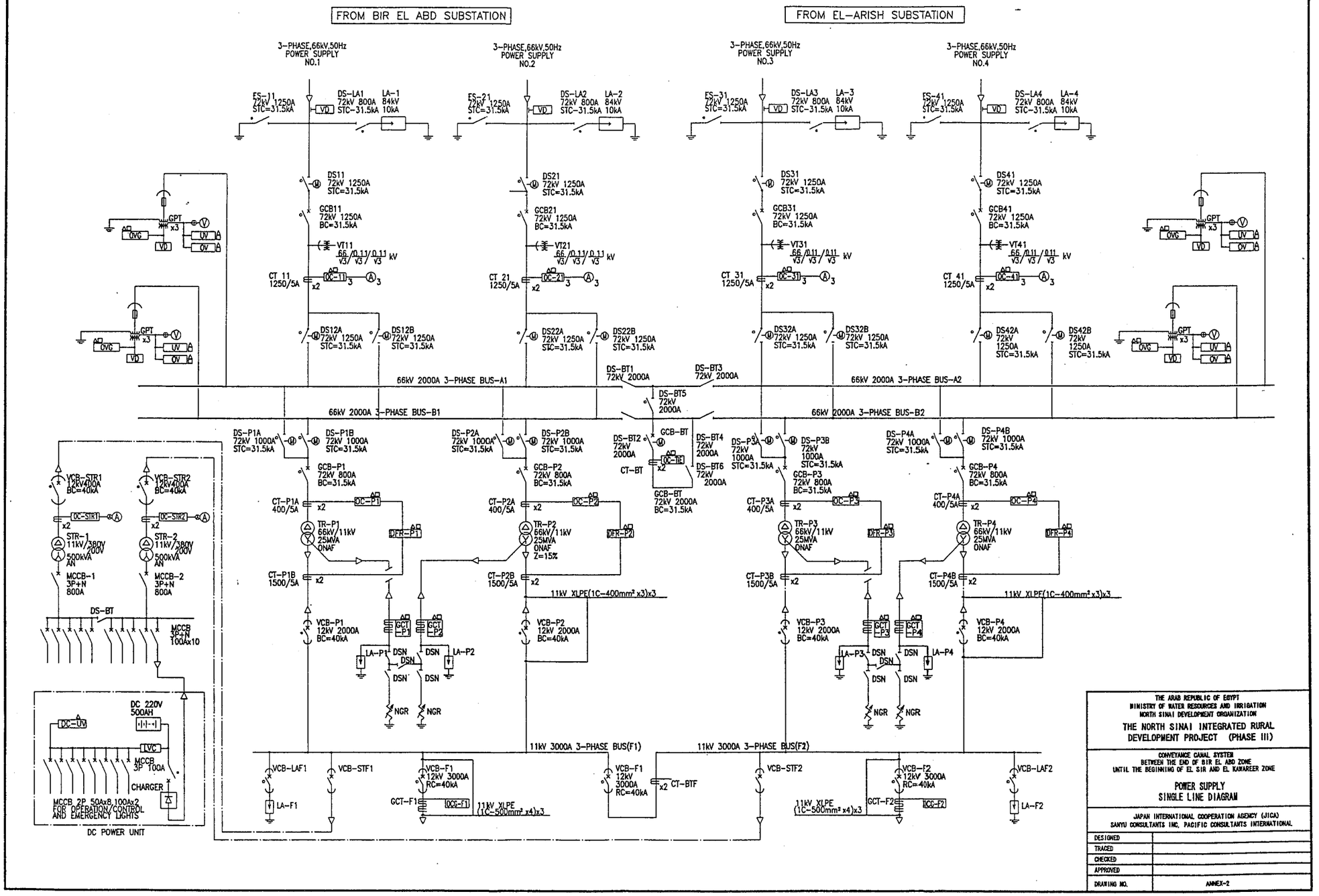
CONVEYANCE CANAL SYSTEM
BETWEEN THE END OF BIR EL ABD ZONE
UNTIL THE BEGINNING OF EL SIR AND EL KANAREER ZONE

