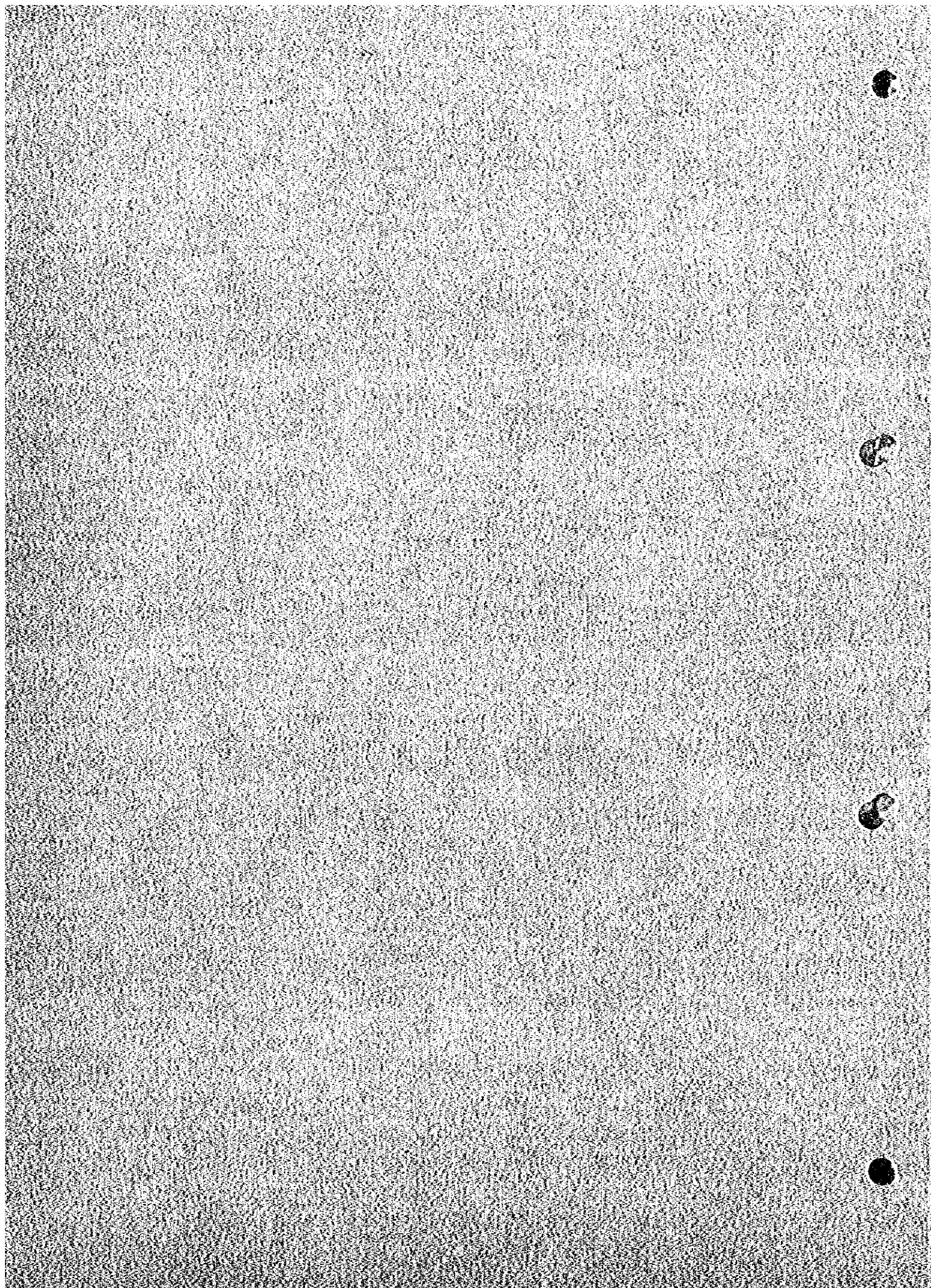


第 6 章

主 要 設 備 仕 様

(1st Stage 300 MW × 2 Units)



第 6 章 主要設備仕様

6-1 発電設備

主要設備の仕様は概要下記の通りである。

6-1-1 発電プラント

1) Boiler

a. Boiler Proper

a) Type : Either natural or forced circulation drum-type, sub-critical, reheat, outdoor type

b) Maximum continuous rating (MCR) : Suitable capacity with 300 MW net output at the high voltage side of the step-up transformer (220 kV)

c) Steam conditions

Main steam pressure at boiler outlet : Corresponding pressure
Pressure drop between steam generator and turbine inlet less than 4% atmosphere

Main steam temperature

at boiler outlet : 541°C

Reheated steam : Corresponding pressure

pressure at RH outlet : Pressure drop between reheater and stop valve less than 10% atmosphere

Reheated steam temperature

at RH outlet : 541°C

d) Number of unit : 2 units/plant

- e) Fuel : Coal and oil
 f) Draft system : Balanced draft system

b. Boiler Auxiliaries

- a) Air preheater
 Type : Vertical, regeneration type
 Number : 2 sets/unit

- b) Steam air preheater
 Type : Fin-tube type
 Number : 2 sets/unit

c) Boiler feed water pump

Turbine-driven boiler feed water pump

- Capacity : 55%
 Number : 2 sets/unit

Motor-driven boiler feed water pump

- Capacity : 55%
 Number : 1 set/unit

- d) Soot-blowers
 Type : Air-jet type
 Number : 1 set/unit

e) Draft equipment

Forced draft fan

- Type : Turbo vane, motor-driven
 Number : 2 sets/unit

Induced draft fan

- Type : Scirroco type, motor-driven
 Number : 2 sets/unit

f) Coal firing equipment

Coal burners

Number : 1 lot/unit

Mill

Type : Vertical bowl mill motor-driven

Number : 5 sets/unit

Primary air fan

Type : Centrifugal type

Number : 2 sets/unit

g) Oil firing equipment

Oil burner

Number : 1 lot/unit

Heavy oil pump

Type : Screw type motor-driven

Number : 3 sets/unit

h) Light oil firing equipment

Number : 1 lot/unit

i) Compressed air equipment

Instrument air compressors

Type : Water-cooled oil-less type

Number : 2 sets/unit

House service air compressors

Type : Water-cooled oil-less type

Number : 1 set/plant

Sootblowing air compressors

Type : Water-cooled type

Number : 3 sets/plant

j) Dust collector

Type : Electrostatic type
 Number : 1 set/unit

k) Ash handling equipment

Bottom ash

Type : Water sluice type
 Number : 1 set/unit

Fly ash

Type : Vacuum type
 Number : 1 set/unit

Ash handling pump

Type : Vertical, motor-driven
 Number : 2 sets/unit

l) Stacks

Type : Steel-made collective type
 (for 2 units)
 Number : 1 lot/plant

m) Desalination plant

Type : Steam type
 Number : 1 lot/plant

n) Water treating equipment

Number : 1 lot/plant

o) Waste water treating plant

Number : 1 lot/plant

p) Fire Fighting System : 1 lot/plant

2) Turbine

a. Turbine Proper

- a) Type : Reheat, condensing, tandem compound type
- b) Rated output at generator sent out : Suitable capacity with 300 MW net output at the high voltage side of the step-up transformer (220 kV)
- c) Steam conditions
- Main steam pressure
- at turbine inlet : 169 kg/cm²
- Main steam temperature
- at turbine inlet : 538°C
- Reheated steam temperature
- at IP turbine inlet : 538°C
- d) Number of unit : 2 units/plant
- e) Rated condenser vacuum : 710 mmHg
- f) Rated speed : 3,000 rpm

b. Turbine Auxiliaries

a) Condenser equipment

Condenser

- Type : Surface type
- Number : 1 set/unit

Cooling water

- Temperature : 27°C

Cooling water pump

- Type : Vertical, motor-driven
- Number : 2 sets/unit

Condensate pump

Type : Vertical, motor-driven

Capacity : 50% MCR

Number : 3 sets/unit

Condenser cleaning device

Number : 1 lot/unit

Seawater electrolysis facility

Number : 1 lot/unit

b) Feed water heater**LP heater**

Type : Horizontal surface type

Number : 4 sets/unit

Deaerator

Type : Horizontal surface type

Number : 1 set/unit

HP heater

Type : Horizontal surface type

Number : 3 sets/unit

c) Bearing cooling water equipment

Number : 1 lot/plant

d) Overhead travelling crane

Number : 1 lot

3) Electrical Equipment and Control System**a. Electrical Equipment****a) Generator****i. Generator Proper**

i) Type : Horizontal-shaft, totally enclosed, hydrogen cooled type

- ii) Capacity : about 400 MVA
- iii) Number of unit: 2 units/plant
- iv) Power factor : 0.8
- v) Short-circuit ratio : 0.58
- vi) Rated voltage : about 18.3 kV or appropriately
- vii) Number of phase: 3
- viii) Frequency : 50 Hz
- ix) Number of pole: 2
- x) Rated speed : 3,000 rpm

ii. Generator auxiliaries: 2 sets

i) Exciter

Type : Static excitation

ii) Isolated phase bus

Type : Self-cooled continuous grounding

iii) PT and SA

Type : Self-standing, phase isolated type

iv) Neutral grounding device

Type : Pole transformer, 2ry resistor type

v) Automatic voltage regulator

Type : Quick-response excitation system

vi) Hydrogen cooler system

Type : Water cooled type

b) Transformers

i. Main transformer with off-load tap changer

Type : 3-phase, OFAF, outdoor type
 Capacity : about 380 MVA
 Number : 1 set/unit
 Voltage : 18.3 kV or appropriately/230 kV

ii. House transformer with off-load tap changer

Type : 3-phase ONAF, outdoor type
 Capacity : about 25 MVA
 Number : 1 set/unit
 Voltage : 18.3 kV or appropriately/6.9 kV

iii. Starting transformer with on-load tap changer

Type : 3-phase, ONAF, outdoor type
 Capacity : about 30 MVA
 Number : 1 set/plant
 Voltage : Primary 220 kV \pm 25 kV
 Secondary 6.9 kV

iv. Aux. transformer

Type : 3-phase AN indoor dry type
 Capacity : about 1,500 kVA
 Number : 7 sets/plant
 Voltage : 6.6 kV/380 V

c) Station service power supply switchgear equipment

i. 6.9 kV switchgear

Type : Metal-clad, draw-out, indoor
 type, 3-pole single throw,
 magnetic-blast breaker

ii. 380 V switchgear

Type : Metal-clad, 3-pole single
 throw, draw-out, indoor type

iii. Motor control center

Type : Steel sheet, self-supporting,
collective switchgear panel
type

iv. 220 V distribution panel

d) Uninterrable power supply unit

Voltage : AC 120 V 1-phase

CVCF : 2 sets/unit

e) DC system

Voltage : DC 125 V

Battery : 1 set/unit

Charger : 3 sets/plant

f) Cable

i. Power cable

ii. Control cable

iii. Instrument cable

g) Emergency generating facilities

Type : Package type gas turbine
driven

Number : 1 set/plant

Rating:

Gas turbine : 17,500 kW (at 40°C)

Generator : 35,000 kVA 6.6 kV or
appropriately

Fuel : Light oil

h) Hydrogen Generator System: 1 set/plant

b. Control System

a) Control panel : 1 set/unit

- i. BTG control panel
- ii. Auxiliary control panel
- iii. Electrical control panel
- iv. Local control panel

b) Control equipment : 1 set/unit

- i. Automatic boiler control system
- ii. Automatic burner control system
- iii. Turbine automatic starting system
- iv. Automatic synchronizing system
- v. Sequential control system
- vi. Data logger system
- vii. Local loop control system

c. Station Service Communication System

- a) Telephone sets : 200
- b) Automatic exchange : 200 circuits
- c) Power source : 1 set
- d) Paging system : 1 set
- e) Alarm system : 1 set

d. Lighting Facilities

- a) Indoor lighting facilities
- b) Outdoor lighting facilities

4) Fuel Handling Facilities

a. Coal Handling

a) Storage capacity : about 335,000 tons (full load operation of 600 MW for 60 days)

b) Unloader : 1,300 t/h x 2 sets

c) Stacker/reclaimer : 3,200 t/h/1,200 t/h x 1 set

d) Stacker : 3,200 t/h x 1 set

e) Reclaimer : 1,200 t/h x 2 sets

f) Conveyor

Unloading conveyor: 1,600 t/h x 2 systems

Stacker conveyor : 3,200 t/h x 3 lines

Reclaimer conveyor: 1,500 t/h x 2 lines

Supply conveyor : 1,500 t/h x 1 line

(incl. conveyor 600 t/h x 2 lines

house) 1,500 t/h x 2 systems

500 t/h x 2 systems

g) Mix bin : 300 t x 2 sets

h) Screen : 500 t/h x 2 sets

i) Crusher : 75 t/h x 2 sets

b. Heavy Oil

Loading arm : 1 set

Unloading facilities : 1 set

(Air separator, strainer, flow meter)

Unloading pump : 1,000 k/h x 1 set

Storage tank : 36,000 k/ x 3 sets

c. Light Oil

Unloading facilities (Strainer, flow meter)

Bulldozer (Coal
storage yard) : 1 set
Bulldozer (Coaler): 1 set

Storage tank

Bulldozer
(Cool storage yard): 50 k/ x 1 set
Bulldozer (Coaler): 5 k/ x 1 set

5) 220 kV Switchyard in Ayun Musa Power Station

a. Main Equipment

- a) 240 kV SF₆ circuit breaker, with built-in bushing
current transformer (outdoor use, puffer-type)

For main transformer, starting transformer, distri-
bution transformer and transmission line

: 16 units

Rated voltage : 240 kV

Rated current : 2,000 A

Rupturing capacity: 40 kA

- b) 240 kV Disconnecting switch (outdoor use)

- i. For main transformer, starting transformer, distri-
bution transformer, bus section and transmission
line (pneumatic operating type)

Pantograph type : 12 units

Horizontal center

break type : 24 units

Rated voltage : 240 kV

Rated current : 2,000 A

Rated short-time

current : 40 kA

- ii. For lightning arrester (outdoor use, manual operating type)

Horizontal center

break type : 4 units

Rated voltage : 240 kV

Rated current : 1,200 A

Rated short-time

current : 31.5 kA

- iii. 220 kV bus earthing device (outdoor use, manual operating type) single-phase

: 6 units

Rated voltage : 240 kV

Rated short-time

current : 31.5 kA

- c) Capacitance potential device

- i. For 220 kV bus

(single-phase) : 6 units

Rated voltage

Primary : $220/\sqrt{3}$ kV

Secondary : $110/\sqrt{3}$ V

Tertiary : 110 V

Rated burden

Secondary : 500 VA

Tertiary : 100 VA

ii. For 220 kV line

(single-phase) : 4 units

Rated voltage

Primary : $220/\sqrt{3}$ kV

Secondary : $110/\sqrt{3}$ V

Rated burden

Secondary : 50 VA

d) Power transformer with on-load tap changer for distribution, three-phase outdoor type