POWER SUPPLY
SYSTEM GENERAL DIAGRAM

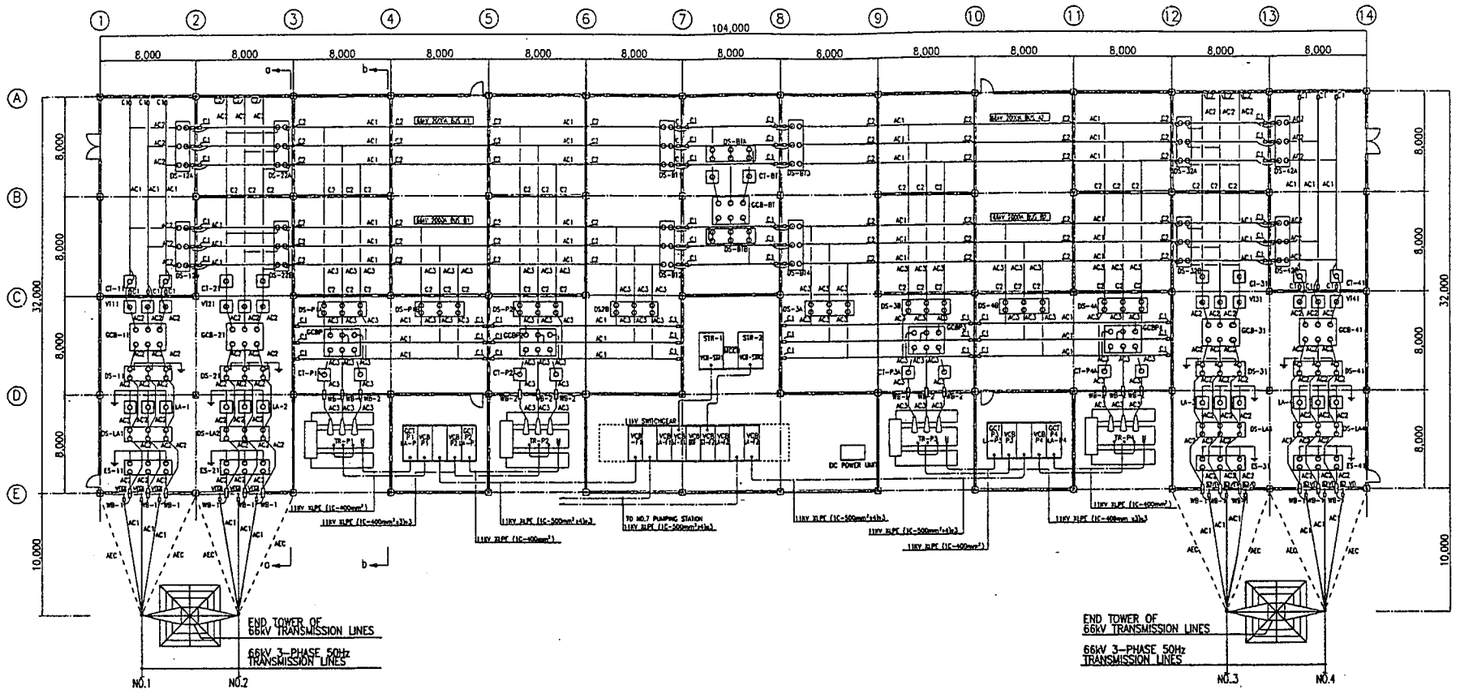
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
SANYU CONSULTANTS INC. PACIFIC CONSULTANTS INTERNATIONAL