: 1 unit

Rated capacity : 40 MVA

Rated voltage

Primary : 220 kV ± 25 kV

Secondary : 22 kV

Cooling system : ONAF

e) Lightning arrester, gapless type

: 12 units

Rated voltage : 210 kV

Nominal discharge

current : 10 kA

f) 24 kV metal clad switchgear

i. Main circuit switchgear: 1 set

Rated voltage : 24 kV

Rated current : 1,200 A

Repturing

capacity : 20 kA

ii. Feeder circuit switchgear: 4 sets

Rated voltage : 24 kV

Rated current : 600 A

Interrupting

current : 20 kA

iii. Auxiliary metal clad switchgear: 1 set

Contained grounding type potential transformer
and lightning arrester

b. Other Equipment

a) Supervisory control panel, operator-console desk, 220
kV system panel and auxiliary panels

b) AC power source (station service panels)

c) DC power source (battery and battery charger)

d) Outdoor steel structure and bus support

e) Hot-line insulator washing apparatus

Water screen type washing apparatus (water tank, pump-
ing set, nozzle, piping and control board)

f) 220 kV conductor

Aluminium pipe conductor (180 ϕ x 10 t, 100 ϕ x 6 t)
and hard-drawn aluminium conductor (HAL 510 mm²)

g) 220 kV insulator

Suspension insulators and station post insulators

h) Air compressor (air reservoir and control panel)

i) Control cable, 22 kV power cable and optical fiber
cable

j) Ground mat materials (annealed copper wire 100 mm² and
conductor)

k) Communication system

Optical fiber communication terminal set: 2 sets

Automatic exchange: 200 cct 1 set

DC power source

48 V 20 A 210 AH : 1 set

24 V 300 A 1,000 AH : 2 sets

Information transmission unit

63 W C.D.T : 1 unit

15 W C.D.T : 1 unit

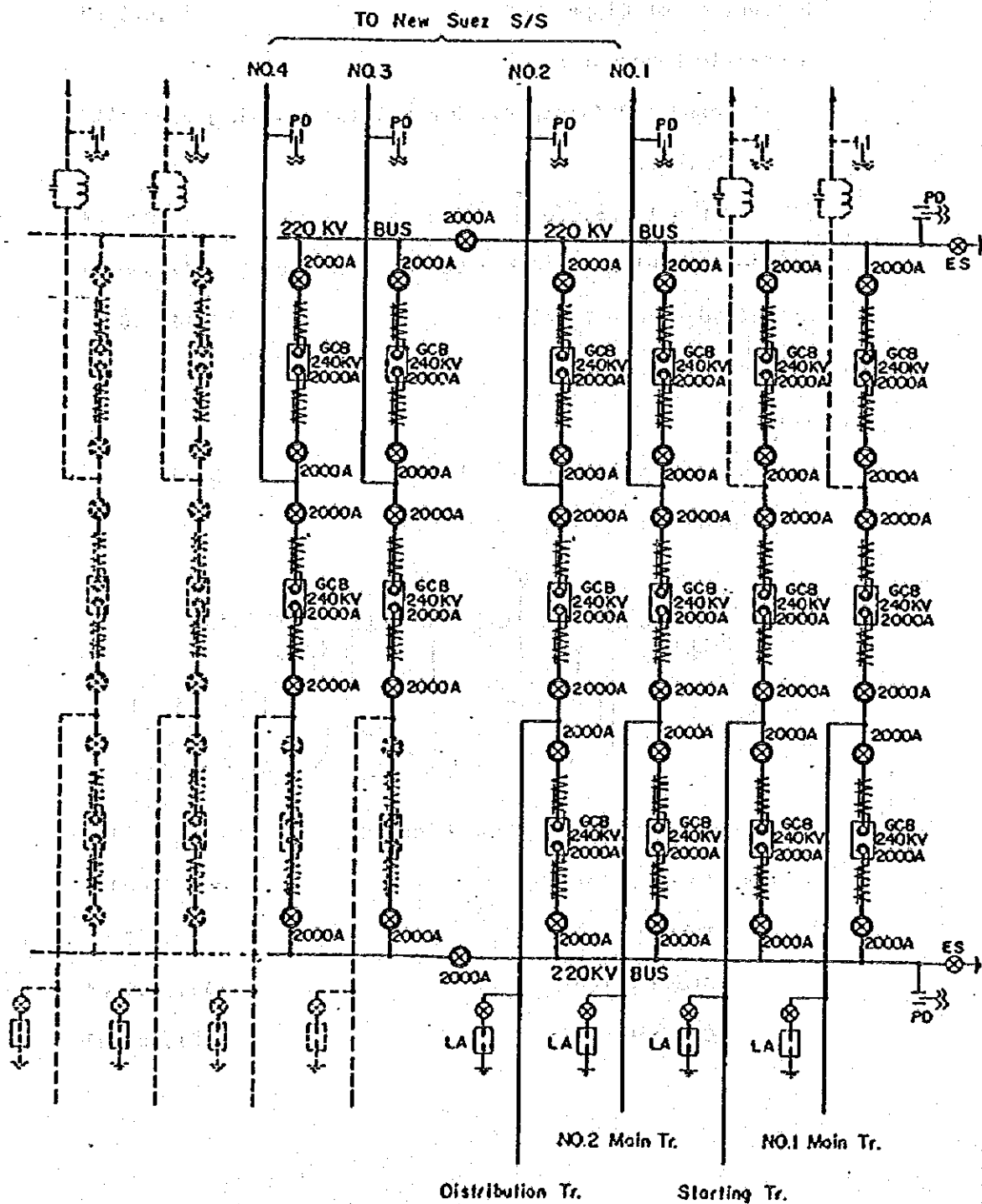
Wireless telephone

2 GHz PCM 0.2 W 24 CH: 2 units

Steel tower, 105 m : 1 set

Ayun Musa P/S Outdoor Switchyard

Single line Diagram



6-1-2 土木設備:

1) Land Reclamation

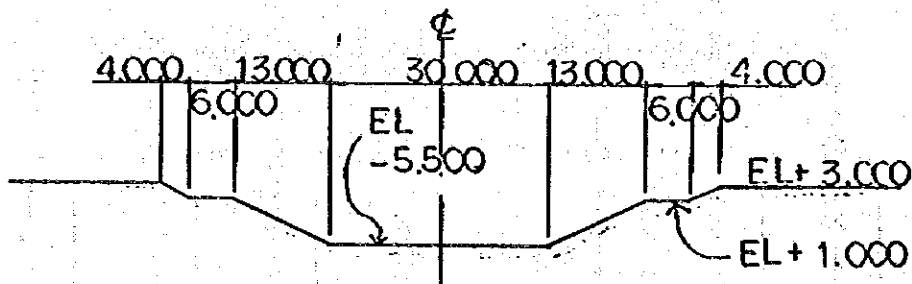
| | |
|---|--------------------------|
| Area of Land Reclamation (1,200 m x 500 m) | 600,000 m ² |
| Compacted Fill | 1,400,000 m ³ |
| Protection of Slope | 14,000 m ² |
| Asphaltic Pavement | |
| Access Road (Width 4.000 m x 2 lanes with green belt in between) | |
| L = 1,625.000 m | 13,000 m ² |
| Road in Plant (Width 8.000 m, 12.000 m) | 41,000 m ² |
| Specified Ground Level | EL +4.000 |

2) Circulating Water System

a. Inlet

Bottom level of inlet channel EL-5.500

Dimensions of inlet channel



| | |
|-----------------------------------|------------------------|
| Required Discharge (for 1,200 MW) | 61.4 m ³ /s |
| Length of inlet channel | 1,472.000 m |
| Rubble stone | 32,000 m ³ |
| Stone pitching | 131,000 m ² |
| Compacted fill | 81,000 m ³ |

b. Intake Pumping Pit

Bottom slab of intake pumping structure EL-5.500

Reinforced concrete

30.800 m x 21.400 m x 10.500 m

(Length) (Width) (Depth)

Level of top slab EL+4.000

Gate 8 pcs

Bar screen 4 pcs

Travelling screen 4 pcs

Sheet type wing wall 19.000 m x 20.000 m

Excavation 25,000 m³Concrete 2,900 m³

c. Circulating Water Pipe Line

Level of circulating water pipe line EL+0.580

Width of Excavation 12.000 m

Material of circulating water pipe line

Core type prestressed concrete pipe

(φ = 2.000 m, t = 0.110 m)

Length of pipe line = 700 m

Excavation 71,000 m³Gravel 9,600 m³Backfill 30,000 m³

d. Discharge Culvert (for 1,200 MW)

Reinforced concrete

12.700 m x 4.500 m x 250.000 m

(Width) (Depth) (Length)

Level of bottom slab EL+0.000

Level of top slab EL+4.000

Discharge channel

16.000 m x 4.000 m x 300.000 m

(Width) (Depth) (Length)

Retaining wall

Height 4.000 m

Slope 1 : 0.5

Level of footing EL+0.000

Level of top EL+4.000

Excavation 35,000 m³

Concrete 2,400 m³

e. Discharge Weir

EL±0.000 (Upstream)

16.000 m x EL+1.000 x

(Width) (Weir) EL-1.000 (Downstream)

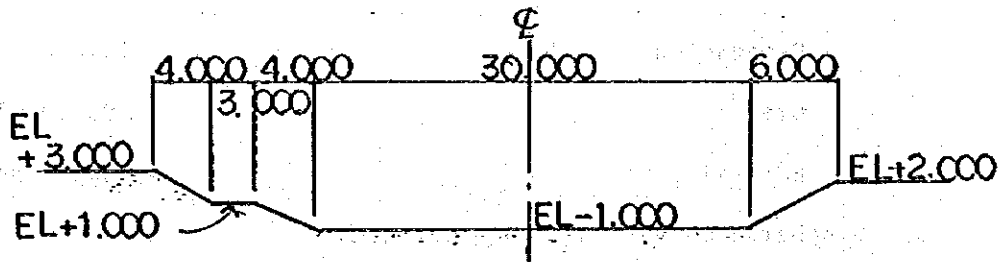
Sheet type wing wall 16.000 m, 18.000 m

(left bank, right bank)

f. Outlet

Bottom level of outlet channel EL-1.000

Dimensions of outlet channel L=600.000 m



Excavation 20,000 m³

Compacted fill 17,000 m³

Stone pitching 30,000 m²

3) Fuel Oil Storage Tank Foundation & Oil Dyke

a. Heavy Oil Storage Tank Foundation

| | |
|---------------------------------|----------------------------|
| Diameter of ring wall | ϕ 54.160 m |
| Dimensions of ring wall | 0.400 m x 0.900 m |
| | (Width) (Height) |
| Thickness of asphaltic pavement | t = 0.050 m |
| Thickness of oil sand | t = 0.100 m |
| Slope of mound | i = 1/120, 1/20 |
| Drain pipe | ϕ = 0.050 m, @1.500 m |
| Depth of displacement | 2.000 m |
| Excavation | 13,000 m ³ |
| Concrete | 180 m ³ |
| Gravel | 5,000 m ³ |
| Compacted soil | 10,000 m ³ |

b. Oil Dyke

| | |
|---------------------|-----------------------|
| Reinforced concrete | |
| 2.000 m | x 0.300 m x 800.000 m |
| (Height from GL) | (Width) (Length) |
| Expansion joint | One (1) per 20.000 m |
| Excavation | 3,000 m ³ |
| Concrete | 1,200 m ³ |

c. Intermediate Dyke

| | |
|--|--------------------|
| Compacted fill (Width of bottom 3.000 m x Width of top | |
| 1.000 m x Height 0.800 m) | L = 200.000 m |
| Asphaltic pavement above compacted fill | t = 0.050 m |
| Compacted fill | 300 m ³ |
| Gravel | 70 m ³ |
| Asphaltic pavement | 30 m ² |

4) Coal Handling & Coal Storage Yard

a. Coal Handling (Conveyer foundation, berth to coal storage yard)

L = 3,100.000 m

Excavation 37,000 m³Concrete 20,000 m³

b. Coal Storage Yard

Area of coal storage yard 420,000 m x 300,000 m

Stacker and reclaimer foundation

Compacted fill shall be made between original surface and EL+4.000 m.

20.000 m x 2.000 m x 4 lanes

(Width of foundation) (Height of compacted fill)

Ballast (EL+4.500 m)

Stacker foundation 10.000 m x 380.000 m x 1 lanes

(Width) (Length)

Reclaimer and stacker-reclaimer foundation

12.000 m x 380.000 m x 3 lanes

(Width) (Length)

Compacted fill 110,000 m³Ballast 10,000 m³Concrete 2,400 m³

5) Ash Disposal Facility

a. Planned Ash Disposal (600 MW for ten (10) years)

Level of dyke for ash pond EL+4.000

Rubble dyke sloping type (ash pond) L = 2,700 m

Slope of rubble 1 : 1.2, Stone pitching 1 : 2.0

Area of ash pond 950,000 m²

| | |
|-------------------------------|--------------------------|
| Volume of ash pond (EL+4.000) | 3,700,000 m ³ |
| Rubble | 27,000 m ³ |
| Stone pitching | 22,000 m ² |
| Compacted fill | 165,000 m ³ |
| Concrete pavement | 14,000 m ² |
| Water-proofing sheet | 40,000 m ² |

b. Planned Ash Disposal (Reference)

600 MW for two (2) years

1,200 MW for eight (8) years

Level of dyke for ash pond EL+4.000

Rubble sloping type (ash pond) L = 2,190 m

Slope of rubble 1:1.2, stone pitching 1:2.0

Area of ash pond 1,616,000 m²

Volume of ash pond (EL+4.000) 6,198,000 m³

Rubble 21,000 m³

Stone pitching 18,000 m²

Compacted fill 140,000 m³

Concrete pavement 12,000 m²

Water-proofing sheet 34,000 m²

c. Planned Ash Disposal (Reference)

600 MW for two (2) years

1,200 MW for twenty eight (28) years

Level of dyke for ash pond EL+4.000

Rubble sloping type (ash pond) L = 6,000 m

Slope of rubble 1:1.2, stone pitching 1:2.0

Area of ash pond (EL+4.000) 4,819,000 m²

| | |
|----------------------|---------------------------|
| Volume of ash pond | 14,908,000 m ³ |
| Rubble | 46,000 m ³ |
| Stone pitching | 48,000 m ³ |
| Compacted fill | 402,000 m ³ |
| Concrete pavement | 42,000 m ³ |
| Water-proofing sheet | 95,000 m ³ |

d. Unloading Jetty

| | |
|---------------------------|-----------------------|
| Level of unloading jetty | EL+3.000 |
| Length of unloading jetty | L = 50.000 m |
| Concrete block type jetty | |
| Rubble | 10,000 m ³ |
| Stone pitching | 9,000 m ³ |
| Dredge | 28,000 m ³ |

6) Miscellaneous Works

a. Lighting Pole Foundation

| | |
|--------------------------|----------------------|
| In the coal storage yard | 10 pcs |
| Road in the plant | One (1) per 40.000 m |

b. Ash Sluicing Pipe Foundation

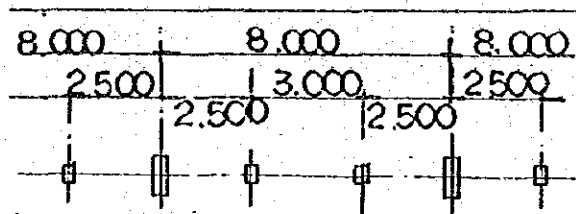
Concrete pipe ϕ 0.350 m x 5 lines
 L = 600.000 m x 5 lines

c. Cable Trench

Reinforced concrete (with cover)
 2.000 m x 1.500 m x 1,500.000 m
 (Width) (Depth) (Length)

d. Oil Pipeline Foundation

L = 4,000 m



e. Neutralization Pit

25.000 m x 40.000 m x 1.700 m

(Width) (Length) (Depth)

f. Demineralized Water Tank Foundation ϕ 8.240 mg. Raw Water Tank Foundation ϕ 14.160 m

h. Desalination Plant Foundation 22.000 m x 25.000 m

i. Landscaping 34,000 m²j. Gravel Pavement t = 0.100 m, Area: 20,000 m²

6-1-3 港灣設備

1) Berthing Facilities

a. Kind of Harbor Facilities

| <u>Kind of Facilities</u> | <u>Size of Ship</u> | <u>Number of Berth</u> | <u>Length of Berth</u> | <u>Water Depth</u> | <u>Width of Berth</u> |
|---------------------------|---------------------|------------------------|------------------------|------------------------------|-----------------------|
| Coaler berth | 60,000 DWT | 1 | 300 m | EL-16 m (C.D.L -14.855 m) | 25 m |
| Oil tanker berth | 5,000 DWT | 1 | 140 m | EL-8.5 m (C.D.L -7.355 m) | 10 m |
| Small craft berth | 500 GT | 1 | 50 m | EL-5 m (C.D.L -3.855 m) | 5 m |

b. Height of Wharf Crown

- a) Coaler wharf : EL+3 m
- b) Oil tanker wharf : EL+3 m
- c) Small craft wharf : EL+2 m

c. Structure Type of Mooring Facilities

a) Coaler wharf

Open-type wharf with coupled battered piles

Materials: Steel pipe pile

Upper parts of the piles (above LWL -1 m) will be covered with fiber glass reinforced plastic (F.R.P) for corrosion prevention, and other parts (from LWL -1 M to GL -1 m) will be protected with corrosion preventive paint and electrolytic protection, or other corrosion preventive method equivalent to the above method will be made.

b) Oil tanker wharf

Gravity quaywall (Concrete block type)

c) Small craft wharf

Gravity quaywall (concrete block type)

2) Channel and Basin

a. Channel

- a) Water depth : EL-16 m (C.D.L. -14.855 m)
- b) Width : 200 m
- c) Length : 1,300 m
- d) Area : About 320,000 m²
- e) Side slope : 1:3

b. Anchorage Basin

a) Coaler ship

- i. Water depth : EL-16 m (C.D.L. -14.855 m)
- ii. Area : About 500 m x 550 m
= 275,000 m²

- iii. Side slope of dredged area : 1:3

b) Oil tanker

- i. Water depth : EL-8.5 m (C.D.L. -7.355 m)
- ii. Area : About 350 m x 380 m
= 133,000 m²

- iii. Side slope of dredged area : 1:3

c) Small craft

- i. Water depth : EL-5 m (C.D.L. -3.855 m)
- ii. Area : About 140 m x 150 m
= 21,000 m²

- iii. Side slope of dredged area : 1:3

3) Causeway

- a. Length of causeway : 2,700 m
- b. Height of causeway crown : EL+3 m

- c. Width of causeway : 20 m
- 4) Beacon, Range Light and Buoy
 - a. Beacon : 5 sets (2 sets on the channel inlet, 2 sets on the channel end and 1 set on the bend point at the middle of the channel)
 - b. Range Light : 2 poles (on the shoreline and land on the center line of the channel)
 - c. Buoy light : 8 sets (Bend points of basin) (2 sets without light)
- 5) Others
 - a. Water hydrant : 5 points (3 points on the coaler wharf, 1 point on the oil tanker wharf and 1 point on the small craft wharf)
 - b. Lighting facilities for night works on the causeway and berth : 1 set
 - c. Electric power source for repair works of ships : 1 set
 - d. Harbor administration office : 1 (100 m²)
 - e. Miscellaneous warehouse : 1 (150 m²)
 - f. Communication system between powerplant and berth : 1 set
 - g. Fire boat : 1 (50 ton class)

6-1-4 建築設備

1) Powerhouse

a. Building Area, Floor Area and Building Volume

| | | |
|-----------------------|---|--|
| Turbine-generator bay | : | 2,990 m ² (height 30 m) |
| Heater bay | : | 1,280 m ² (height 24 m) |
| Control bay | : | 1,230 m ² (height 18 m) |
| <u>Bunker bay</u> | : | <u>1,380 m² (height 43.5 m)</u> |
| Total building area | : | 6,880 m ² |
| Total floor area | : | 19,730 m ² |
| Building volume | : | 142,020 m ³ (excl. bunker bay) |
| | | 51,320 m ³ (bunker bay) |
| Total building volume | : | 193,340 m ³ |

b. Substructure

| | | |
|---------------|---|---|
| a) Pile | : | High strength prestressed concrete pile or bored pile φ = 600 mm Bearing Capacity 120 t/pile Number of pile 700 piles |
| b) Foundation | : | Reinforced concrete, concrete tie beam Excavation Volume 53,000 m ³ Concrete Volume 11,000 m ³ |

c. Superstructure

| | | |
|----------|---|---|
| a) Frame | : | Steel structure Weight of steel structure 5,700 ton |
|----------|---|---|

b) Roof : Corrugated resin coated steel sheet with insulation material and partly reinforced concrete structure, asphalt water-proofing

c) Floor : Reinforced concrete structure, tile and mortar finish and partly steel grating floor

Concrete Volume 2,000 m³

d) Exterior wall : Corrugated resin coated steel sheet with insulation materials and partly Hollow concrete block, and sand textured coating

e) Interior wall : Hollow concrete block, paint on plastered and partly metal partition wall

f) Ceiling : Suspended ceiling, acoustic board, asbestos board and partly exposed concrete

d. Appurtenant Facilities

a) Air conditioning System: Air conditioning unit
Cooling capacity 230,000 kcal/h
Air volume 29,700 m³/h

b) Ventilating system : Ventilating unit and roof ventilating fan
Ventilating unit 4 sets
Capacity 187,000 m³/h/set

c) Water supply, drainage, sanitary and hot water supply system

d) Lightening Lod

e) Elevator system : 2 sets

Lifting capacity : 1,000 kg

Capacity : 15 persons

2) Service Building

a. Floor Area

Ground floor : 1,370 m²

First floor : 1,370 m²

Total floor area : 2,740 m²

b. Substructure : Reinforced concrete, spread foundation

Excavation volume 3,000 m³

Concrete volume 700 m³

c. Superstructure

a) Structural frame : Reinforced concrete structure

b) Roof : Reinforced concrete structure, asphalt water-proofing

c) Floor : Reinforced concrete structure, tile and mortar finish

Concrete volume 1,400 m³

d) Exterior wall : Hollow concrete block, sand textured coating

e) Interior wall : Hollow concrete block, paint on plastered and partly metal partition wall

- f) Ceiling : Suspended ceiling, acoustic board, asbestos board

d. Appurtenant Facilities

- a) Air conditioning system: Air conditioning unit
Cooling capacity 300,000 kcal/h
Air volume 25,360 m³/h
- b) Ventilating system
- c) Water supply, drainage, sanitary and hot water supply system
- d) Lighting, wall receptacle and other electric system
- e) Fire fighting system
- f) Kitchen facilities

3) Auxiliary Buildings

| Buildings | Houses | Structure | Total floor area | Quantities of major material | | Air conditioning | Ventilating | Lighting | Water & hot water supply | Sanitary |
|--|--------|-------------------------------|---------------------|------------------------------|------------------|------------------|-------------|----------|--------------------------|----------|
| | | | | Concrete | Structural Steel | | | | | |
| Electric, instrument & control maintenance workers house | 1 | Reinforced concrete structure | 390m ² | 250m ³ | | o | o | o | o | o |
| Coal handling workers house | 1 | Reinforced concrete structure | 340m ² | 220m ³ | | o | o | o | o | o |
| Store house | 4 | Reinforced concrete structure | 1,380m ² | 700m ³ | | o | o | o | o | o |
| Coal handling control house and coal reduction house | 1 | Steel structure | 3,200m ² | 240m ³ | 380 t | o | o | o | o | o |
| Seawater electrolysis house | 1 | Reinforced concrete structure | 50m ² | 30m ³ | | o | | o | | |
| Switchyard control house | 1 | Reinforced concrete structure | 450m ² | 300m ³ | | o | | o | | |
| Machine shop | 3 | Steel structure | 900m ² | 270m ³ | 80 t | o | o | o | o | o |
| Water treatment control house | 1 | Reinforced concrete structure | 75m ² | 40m ³ | | o | | o | | |
| Fire fighting pump house | 1 | Reinforced concrete structure | 75m ² | 40m ³ | | | o | o | | |
| Cylinder house | 1 | Reinforced concrete structure | 100m ² | 50m ³ | | | o | o | | |
| Guard house | 3 | Reinforced concrete structure | 300m ² | 150m ³ | | o | | o | o | o |
| Oil fence house and harbor workers house | 1 | Reinforced concrete structure | 90m ² | 45m ³ | | o | o | o | o | o |
| Garage | 1 | Reinforced concrete structure | 440m ² | 150m ³ | | | | o | | |
| Bulldozer house | 2 | Reinforced concrete structure | 75m ² | 40m ³ | | | | o | | |
| Intake pump house | 1 | Steel structure | 220m ² | | 50 t | | o | o | | |
| Lube oil storage house | 1 | Reinforced concrete structure | 100m ² | 50m ³ | | | o | o | | |
| Oil pump house | 3 | Reinforced concrete structure | 150m ² | 75m ³ | | | o | o | | |
| Neutralization control house | 1 | Reinforced concrete structure | 50m ² | 25m ³ | | o | | o | | |

4) Major Equipment Foundations

Major equipment foundations will be made by reinforced concrete and will be supported by high strength prestressed concrete pile or bored pile.

a. Turbine-Generator Foundation

Excavation volume : 3,000 m³
 Pile : Dia. 600 ϕ
 Bearing capacity 120 t/pile
 Quantity 200 piles
 Concrete volume : 7,000 m³

b. Boiler Foundation

Excavation volume : 15,000 m³
 Pile : Dia. 600 ϕ
 Bearing capacity 120 t/pile
 Quantity 650 piles
 Concrete volume : 8,000 m³

c. Stack Foundation

Excavation volume : 7,000 m³
 Pile : Dia. 600 ϕ
 Bearing capacity 120 t/pile
 Quantity 70 piles

5) Planning of Residential Quarters

Housing, recreation facilities and community service facilities for power plant personnel and their families will be planned. (Construction cost of residential quarters will be excluded in the construction cost of this project.)

a. Housing

| | | |
|--------|----------------------------------|--------------------------------|
| Type A | 6 flats | 150 - 170 m ² /flat |
| Type B | 132 flats | 100 - 110 m ² /flat |
| Type C | 162 flats | 80 - 90 m ² /flat |
| Total | 300 flats (for 300 MW x 2 units) | |

In the future expansion of power generating facilities, it is necessary to expand housing 250 - 300 flats more.

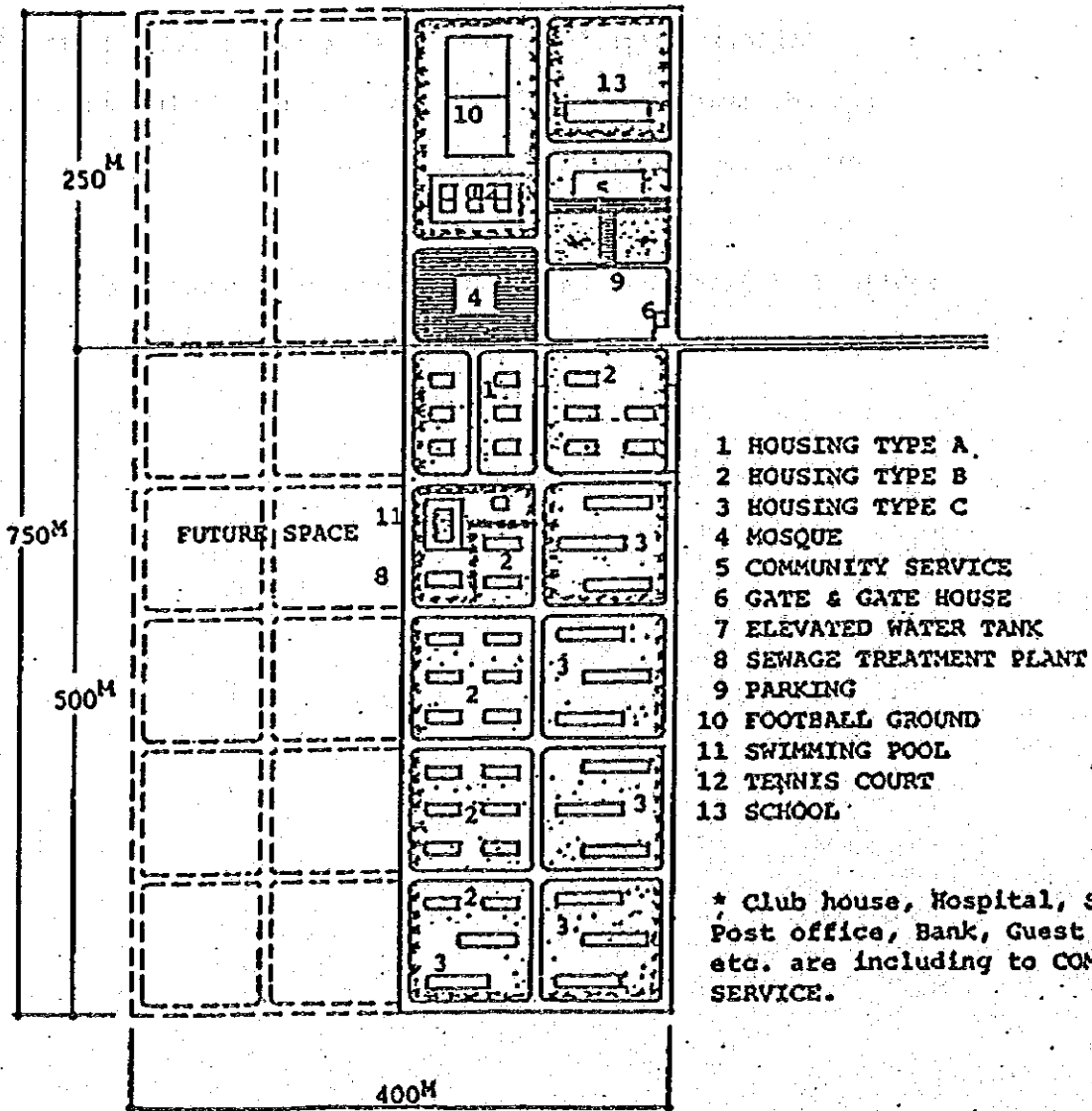
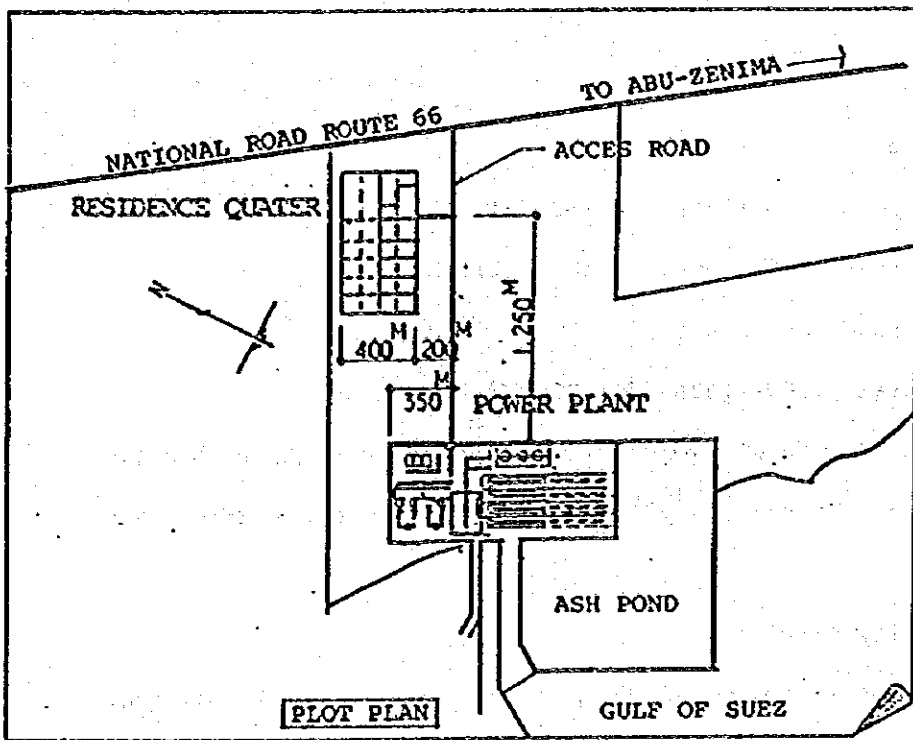
b. Community Service

Hospital, post office, shop, bank, school, mosque, park, etc. will be planned for community.

c. Recreation Facilities

Athletic facilities such as tennis court, football ground, swimming pool, etc. and club house with accommodations for guests will be planned.