DESIGNED	
TRACED	
CHECKED	
APPROVED	
DRAWING NO.	ANNEX-1

ANNEX 1 : POWER SUPPLY SYSTEM GENERAL DIAGRAM



ANNEX 2 : POWER SUPPLY SINGLE LINE DIAGRAM



MAIN POWER SUBSTATION LAYOUT PLAN

LEGENDE

CODE	DESCRIPTION	SIZE
AC1	HEAT RESISTANCE ALUMINIUM ALLOY STRANDED CABLE	1600 mm²
AC2	ALUMINUM PIPE CONDUCTOR	60 mm dia.
AC3	ALUMINUM PIPE CONDUCTOR	50 mm dia.
XLPE	11kV XLPE POWER CABLE	
C1	SUSPENSION INSULATOR DISK TYPE 250mm x 4 UNIT	
C2	LINE POST INSULATOR 190mm dia 740mm LENGTH	
WB1	66kV BUSHING(WALL THROUGH)	2000 A
WB2	66kV BUSHING(WALL THROUGH)	1000 A
PD	CAPACITANCE POTENTIAL DEVICE	66 kV
VD	66kV VOLTAGE DETECTOR	
AEC	AERIAL EARTHING CONDUCTOR:HARD DRAWN COPPER CALBE	5 mm

0 2 4 6 8 10 20 m
SCALE

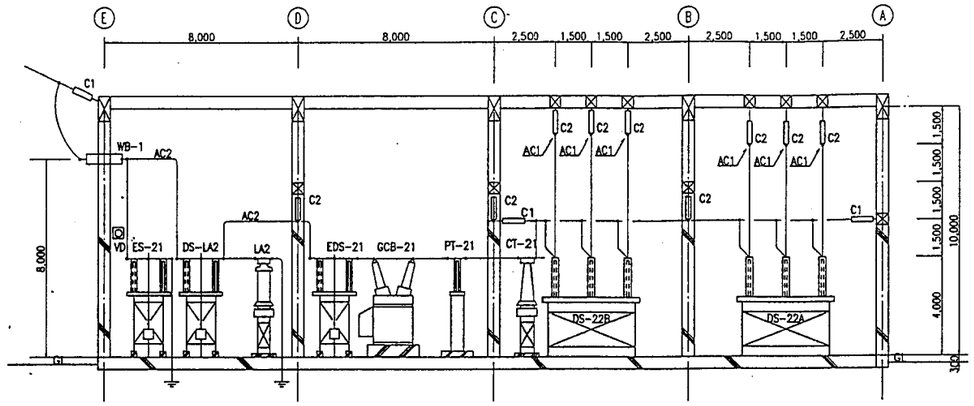
THE ARAB REPUBLIC OF EGYPT
MINISTRY OF WATER RESOURCES AND IRRIGATION
NORTH SINAI DEVELOPMENT ORGANIZATION
THE NORTH SINAI INTEGRATED RURAL DEVELOPMENT PROJECT (PHASE III)

CONVEYANCE CANAL SYSTEM
BETWEEN THE END OF BIR EL ABD ZONE
UNTIL THE BEGINNING OF EL SIR AND EL KANAREER ZONE
POWER SUPPLY
MAIN POWER SUBSTATION
LAYOUT PLAN