Public facilities such as road, waterworks, sewage, electric power supply facilities, lighting facilities will be planned.



6-2 送変電設備

6-2-1 送電設備

1) 220 kV Overhead Transmission Line

a. Facility

| | | |
|-----------------|---|---|
| Voltage | : | 220 kV |
| Conductor | : | AAAC 620 mm ² x 2 |
| No. of circuits | : | 4 circuits |
| Length | : | 40 km |
| Steel tower | : | 2 circuits/tower |
| Insulators | : | 320 mm Fog type insulators 20 pc/string |
| Ground wire | : | 130 mm ² compound wire with optical fiber |

b. Steel Tower (see: Figs. 6-1, 6-2 and 6-3)

| | Height | Weight | No. of Towers |
|----------------------------|--------|--------|------------------|
| A type tower (tangential) | 44.4 m | 14.3 t | 188 |
| B type tower (light angle) | 43.6 m | 16.3 t | 16 |
| C type tower (heavy angle) | 43.6 m | 18.4 t | 14 |
| D type tower (dead end) | 43.6 m | 22.9 t | 4 |
| Total | | | 222 |

2) Canal Crossing Cable

a. Facility

Voltage : 220 kV
 Conductor : OF cable 2,000 mm²
 No. of circuits : 4 circuits
 Length : 2 km

3) 220 kV Branch Line

a. Facility

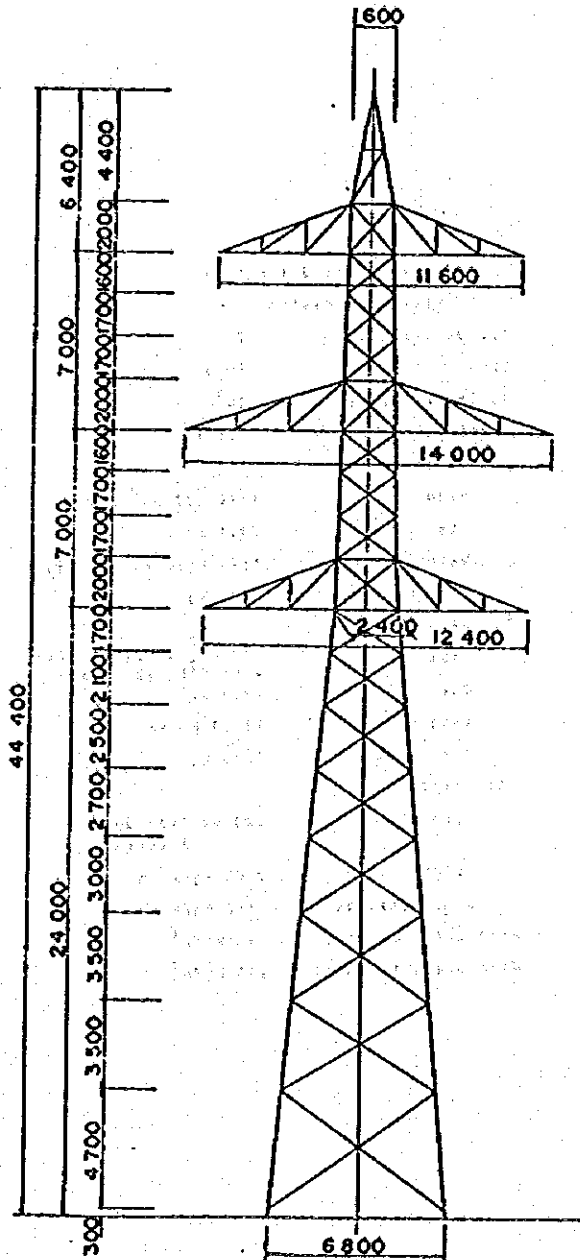
Voltage : 220 kV
 Conductor : AAAC 620 m² x 1
 Length : 1.5 km
 No. of circuits : 4 circuits
 Steel tower : 2 circuits/tower
 Insulators : 320 mm Fog type 20 pc/string
 Ground wire : 108 mm² Zn coated steel
 strand wire

b. Steel Tower

A type tower Height: 44.4 m, Weight: 10.9 t, 6 pcs.
 D type tower Height: 43.6 m, Weight: 17.0 t, 4 pcs.

Fig 6-1
220KV AAAC 620mm²x2 : two circuits A Type

220KV 2cct A Type

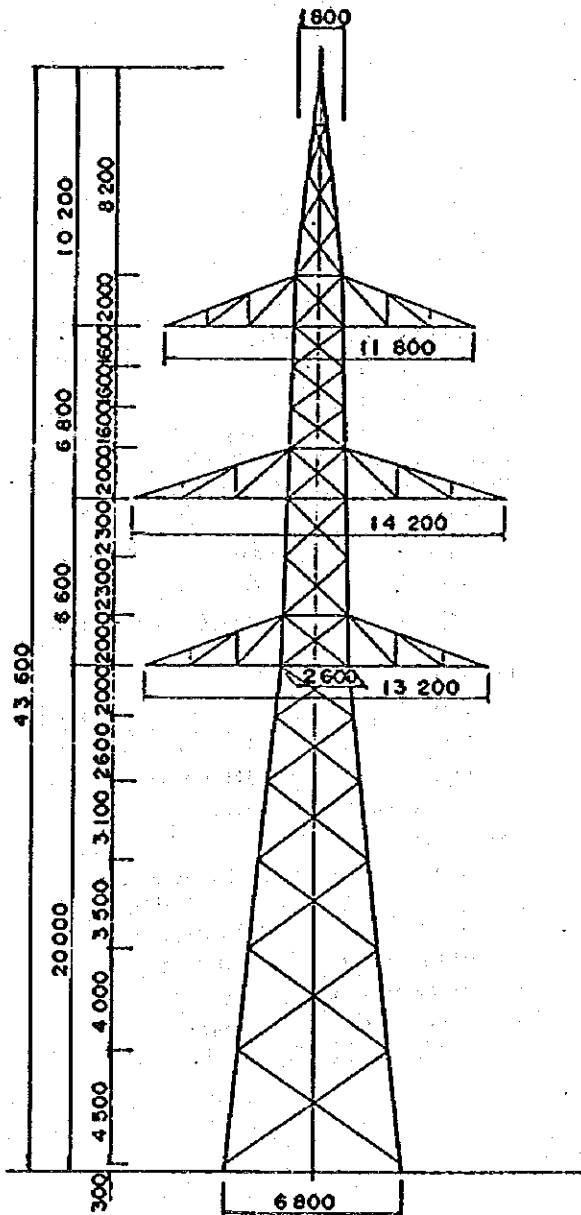


220 KV 2 cct A type
 Design condition

| | |
|---------------------|---|
| No. of circuits | 2 |
| Span | 350 m |
| Horizontal angle | 3° |
| Vertical angle | 0.1 T |
| Conductor | |
| Size | AAAC 620 mm ² x 2 |
| Dia | 28.1 mm |
| Weight | 1674 kg/km/one cond. |
| Max. tension | 5500 kg |
| Gr. Wire | |
| Size | 130 mm ² Cosocad wire with Optical fiber |
| Dia | 17.4 mm |
| Weight | 785.8 kg/km |
| Max. tension | 3200 kg |
| Insulator | |
| Type | 320 mm Smc 20 pc 1 string |
| Weight | 680 kg/each |
| Wind pressure | 200kg/each |
| Wind pres. to wire | 80 kg/m ² |
| Wind pres. to tower | 255 kg/m ² |

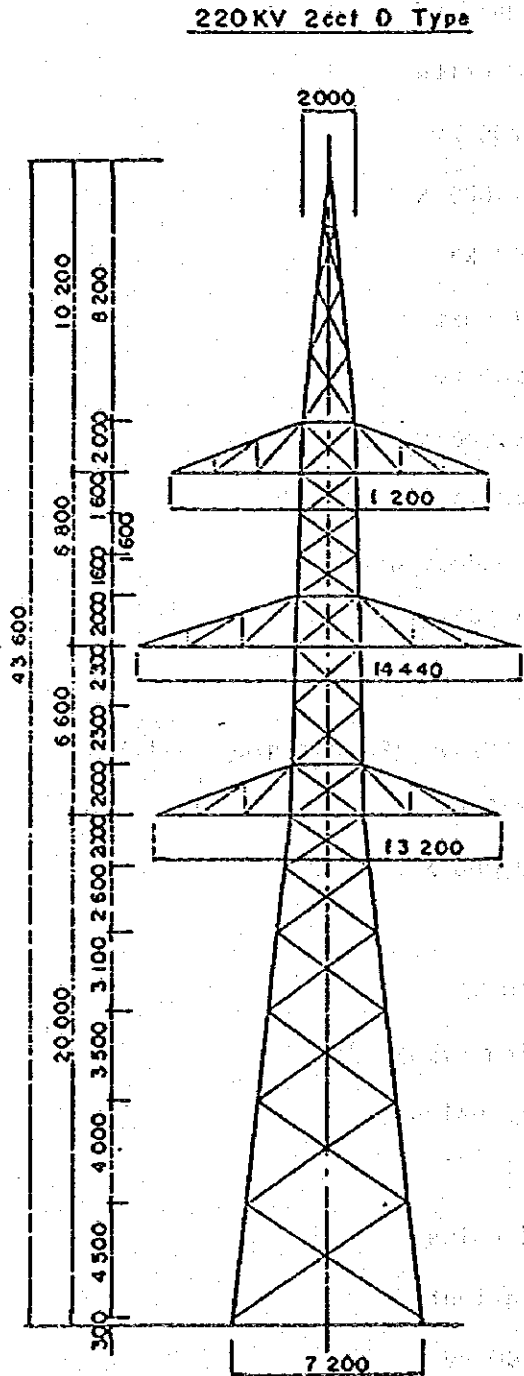
Fig 6-2
 220 KV AAAC 620mm² x 2: two circuits Tower: B & C Type

220 KV 2 cct C Type



| 220 kv 2 cct B & C Type | |
|-------------------------|--|
| Design Condition | |
| No. of circuit | 2 |
| Span | 350 m |
| Horizontal angle | 30° |
| Vertical angle | 0.17 |
| Conductor | |
| Size | AAAC 620 mm ² x 2 |
| Dia | 28.1 mm |
| Weight | 1876 kg/km/one cond. |
| Max. tension | 5500 kg |
| Gr. Wire | |
| Size | 130 mm ² Compound wire with optical fiber |
| Dia | 17.4 mm |
| Weight | 745.8 kg/km |
| Max. tension | 3200 kg |
| Insulator | |
| Type | 320 mm 5sqg 20 pc 2 string |
| Weight | 2200 kg/each |
| Wind pressure | 560 kg/each |
| Wind pres. to wire | 90 kg/m ² |
| Wind pres. to tower | 255 kg/m ² |

Fig 6-3
220KV AAAC 620mm²x 2 : two circuits D Type



220 kv 2 cct D Type

Design Condition

| | |
|---------------------|--|
| Re. of circuit | 2 |
| Span | 350 m |
| Horizontal angle | Dead end |
| Vertical angle | 0.1 I |
| Conductor | |
| Size | AAAC 620mm ² x 2 |
| Dia | 28.1 mm |
| Weight | 1674 kg/km/one cond. |
| Max. tension | 5500 kg |
| Gr. Wire | |
| Size | 130 mm ² Compound wire with Optical fiber |
| Dia | 17.4 mm |
| Weight | 785.9 kg/km |
| Max. tension | 3200 kg |
| Insulator | |
| Type | 320 mm Swag 20 pc } string |
| Weight | 2200 kg/each |
| Wind pressure | 560 kg/each |
| Wind pres. to wire | 80 kg/m ² |
| Wind pres. to tower | 255 kg/m ² |

6-2-2 New Suez 変電所

1) Main Equipment

a. 240 kV SF₆ gas circuit breaker, with built-in bushing current transformer (outdoor use, Puffer-type)

a) For transmission line : 8 units

Rated voltage : 240 kV

Rated current : 2,000 A

Rupturing capacity: 40 kA

b) For bus coupler : 1 unit

Rated voltage : 240 kV

Rated current : 4,000 A

Rupturing capacity: 40 kA

b. 240 kV Disconnecting Switch (outdoor use)

a) For transmission line : 8 units

(pneumatic operating type)

Horizontal center break type, with earthing switch

Rated voltage : 240 kV

Rated current : 2,000 A

Rated short-time

current : 40 kA

b) For bus (pneumatic operating type)

- Pantagraph type : 16 units

- Horizontal center
break type : 4 units

(45-degree angle installation)

Rated voltage : 240 kV

Rated current : 2,000 A

Rated short-time

current : 40 kA

c) For bus coupler (pneumatic operating type)

Pantograph type : 4 units
 Rated voltage : 240 kV
 Rated current : 4,000 A
 Rated short-time
 current : 40 kA

d) For bus section (pneumatic operating type)

Horizontal center
 break type : 2 units
 Rated voltage : 240 kV
 Rated current : 4,000 A
 Rated short-time
 current : 40 kA

e) 220 kV bus earthing device

(outdoor use, manual operating type)

single phase : 12 units
 Rated voltage : 240 kV
 Rated short-time
 current : 31.5 kA

c. Capacitance Potential Device

a) For 220 kV bus (single phase): 12 units

Rated voltage

Primary : $220/\sqrt{3}$ kV
 Secondary : $110/\sqrt{3}$ V
 Tertiary : 110 V

Rated burden

Secondary : 500 VA
 Tertiary : 100 VA

b) For 220 kV line (single phase): 12 units

Rated voltage

Primary : $220/\sqrt{3}$ kV

Secondary : $110/\sqrt{3}$ V

Rated burden

Secondary : 50 VA

2) Other Equipment

- a. Supervisory control panel, operator-console desk, 220 kV system panel and auxiliary panels
- b. AC power source (station service panels and service transformer)
- c. Emergency diesel generator (battery starting system)
- d. DC power source (battery and battery charger)
- e. Outdoor steel structure and bus support
- f. 220 kV conductor (see : Appendix II)
Aluminium pipe conductor (180 ϕ x 10 t, 120 ϕ x 8 t)
Refer to APPENDIX-B.
- g. 220 kV insulator
Suspension insulators and station post insulators
- h. Air compressor (air reservoir and control panel)
- i. Ground mat materials (annealed copper wire 100 mm² and connector)

Fig.6-4 New Suez Substation
Single line Diagram

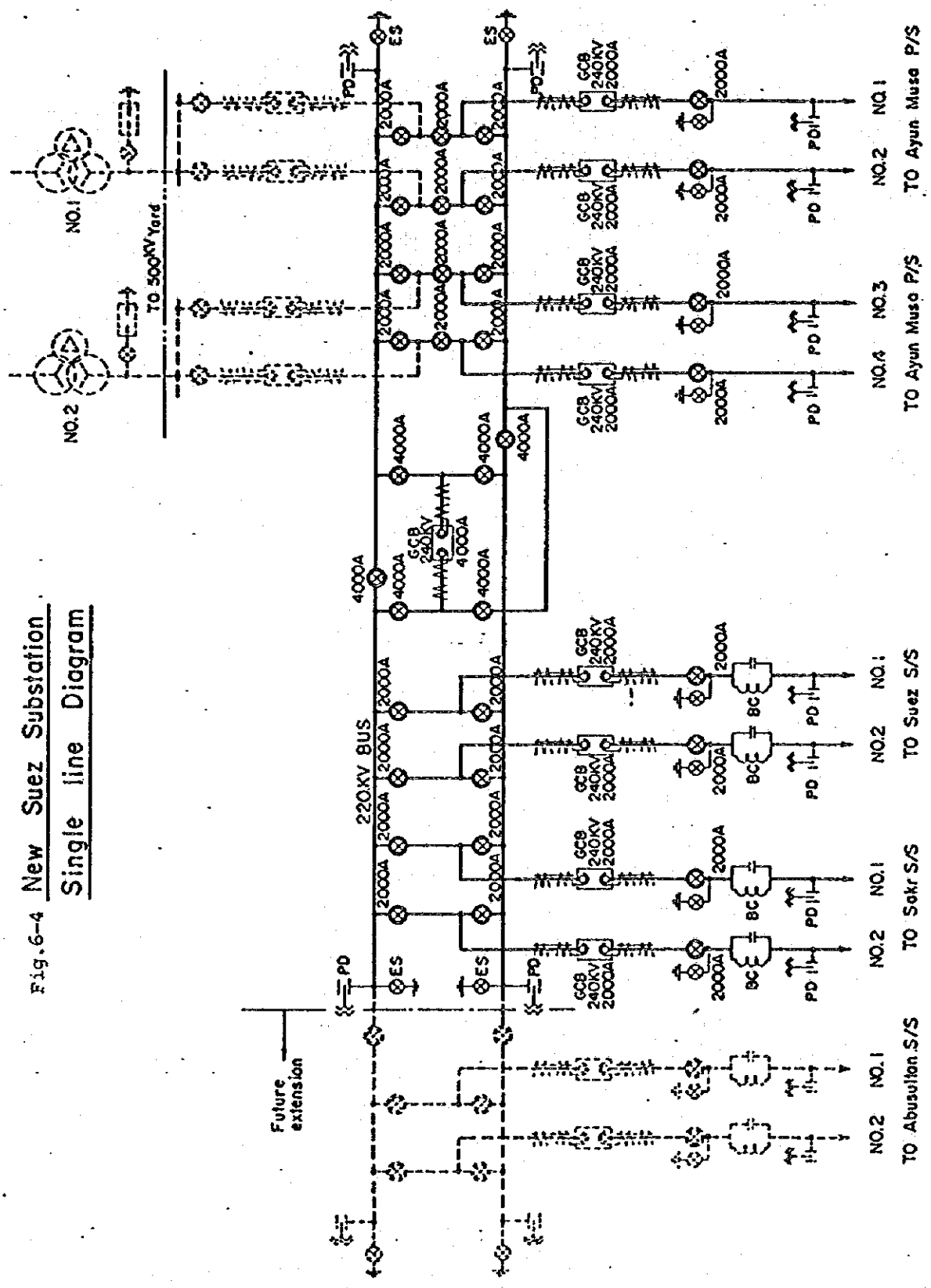
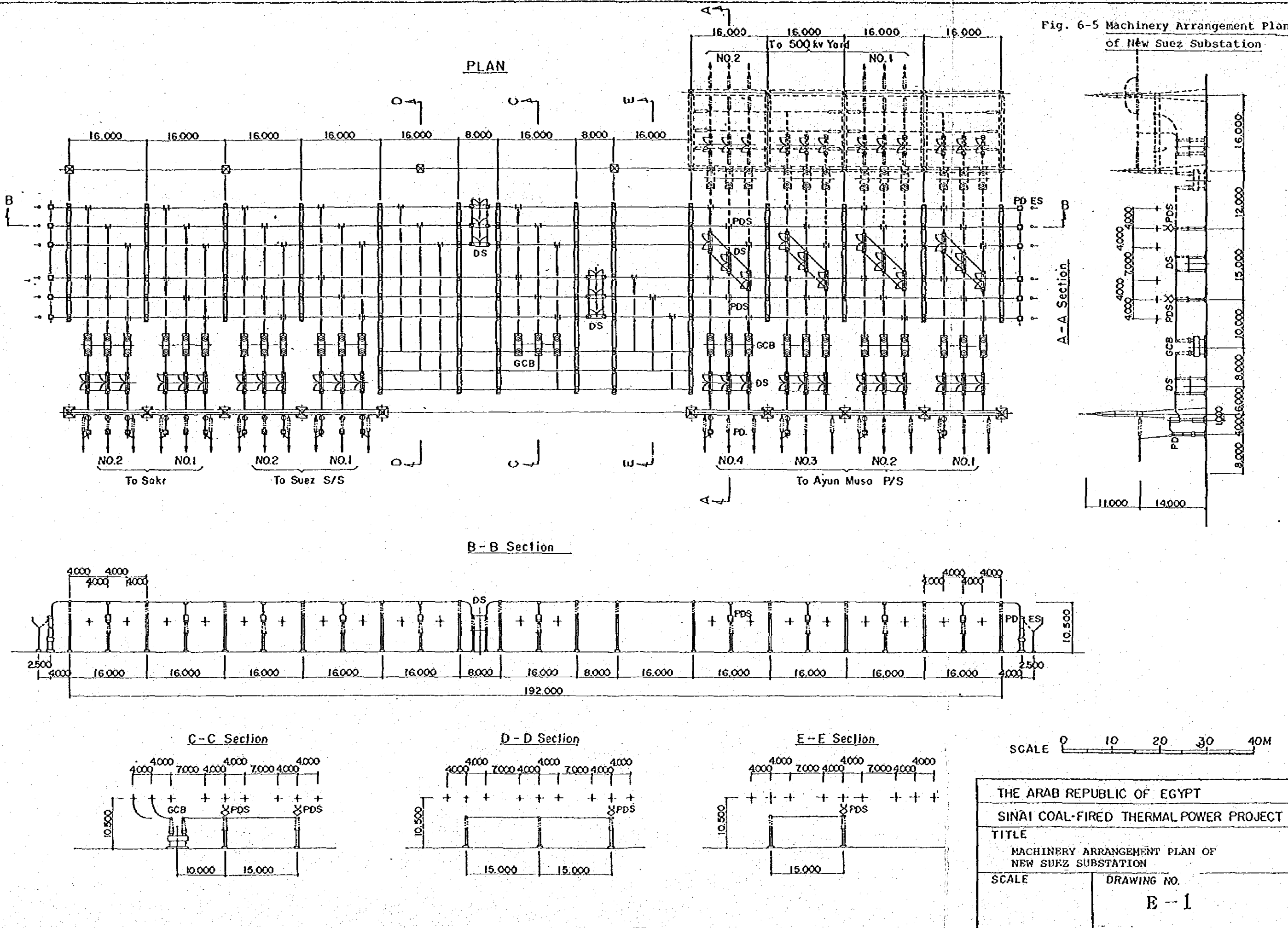
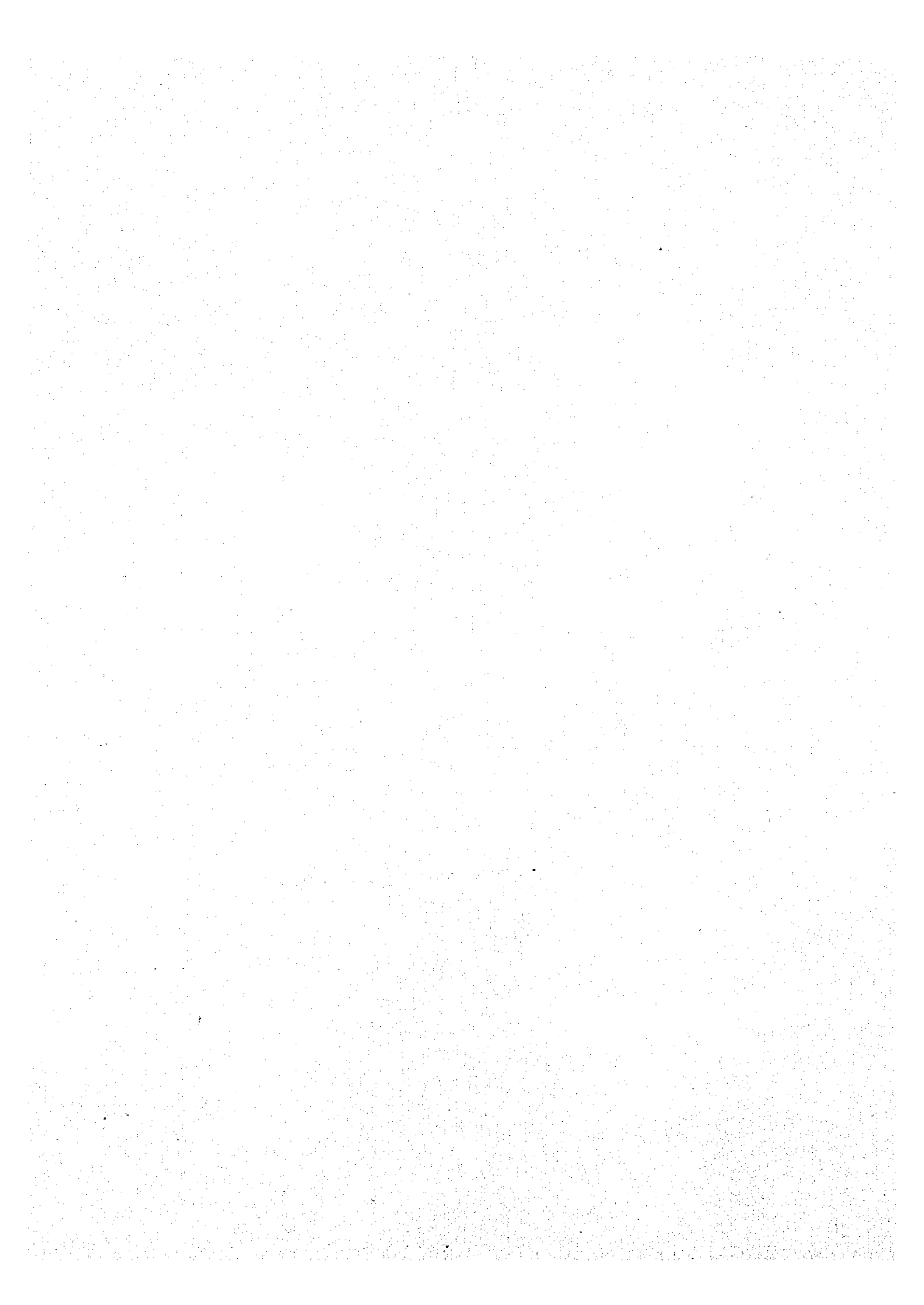


Fig. 6-5 Machinery Arrangement Plan of New Suez Substation





6-2-3 保護リレー設備

1) For Ayun Musa PS Line

a. Main Relay

#1 set Transient comparison or phase comparison based on wave deflection with micro wave system

#2 set Directional comparison distance relay with power line carrier system (three steps)

Distance relay.. Full scheme, No any switching is accepted earlier in zone or type of fault. Multi measuring scheme

b. Reclosing Relay System (one shot)

Three phase reclosing system (dead time adjustable up to 6 sec.)

c. Back-up Relay

Directional over current relay with voltage restraint

d. Others

a) A protection scheme of circuit breaker failure

b) Over-voltage relay blocked with reactive power

c) Low voltage relay

2) For Sakr SS and Suez Tr. SS Line (Other side's relay sets are same.)

a. Main Relay

#1 set Transient comparison or phase comparison with power line carrier system

#2 set Directional comparison distance relay with power line carrier system (Three steps)

b. Reclosing Relay System (one shot)

Three phase reclosing system (dead time adjustable up to 6 sec.)

c. Back-up Relay System

Directional over current relay with voltage restraint

3) For Bus Coupler Circuit Breaker

High speed differential relay and over current relay with voltage restraint

4) For Bus Protection

One protection scheme for bus protection

5) Fault Recorder Sets with sequential chart recorder

6) Fault Localizer

Pulse ejector system and impulse detecting system

7) Continuous Monitoring of Relay System

8) Testing instrument sets at protecting relay room and portable one

6-2-4 通信設備

1) Micro Wave System

a. Location of Site

Frequency : 2 GHz

| Name of station | Distance (km) | Elevation (m) |
|------------------|---------------|---------------|
| Sakr SS | 66.2 | 180 |
| Repeater station | 32.3 | 500 |
| New Suez SS | 23.0 | 70 |
| Ayun Musa PS | | 5 |

b. Equipment

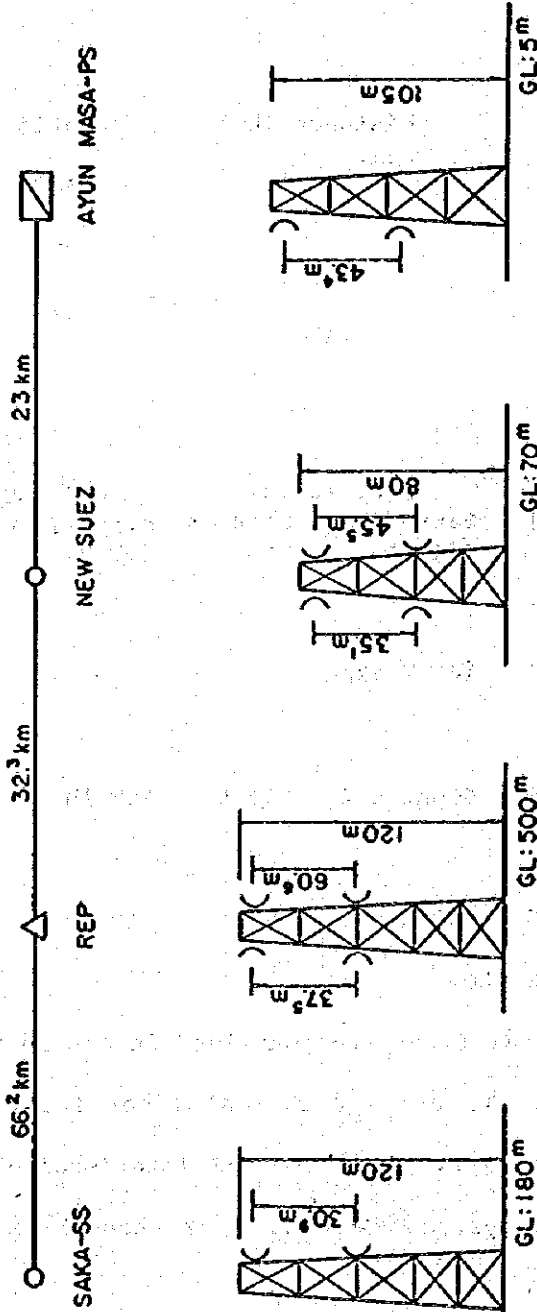
| Name of Station | Steel Tower (m) | Parabola Antena | Micro Set | Feeder (m) | D.C. source | | Exchanger | |
|------------------|-----------------|----------------------------------|-----------|------------|----------------|---------|----------------|---------|
| | | | | | Battery (24 V) | Charger | Battery (48 V) | Charger |
| Sakr SS | 120 | 8 m ϕ x 2 | 2 | 270 | - | - | - | - |
| Repeater station | 120 | 8 m ϕ x 2 3 m ϕ x 2 | 2 | 410 | 14V 7.5kAh | - | - | - |
| New Suez SS | 80 | 3 m ϕ x 2 3 m ϕ x 2 | 2 | 360 | 500Ah x 2 | 150 A | 108 Ah | 20 A |
| Ayun Musa P.S. | 105 | 3 m ϕ x 2 | 2 | 405 | 500Ah x 2 | 150 A | 210 Ah | 50 A |

2) Optical Communication System

Most parts of optical fiber are contained in ground wires of transmission lines. To use the optical fiber for signal transmission is mainly to avoid an induced interference from the heavy loaded cable system. PCM-1.5 M 12 channel is used for signal transmission at both terminals.