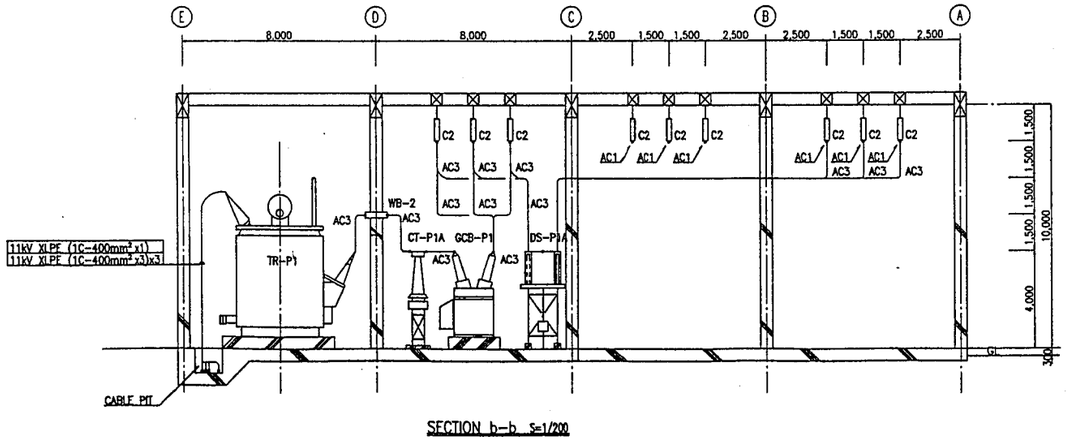
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
SANYU CONSULTANTS INC. PACIFIC CONSULTANTS INTERNATIONAL

DESIGNED	
TRACED	
CHECKED	
APPROVED	
DRAWING NO.	ANNEX-3

ANNEX 3 : POWER SUPPLY MAIN POWER SUBSTATION (LAYOUT PLAN)



SECTION a–a S=1/200



SECTION b–b S=1/200

0 1 2 3 4 5 20 m

SCALE

THE ARAB REPUBLIC OF EGYPT
MINISTRY OF WATER RESOURCES AND IRRIGATION
NORTH SINAI DEVELOPMENT ORGANIZATION

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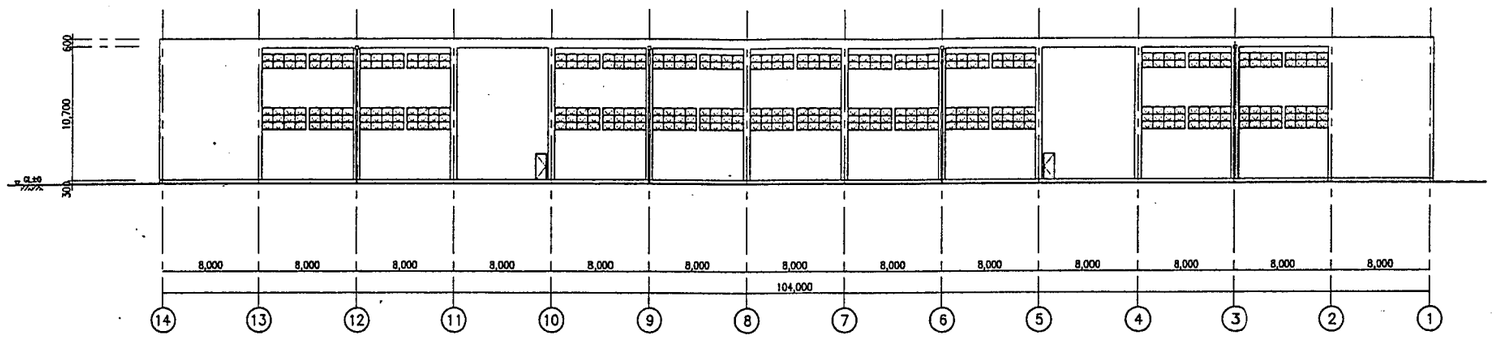
CONVEYANCE CANAL SYSTEM
BETWEEN THE END OF BIR EL ABD ZONE
UNTIL THE BEGINNING OF EL SIR AND EL KANAREER ZONE