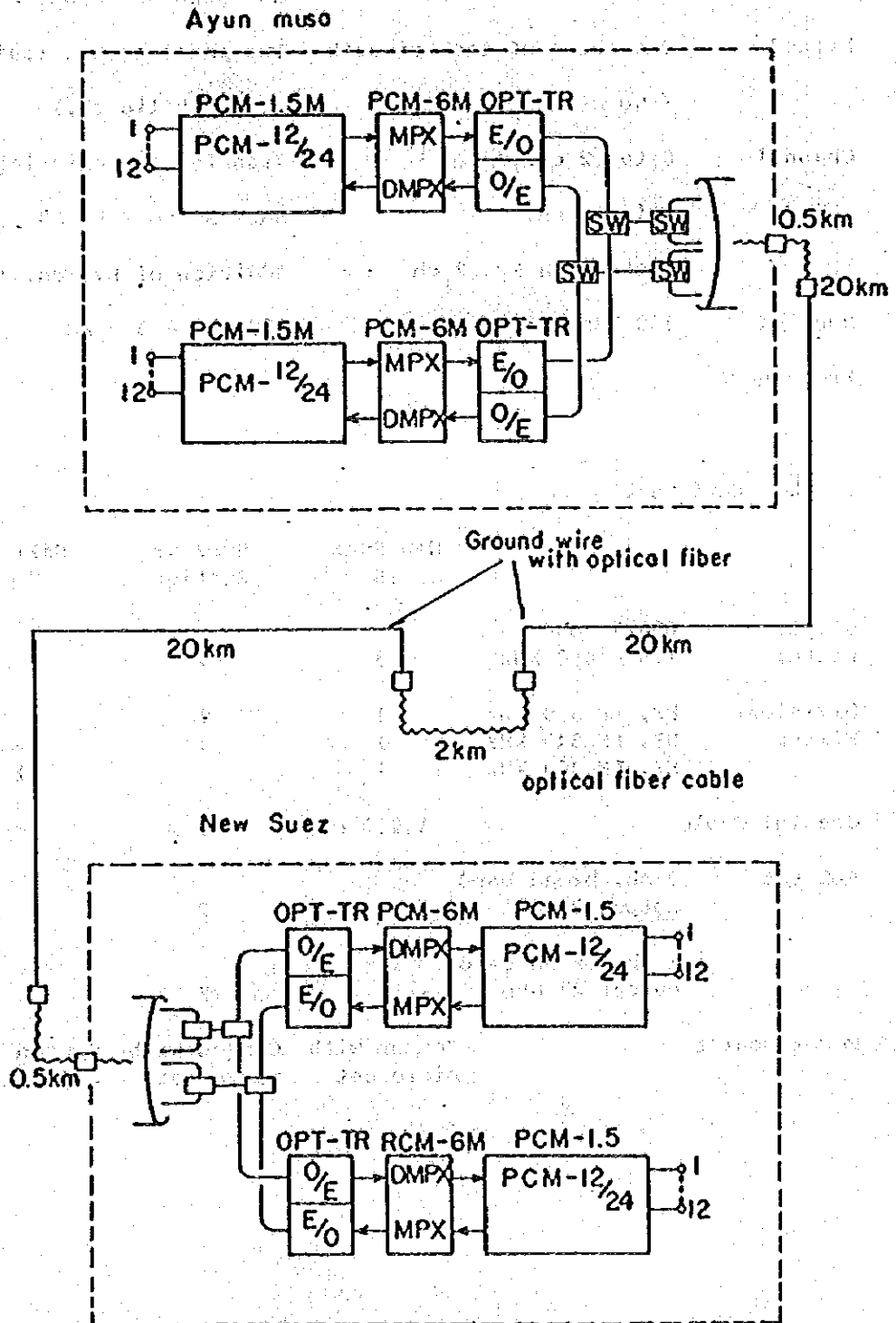
| Item | Ayun Musa PS | New Suez SS | Ahmed Hamdi Tunnel |
|---------------------------------|--------------|-------------|--------------------|
| PCM-12 channel | 2 | 2 | |
| Optical transmitter | 2 | 2 | |
| Optical fiber cable | 0.5 km | 0.5 km | 2 km |
| Optical fiber in the groundwire | 40 km x 2 | | |

Fig 6-6 MICRO-WAVE COMMUNICATION SYSTEM



| | SAKA SS | | REP | | NEW SUEZ (B) | | AYUN MUSAPS | | REMARK |
|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|--------|
| | I | W | TO SAKA | TO SUEZ (B) | TO REP | TO AYUN MUSAPS | I | W | |
| Out Put | (30 dBm) | (30 dBm) | (30 dBm) | (30 dBm) | (30 dBm) | (30 dBm) | (30 dBm) | (30 dBm) | |
| Dir. of ANTENA | 8m x 2 | 8m x 2 | 3m x 2 | 3m x 2 | 3m x 2 | 3m x 2 | 3m x 2 | 3m x 2 | |
| Length of FEEDER | SF-50-13 270m | SF-50-13 220m | SF-50-13 190m | SF-50-13 185m | SF-50-13 175m | SF-50-13 230m | SF-50-13 230m | SF-50-13 230m | |
| Received Input | -38. dBm | -38. dBm | -47. dBm | -47. dBm | -47. dBm | -45. dBm | -45. dBm | -45. dBm | |
| RELIABILITY | 99.9999954 | | 99.9999934 | | 99.9999943 | | 99.9999943 | | |
| Height of TOWER | 120m | 120m | 120m | 80m | 80m | 80m | 105m | 105m | |

Fig. 6-7 Optical fiber system



Note E/O, O/E Optical Signal/Electrical Signal Changer

2) Power Line Carrier

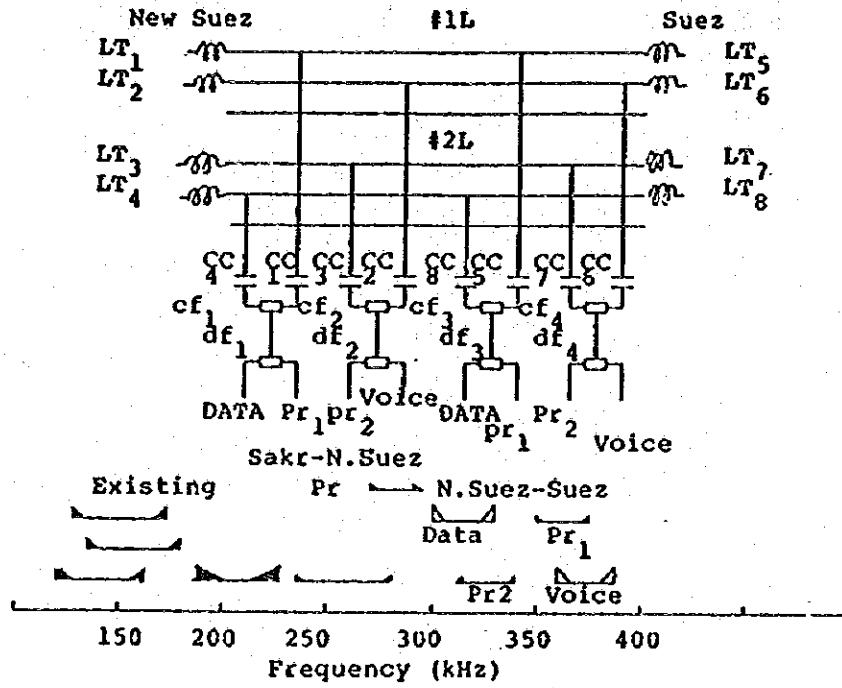
a. Design of Channel

| | | |
|----------------------|--|--|
| Section: | New Suez SS - Suez SS | New Suez SS - Sakr SS |
| Method | One phase of each circuit (two metallic ch.) | Two phase each circuit (two metallic ch.) |
| Channel | Data 2 ch. Voice 2 ch. Protection Ry. 2 ch | Transfer the existing Suez SS to Sakr SS set Addition of Ry. ch. 1 ch. |
| Band of Frequency | 300 kHz - 390 kHz | 250 kHz - 300 kHz |

b. Equipment

| | | New Suez SS | Suez Tr Station | Sakr SS |
|--------------------|--|--------------------------|--------------------------|-----------------------------|
| Coupling Filter | 600:75 ohm 175 - 450 kHz | 3 | 2 | - |
| Division Filter | HF, LF 350 kHz HF, LF 340 kHz HF, LF 300 kHz | 1 1 1 | 1 1 - | - - 1 |
| Coaxial Cable | | 1,200 m | 400 m | - |
| PIC set | 2 ch. broad band output 27 dBm 1 ch. broad band output 27 dBm | 2 3 | 2 2 | - 1 |
| Power source | | Common with micro set | Common with micro set | Common with existing set |

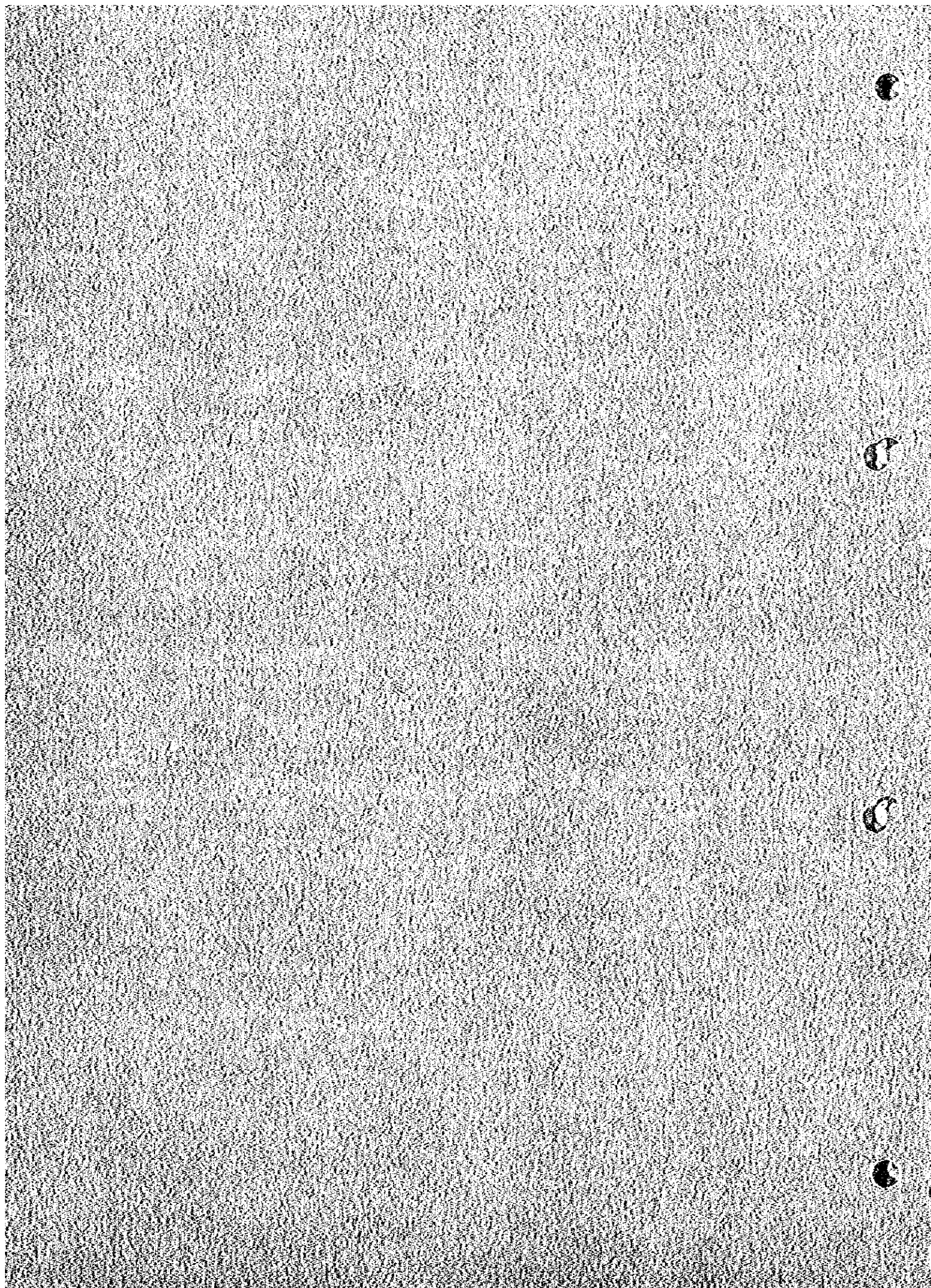
Fig. 6-8 PLC Layout



第 7 章

建 設 費

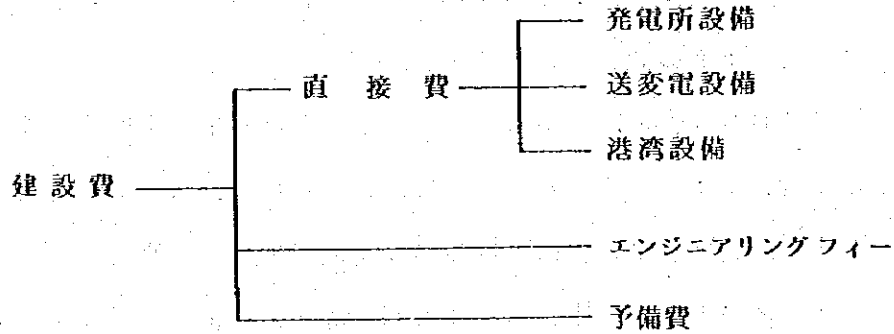
(1st Stage 300 MW × 2 Units)



第7章 建設費

7-1 建設費算定の基本的考え方

- 1) 建設費は建設工事中の工事中心年を考慮して算定する。
- 2) 建設費は下記の区分により組立て算出する。



- 3) 建設費はエジプト国内貨所要分と、外貨所要分に分け、内貨所要分には国内労務者の賃金、工事監督（E E A職員）に要するエンジニア、テクニシヤンの経費、セメント、骨材、木材、燃料等エジプト国内で調達し得る建設費、資材費及び輸入資材の国内輸送費を含めた。それ以外は、総べて外貨所要分に計上した。
- 4) 工事要領はE E Aとコンサルタントとの技術役務契約に基づいてコンサルタントが作成した仕様書に従ってE E Aが一括請負方式によりコントラクターと工事請負契約をむすび、工事を実施するものとした。
工事期間中、コンサルタントはE E Aに対し工事監理業務援助を行うものとして算出する。
- 5) 工事に必要な資金の調達事業主体であるE E Aが行うものとし、外貨分については国際金融機関から内貨分についてはエジプト国内の金融機関から借り入れるものとした。

7-2 建設費算定の範囲及び条件

1) プロジェクトの範囲

1988年以降のエジプトにおける電力供給計画によるシナイ石炭火力1,200 MW 開発計画のうち、300 MW × 2 Unitsの発電所、輸入炭荷揚港及び発電所より既設との連系地点までの送電線とそれに附随する設備が本プロジェクトの範囲である。

すなわち進入道路、用地造成、護岸、復水器冷却水取放水設備、海水淡水化設備、ボイラ・タービン発電機及びそれらの付属設備、揚炭運炭設備、灰処理設備、排水処理設備、燃料油設備、貯炭場、灰捨場、サービスビルディング、修理工場、倉庫、送電設備、変電設備および通信設備である。

但し、将来増設する600 MWに必要な共通設備として最小限の用地造成、揚炭設備、輸送設備、取放水設備を含むものとする。

2) 建設費算定の条件

a 建設費算定の範囲は本プロジェクトを実施するために必要な費用を計上するが、その限界は下記の通りである。

a) 工事に必要な用地の取得、工事に伴って生ずる各種の補償に必要な経費は計上しない。但し、取得した用地の造成費用は含む。

b) 輸入される資材、及び機器に対する関税、その他の諸税、エンジニアリングフィーに対する税金及び外国人エンジニアの所得税は免除されるものとして計上しない。

c) 事業主体であるE E Aが行う金融機関融資手続きに必要な諸経費は含まない。

d) 国内炭輸送のための設備、道路または鉄道の建設費は含まない。

e) 燃料油及び輸入炭輸送のためのタンカー及び石炭輸送船に要する費用は含まない。

従って燃料受入れについては棧橋から貯炭場までの運炭設備及び油貯蔵タンクまでの送油設備を計上する。

f) 建設、運転に必要な事務所、工事用道路、予備品、自動車、売店は含むが職員住宅、ゲストハウス、学校等の施設は含まない。

b. 価格の算定

a) 外貨分 : 1983年の日本の価格を基準とし建設時点までの物価上昇を考慮した。又、日本よりエジプトまでの海上輸送費を考慮する。

b) 内貨分 : 1982年のエジプト国内の価格を基準とし建設時点までの物価上昇を考慮する。

c) 試運転に必要な燃料費は試運転電力と相殺されるものとして建設費には含まない。

d) 通貨の交換率は下記の通りとした。

$$\text{US\$}1 = \text{L. E. } 0.823$$

$$\text{US\$}1 = 230 \text{ 円}$$

$$\text{L. E. } 1 = 279.5 \text{ 円}$$

e) 予備費はやむを得ない理由による設計変更に引当てるものとして外貨分の約4%、内貨分の5%及びエンジニアリングフィーの10%を計上する。

f) エンジニアリングフィーは業務に必要な人件費、諸経費、技術料の他、旅費、通信費等、直接経費の費用として直接工事費の1.1%とする。

g) 資金調達条件

外貨 : ・ 80%分は金利4%、5年間の据置期間を含む30年間返済

・ 20%分は金利9%、5年間の据置期間を含む15年間返済

内貨 : 金利8%、3年間の据置期間を含む15年返済

h) 支払条件

i) 輸入機器代 契約時20%、船積時70%、完成時10%

ii) 建設費 契約額の90%を出来高払いとし完成時10%

iii) エンジニアリングフィー

年度別の仕事量を推定し人月比例で算出

7-3 建設費の算出

7-1、7-2項で述べた条件に基づき算出した建設費を表7-1に示す。

建設費は 510.4×10^6 L.E. となった。各段階の建設費と年度毎の支出予定を各々表7-2、7-3に示す。

表7-1 建設費

| Items | F.C. | | L.C. | | Total | |
|---|-------|---------|------|--------|-------|---------|
| | | | | | | |
| Unit: $\times 10^6$ LE ($\times 10^6$ US\$) | | | | | | |
| 1. Generating Facilities | | | | | | |
| 1) Equipments | 262.0 | (318.3) | - | - | 262.0 | (318.3) |
| 2) Erection | 42.2 | (51.3) | 19.6 | (23.8) | 61.8 | (75.1) |
| 3) Civil works | 10.4 | (12.6) | 18.3 | (22.2) | 28.7 | (34.8) |
| 4) Architectural works | 34.0 | (41.3) | 16.1 | (19.6) | 50.1 | (60.9) |
| 5) Harbor facilities | 28.3 | (34.4) | 7.6 | (9.2) | 35.9 | (43.6) |
| Sub-total | 376.9 | (457.9) | 61.6 | (74.8) | 438.5 | (532.7) |
| Unit Construction Cost [LE/kW (US\$/kW)] | - | - | - | - | 730.8 | (887.8) |
| 2. Transmission Lines and Substation | | | | | | |
| 1) Transmission lines | 25.6 | (31.1) | 7.5 | (9.1) | 33.1 | (40.2) |
| Unit Construction Cost (10^3 LE/km (10^3 US\$/km)) | - | - | - | - | 760.9 | (924.1) |
| 2) Substation | 10.8 | (13.1) | 2.3 | (2.8) | 13.1 | (15.9) |
| Sub-total | 36.4 | (44.2) | 9.8 | (11.9) | 46.2 | (56.1) |
| 3. Engineering Fee | | | | | | |
| | 5.4 | (6.6) | - | - | 5.4 | (6.6) |
| 4. Total (1 + 2 + 3) | | | | | | |
| | 418.7 | (508.7) | 71.4 | (86.7) | 490.1 | (595.4) |
| 5. Contingency | | | | | | |
| | 16.7 | (20.3) | 3.6 | (4.4) | 20.3 | (24.7) |
| 6. Grand Total (4 + 5) | | | | | | |
| | 435.4 | (529.0) | 75.0 | (91.1) | 510.4 | (620.1) |

表 7-2 阶段别预算

Unit: $\times 10^6$ LE ($\times 10^6$ US\$)

| <u>Items</u> | <u>F.C.</u> | | <u>L.C.</u> | | <u>Total</u> | |
|--------------|-------------|---------|-------------|--------|--------------|---------|
| 1st Phase | 63.4 | (77.0) | 24.1 | (29.3) | 87.5 | (106.3) |
| 2nd Phase | 207.5 | (252.1) | 32.6 | (39.6) | 240.1 | (291.7) |
| 3rd Phase | 164.5 | (199.9) | 18.3 | (22.2) | 182.8 | (222.1) |
| Total | 435.4 | (529.0) | 75.0 | (91.1) | 510.4 | (620.1) |

表 7-3 年度别预算

Unit: $\times 10^6$ LE ($\times 10^6$ US\$)

| | <u>F.C.</u> | | <u>L.C.</u> | | <u>TOTAL</u> | |
|-------|-------------|---------|-------------|--------|--------------|---------|
| 1984 | 4.0 | (4.9) | 1.2 | (1.5) | 5.2 | (6.4) |
| 1985 | 54.0 | (65.6) | 8.2 | (10.0) | 62.2 | (75.6) |
| 1986 | 121.6 | (147.8) | 19.0 | (23.0) | 140.6 | (170.8) |
| 1987 | 183.9 | (223.4) | 29.5 | (35.8) | 213.4 | (259.2) |
| 1988 | 58.7 | (71.3) | 15.9 | (19.4) | 74.6 | (90.7) |
| 1989 | 13.2 | (16.0) | 1.2 | (1.4) | 14.4 | (17.4) |
| TOTAL | 435.4 | (529.0) | 75.0 | (91.1) | 510.4 | (620.1) |

表7-4 プロジェクト発電原価諸元

| <u>Item</u> | <u>Unit</u> | <u>Formula</u> | <u>Value</u> |
|---|-------------------|--|--------------|
| A. Unit Capacity | MW | | 320 x 2 |
| B. Availability | % | | 80 |
| C. Annual Gross kWh | $\times 10^6$ kWh | $A \times 8.760 \times B / 100$ | 4,485.1 |
| D. Station Service Loss (kW) | % | | 6.25 |
| E. Annual Available Energy at P/S Tr. End | $\times 10^6$ kWh | $C \times (1 - D / 100)$ | 4,204.8 |
| F. Plant Efficiency | % | | 39 |
| G. Construction Cost including T/L | $\times 10^6$ LE | | 510.4 |
| H. Fuel Calorific Value | kcal/kg | | 6,500 |
| I. Fuel Consumption | $\times 10^3$ ton | $\frac{860 \times C}{F \times H} \times 100$ | 1,521.5 |
| J. Unit Price of Fuel | LE/ton | | 4.9 |
| K. Fuel Cost | $\times 10^6$ LE | $I \times J \times 10^{-3}$ | 7.5 |
| L. Operation Maintenance Cost | $\times 10^6$ LE | $G \times 0.02$ | 10.2 |
| M. Administration Cost | $\times 10^6$ LE | $G \times 0.005$ | 2.6 |
| N. Depreciation | $\times 10^6$ LE | $G / 30$ | 17.0 |
| O. Annual Cost | $\times 10^6$ LE | $K + L + M + N$ | 37.3 |
| P. Generating Cost at P/S Tr. End | Millimes/kWh | $O / E \times 10^3$ | 8.87 |
| Q. T/L and D/L Loss | % | | 12 |
| R. Salable Energy at Consumer End | $\times 10^6$ kWh | $E \times (1 - Q / 100)$ | 3,700.2 |
| S. Salable Unit Price | Millimes/kWh | 33.646×0.7 | 23.55 |
| T. Revenue/kWh | Millimes/kWh | $S - P$ | 14.68 |
| U. Annual Revenue | $\times 10^6$ LE | $R \times T \times 10^{-3}$ | 54.3 |

第 8 章

プロジェクトの実施計画

(1st Stage 300MW×2 Units)

第8章 プロジェクトの実施計画

8-1 建設総合工程

プロジェクトの実施にあたり、下記の建設総合工程を考慮した。

8-1-1 プロジェクト実施のための準備作業期間

フィージビリティレポートが完成したら直ちに資金調達の手続、コンサルタントの雇用、入札書類の作成、入札/契約その他公的な所要手続きが必要である。資金調達申請から施工業者の決定まで約13カ月必要であると考えられる。

8-1-2 建設工程

プロジェクトの実施方法は、3段階に大別するものとする。

第1段階においては、港湾設備の建設、発電所用地の造成工事、発電設備300MW×2基分の主要機器・材料の詳細設計、300MW 1 Unit ボイラ・タービン発電機の基礎工事と発電所建屋工事、および New Suez 変電所の建設工事を実施する。

第2段階においては、第1段階に引き続き、300MW 2 Unit ボイラ・タービン発電機の基礎工事と発電所建屋工事、300MW 1 Unit ボイラ・タービン発電機の据付、その他の機器の土木建築工事、および送電線設備220KV 4回線のうち2回線の送電線建設工事を実施する。

第3段階においては、第2段階に引き続き、300MW 2 Unit ボイラ・タービン発電機の据付、その他の機器の据付、附帯設備の土木建築工事、および送電線設備220KV 4回線のうち残りの2回線の送電線建設工事を実施する。

工事工程は図8-1の建設総合工程に示す通りであり、その主要項目を以下に示す。

(最初の契約から、1st Unitの引渡しまで44カ月、2nd Unitまで50ヶ月とする。)

1) 第 1 段階

a 港湾設備

| <u>主 要 設 備</u> | <u>最初の契約調印後</u> |
|----------------|-----------------|
| 浚渫工事開始 | 7 カ月 |
| 杭 打 着 工 | 1 4 カ月 |
| 完 成 | 3 8 カ月 |

b 発電設備、BTG 基礎、発電所建家の詳細設計

| <u>主 要 項 目</u> | <u>最初の契約調印後</u> |
|----------------|-----------------|
| 基礎工事開始 | 9 カ月 |
| 完 成 | 4 3 カ月 |

c New Suez 変電所

| <u>主 要 項 目</u> | <u>最初の契約調印後</u> |
|----------------|-----------------|
| 基礎工事開始 | 1 3 カ月 |
| 完 成 | 3 2 カ月 |

2) 第 2 段階

a. 発電設備 (No. 1 Unit)

| <u>主 要 項 目</u> | <u>最初の契約調印後</u> |
|-------------------|-----------------|
| ドラム揚げ | 2 2 カ月 |
| 火 入 れ | 3 5 カ月 |
| 通 気 | 3 7 カ月 |
| 試 運 転 開 始 | 3 7 カ月 |
| 営業運転 (No. 1 Unit) | 4 1 カ月 |
| 引 渡 し | 4 4 カ月 |

b. 送電線設備 (220KV 2 回線)

| <u>主 要 項 目</u> | <u>最初の契約調印後</u> |
|----------------|-----------------|
| 基礎工事開始 | 9 カ月 |
| 建 方 開 始 | 1 7 カ月 |
| 架線工事開始 | 2 4 カ月 |
| 完 成 | 3 0 カ月 |

3) 第 3 段 階

a. 発電設備 (No. 2 Unit)

| <u>主 要 項 目</u> | <u>最初の契約調印後</u> |
|-------------------|-----------------|
| ドラム揚げ | 28 カ月 |
| 火 入 れ | 41 カ月 |
| 通 気 | 43 カ月 |
| 試 運 転 開 始 | 43 カ月 |
| 営業運転 (No. 1 Unit) | 47 カ月 |
| 引 渡 し | 50 カ月 |

b. 送電線設備 (220 KV 2 回線)