POWER SUPPLY
66kV MAIN SUBSTATION TYPICAL SECTIONS

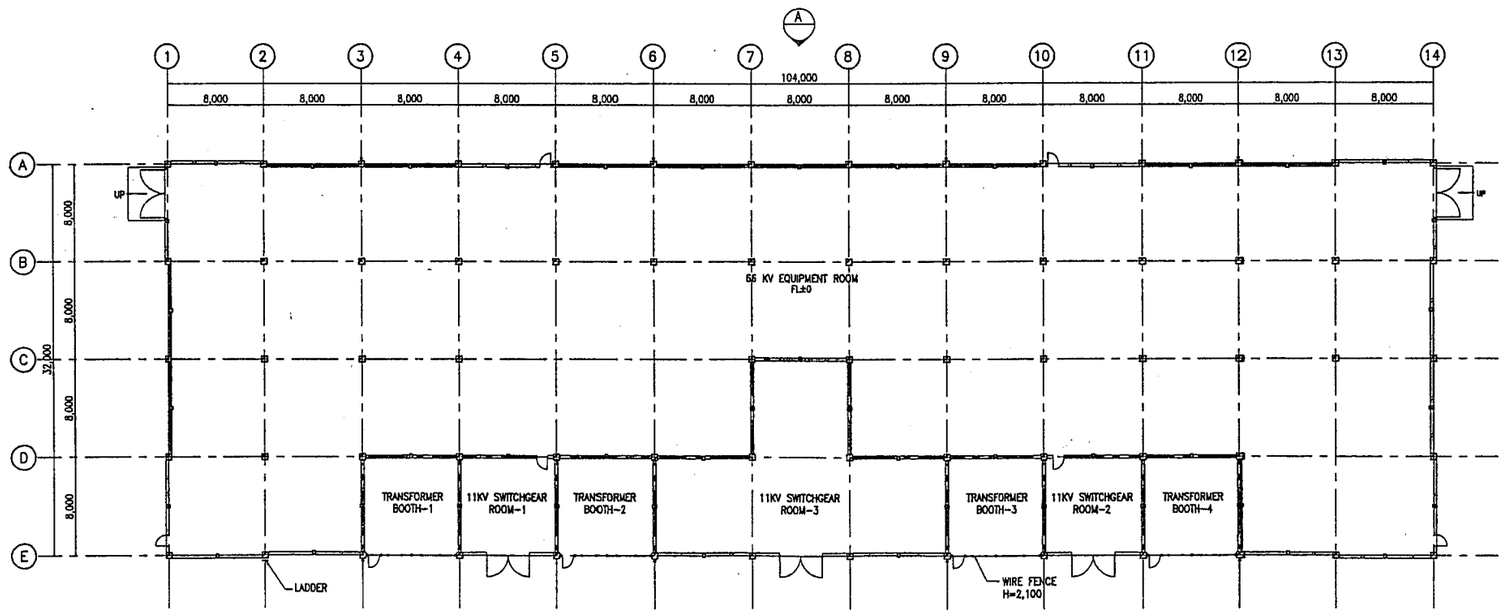
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
SANYU CONSULTANTS INC. PACIFIC CONSULTANTS INTERNATIONAL

DESIGNED	-
TRACED	
CHECKED	
APPROVED	
DRAWING NO.	ANNEX-4

ANNEX 4 : POWER SUPPLY 66 kV SUBSTATION (TYPICAL SECTIONS)



A ELEVATION



GROUND FLOOR PLAN (EL+25.30)

0 10 20m

SCALE 1:400

THE ARAB REPUBLIC OF EGYPT
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NORTH SINAI DEVELOPMENT ORGANIZATION

THE NORTH SINAI INTEGRATED RURAL DEVELOPMENT PROJECT (PHASE III)

CONVEYANCE CANAL SYSTEM
BETWEEN THE END OF BIR EL ABD ZONE
UNTIL THE BEGINNING OF EL SIR AND EL KAMAREEN ZONE

MAIN SUBSTATION
GROUND FLOOR AND ELEVATION

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
SANYU CONSULTANTS INC, PACIFIC CONSULTANTS INTERNATIONAL

DESIGNED	
TRACED	
CHECKED	
APPROVED	
DRAWING NO.	ANNEX-5

ANNEX 5 : MAIN SUBSTATION (GROUND FLOOR AND ELEVATION)