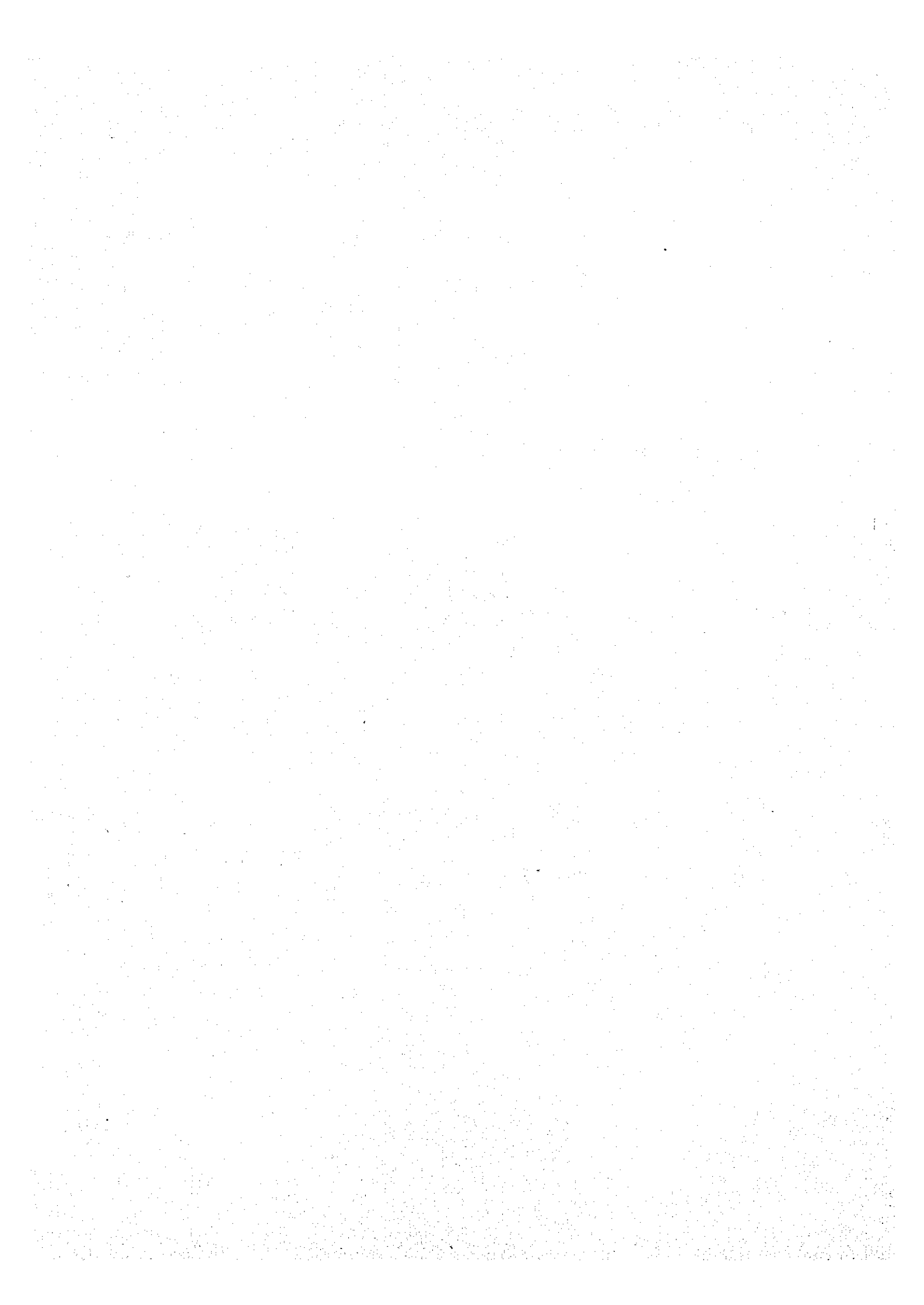
| <u>主 要 項 目</u> | <u>最初の契約調印後</u> |
|----------------|-----------------|
| 基礎工事開始 | 23 カ月 |
| 建 方 開 始 | 30 カ月 |
| 架線工事開始 | 39 カ月 |
| 完 成 | 45 カ月 |

4) コンサルタントは契約後プロジェクトの完成までの全期間についてエンジニアリングサービスを提供するものとする。

5) プロジェクト全体の期間はコンサルタント契約後 57 カ月を要する。

表 8-1 Overall Construction Program (Tentative) 1st Stage

| I T E M | YEAR & MONTH | 1983 | | 1984 | | | | | 1985 | | | | 1986 | | | | 1987 | | | | 1988 | | | | 1989 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--------------|---------|---|--------------|----|--------------------|----|----------|------|-----------------|---|---|------|----------------------------|---|---|------|--------------------------|----|---|------|--------------------------------|---|---|------|-----------------|---|---|----|----|----|---|---|---|---|---|---|---|---|---|----|----|----|---|---|---|---|---|---|---|---|---|----|
| | | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| FINANCING AND OFFICIAL PROCEDURES | | Summary | | I.P. | | I.P.Pledge | | Appr. | | Appr. | | | | Appr. | | | | Appr. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TENDERING/CONTRACTING AND RELATED PROGRAMME | | F.R. | | Fact finding | | C/A for consultant | | T. Issue | | C/A-1 | | | | C/A-2 | | | | C/A-3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Harbour facility 2. Land reclamation of Power Plant | | | | | | | | | | Dredging | | | | Piling | | | | | | | | Completion | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. Detailed design of main equipments & materials of Power Plant for 300MW x 2 | | | | | | | | | | | | | | Foundation for 1st unit | | | | Land reclamation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. Boiler, T/G foundation for 300MW x 1.5 Building works for powerhouse of 1st unit | | | | | | | | | | | | | | Bldg. | | | | Finishing works | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5. Detailed design, manufacturing, delivering & erection of New Suez Substation, civil/arch. works of outdoor foundation, control house, access road and other related works for substation | | | | | | | | | | Detailed Design | | | | Foundation & Erection | | | | Finishing works of civil | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Detailed designing, manufacturing, delivering & installation of equipments & materials for 1st unit Power Plant with accessories, coal unloading facilities, fuel handling facilities for 1st unit, water treatment, Screen/scrapper & intake pump for 1st unit, desalination facility, main transformer & switching yard facilities for 1st unit, machine shop equipments/materials & tools, EP and other related facilities | | | | | | | | | | | | | | Drum Lifting | | | | Receiving | | | | Commissioning | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. Civil works of intake/intake pit, circulating cooling water channel, discharge/outlet, foundations of fuel storage & transportation facilities, aux. equipments foundations, fresh water pond & tank, ash pond facility and other related civil works for 1st unit | | | | | | | | | | | | | | Manufacturing & delivering | | | | Light | | | | Take Over | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. Architectural works of service building, machine shop house, ware house, stack works incl. foundation, control house for aux. facilities for 1st unit, gate & fense and misc. works | | | | | | | | | | | | | | | | | | Hydro Test | | | | Steam Admission | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Architectural works of boiler turbine-generator foundations and powerhouse for 300 MW x 1 (2nd unit) | | | | | | | | | | | | | | Coal transportation | | | | Stack | | | | Finishing works | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. Detailed designing, manufacturing, delivering and installation of equipments and materials for 220 kv x 2cct transmission line incl. Suez crossing facilities civil works of steel tower foundations and related works | | | | | | | | | | | | | | Service Bldg. | | | | Appurtenant Bldg. | | | | Finishing works | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Detailed designing, manufacturing, delivering & installation of equipments & materials for 2nd Power Plant with accessories, fuel handling facilities for 2nd unit, screen/scrapper & intake pump for 2nd unit, main transformer & switching yard facilities for 2nd unit, EP and other related facilities | | | | | | | | | | | | | | Stack | | | | Bldg. for 2nd unit | | | | Finish works | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. Civil works of foundations of fuel storage & transportation facilities for 2nd unit aux. equipments foundations, drainage system works, access roads/station roads, land clean-up works, wash pond facilities and other related civil works incl. plantation | | | | | | | | | | | | | | Foundation for 2nd unit | | | | Erection | | | | Completion (220 kv x 2cct T/L) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. Architectural works of ware house, worker's house, control houses of aux. equipments for 2nd unit and other miscellaneous works | | | | | | | | | | | | | | Foundation | | | | Stringing | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. Detailed designing, manufacturing, delivering and installation of equipments & materials for 220 kv x 2cct transmission line incl. Suez canal crossing facilities | | | | | | | | | | | | | | Drum Lifting | | | | Receiving | | | | Commissioning #2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Civil works for steel tower foundations and other related works | | | | | | | | | | | | | | Manufacturing & delivering | | | | Lighting | | | | Take Over | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | Storage yard | | | | Hydro Test | | | | Road | | | | Steam Admission | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | misc. work | | | | Erection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | Stringing | | | | Completion | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | 220 kv x 2cct T/L | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | Foundation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



8-2 調達計画

本プロジェクトの調達方法としてはプロジェクトの内容から判断して、ターンキー方式による一括契約とすることが望ましい。

またこの建設工事はこのプロジェクトがエジプトの公益事業であり、電力の高い供給信頼度が要求されるために、土木建築を含む全ての設備工事が高い質のものでなければならないことから、施工業者には十分高度な資格が要求される。

エジプトで調達できる機器や材料で本プロジェクトで使用可能なものは、これを採用することを原則とする。

ボイラ、タービン、発電機、主要変圧器その他施工業者によってエジプト以外で調達される機器材料については、調達国で工場試験に合格後、船積みされるものとする。

原則として主契約者プライムコントラスターは土木、建築及び機器据付工事に関する業者には現地業者を採用するものとする。

但し、前述の如く高い質が要求されるため、現地業者ではそれに応え得る施工技術が不足する場合、その部分については外国の施工業者によって補足実施されることもあり得る。

また、建設総合工程の調整のために外国のエンジニア、テクニシャン及び熟練工による特殊な施工技術及び指導が必要となることもあり得る。

8-3 プロジェクト実施のための組織

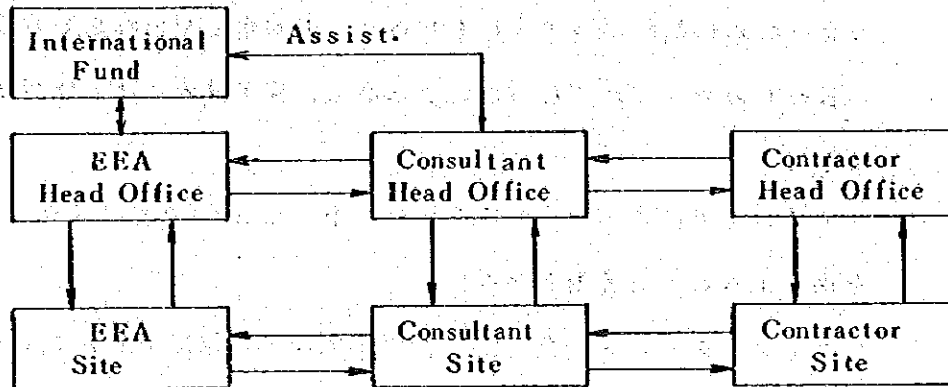
8-3-1 組織

本プロジェクトはエジプトで初めての石炭火力であり、かつ運開時期も決められていることから、プロジェクトの実施に当たりE E Aはコンサルタントを雇用しその業務を援助させる。

一方建設工事は、全工事を一括発注とし責任体制を明確にするとともに工事を円滑に進捗させることが望ましい。

EEA、コンサルタント、施工業者3者間の組織図を示せば次の通りである。

図8-1 組織図



8-3-2 業務

本プロジェクトの遂行に際しEEA及びコンサルタントの行うべき主要業務は、次の通りである。

1) EEAの行うべき業務

- a. コンサルタント選定。
- b. 調査、検討業務

契約のための一般条件、特殊条件、仕様書、図面等の検討とその決定、
現場条件の検討

- c. 施工業者の選定及び付帯業務

コンサルタントの援助の下に入札手続き、施工業者の選定、L/Cの
発行手続きを行なう。

- d. 施工全体方針の決定

組織編成、施工方針、工事管理方式、試験計画、受取方法、その他の
決定。

- e. 工事準備

用地購入、補償、その他必要な調査

- f. 建設工事の検査・調整
- g. 発電所の試運転の実施と性能検討及び受取り
- h. 送電線、変電所設備の諸試験と性能検討及び受取り
- i. その他

2) EEAの援助業務としてコンサルタントの行うべき業務

- a. フィジビリティレポートの見直し
- b. 資金調達手続及び融資機関のガイドラインにもとづく技術的手続の援助
- c. 現地調査と全項目に亘る基本設計
- d. 入札書類の作成
- e. 入札諸手続き、施工業者との契約手続き
- f. 承認用図面及び書類の審査
- g. 土木建築工事用詳細設計の実施
- h. 工場試験の立会い及び審査
- i. 工事施工管理
- j. 諸試験要領書の作成
- k. 諸試験の援助
- l. 受取試験の立会とデータ分析
- m. EEA 運転、保守職員の訓練
- n. 運転保守要領書の編集
- o. 工事進捗報告書及び工事完成報告書の作成

8-4 工事施工計画

EEAが提示した基本工程にもとづき、契約後直に施工業者は全般にわたる施工実施計画書をEEAに提出承認をえた後、主として下記の準備工事を実施するものとする。

8-4-1 工事用電源及び工事用水

1) 工事用電源

Ayun Musa 地点近くに既設高圧配電線は無く、既設電源よりの工事用

電力は期待出来ないので、工事用仮設備としてディーゼル発電設備を設置する。

工事用電力は、ピーク時約 1,500 kVA 必要である。

2) 工事用水

Ayun Musa 近くには工事用水として利用できる河川・湖沼及び工業用水がないので工事用水を供給するために、海水淡水化装置を設置する。

最大所要水量は工事のピークで約 1,000 t/day である。

8-4-2 建設事務所及び宿舍

建設工事を総合的に管理する建設事務所、建設要員及び作業員の宿舍は EEA の指示により発電所近くの国道 66 号線沿いに施工業者によって準備するものとする。変電所建設地点にも宿舍を設ける。

8-4-3 資機材置場

発電所建設に要する資機材は発電所と国道 66 号線間に、各作業分野毎に区割りして配置する。

変電所建設地点にも配置する。

8-4-4 建設機械

1) 機械名称

a. 共通機械

荷揚用起重機、バッチャー・グラント、ミキサー車、クローラ・クレーン、トラック・クレーン、ショベルカー、フォーク・リフト、トラック、空気圧縮機、ウインチ、溶接機 外

b. 発電設備

ジンプール、発電機ポールアップ設備、ドラム揚用・ウインチ

c. 土 木

浚渫船、杭打船、杭打機、ダンプカー、テトラ、スクレーパー、ブルドーザー、ロードローラー、アスファルトプラント、アスファルトフィニッシャー、外

d. 建 築

杭打機、コンクリート・ポンプ 外

e. 送 変 電 設 備

杭打機、延線車、延線用巻取エンジン、地上せり上げデリック

2) 運搬・交通用車輛及び船舶

バス、交通船、材料運搬船、タグボート、

3) 機械の調達

上記の建設機械に関して、エジプト国内で調達可能なものは出来るだけ利用するものとする。

なお、機械の容量及び台数については、施工業者による詳細な工事の計画書をE E Aにて検討し承認された後決定する。

8-4-5 建設資材

セメント・砂、砂利、木材、鋼材、燃料等エジプト国内で調達し得るものはすべて現地購入とする。

8-4-6 建設作業員

1) 作 業 員

石炭火力発電所建設のための特殊技術工、熟練工、世話役など高度の技術と作業間調整業務を除き、エジプトにおける火力発電所建設の経験者を出来るだけ採用するものとし、一般作業員はすべてエジプト国内より雇用する。

2) 作業員の宿舍

作業員の宿舍はE E Aの指示に従い建設現場近くに設ける。

8-4-7 資機材輸送

1) 海上輸送について(水切場所及び方法)

施工業者による輸入機器は、海路スエズ湾に輸送される。

サイトに最も近い通関手続可能な港はスエズ港であるが、ここで水切りして、陸路サイトまで輸送する場合、小物及び軽量物は問題なく輸送可能であるが、大物及び重量物(発電機、主変圧器、ボイラーなど)の輸送は途中のスエズ運河横断トンネル(Ahmed Hamdi Tunnel)を通過することが不可能である。

従って、これら大物及び重量物はサイトで水切りするものとする。

この方法はスエズ港内又はサイト沖で本船よりバージに積み代えてサイト岸壁においてフローティングクレーンで水切りを行う。

サイトへの重機材搬入は、取水口横に600 ton フローティングクレーン船及び1,000トンバージが接岸出来る程度の仮設荷揚げ用岸壁を作るものとする。

2) 陸上輸送について

スエズ港で水切りした小物及び軽量物はトラック又はトレーラー等で運搬する。サイト岸壁で水切りした大物及び重量物は構内所定場所までコロ引きにて運搬し仮置・オンベースする。

3) 通関について

大物及び重量物のサイト岸壁での水切りを行う資機材についてはスエズ港に於て"沖取り方式"で通関手続を受け、その他スエズ港での小物、軽量物については従来通りの方式とする。

4) 水切・輸送に必要な機材リスト

- a. 600トン級フローティングクレーン船
- b. 1,000トン級バージ
- c. タグボート(自走バージの場合は不要)
- d. コロ引き用35トン級トラッククレーン