5-2-4 Generating System

Generating system will be 3 phase, 3 wire, 11 kV, 50 Hz.

5-2-5 Use of Existing Facilities

As a result of a study based on the policies described in 5-1-5, the facilities that can be used for the project among the existing common facilities are as shown in Table 5-3.

Table 5-3 Existing Facilities that will be Used for This Project

Item		Application
Machinery Equipment	(1) Heavy oil tank (407,000 gallons x 2 units)	To be used for main fuel
	(2) Diesel oil tank (11,000 gallons x 1 unit)	To be used for starting or stopping generator
	(3) Fire-fighting water tank	To be used for cooling water and steam. (For steam, water in this tank is used after passing through water softening system.)
	(4) Drainage ditch	To discharge waste oil and waste water after sludge is removed
	(5) Header for steam supply (located in existing generator building)	To conduct surplus steam for use in bottom heater heavy of oil tank
Electric Equipment	(1) 11 kV distribution system (installed in generator building)	To connect existing distribution system with project generating system
	(2) Battery system	The existing battery system will be used as the power source for operation of systems such as open/close of the switchgear for connection with existing facilities.
	(3) Grounding system (grounding electrode)	To connecting grounding systems for project equipment with existing grounding electrode
	(4) Cable pits (in generator building)	To use cable pits, cable racks, etc., for installation of cables for this project

5-2-6 Applicable Standards

The following standards shall be applied to the design of this project:

(1) Japanese Industrial Standards (JIS)

(2) Japanese Electrotechnical Commission (JEC)

(3) The Standard of Japan Electrical Manufacturers Association (JEM)

(4) Japan Cable Makers Association (JCS)

(5) International Electrotechnical Commission (IEC)

(6) International Standardization Organization (ISO)

(7) Other Relative Japanese Standards

5-3 Basic Plan

5-3-1 Site and Facilities Arrangement Plans

As described in section 4-2-2, the generating facilities will be located in the vacant lot alongside the Training Center in the Power Station compound.

In making the layout arrangement plan, particularly the following points will be taken consideration:

(1) The engine will be installed as far away from the existing Training Center and classroom building as possible and attach noise proof material inside the enclosure to minimize the effect of noise from the generating facilities on these buildings.

(2) To facilitate work for cable connection with the existing 11 kV distribution system, the generator of the project generating facilities will be installed facing toward this distribution system.

(3) To facilitate maintenance work on the diesel generating facilities, the hoist crane will be installed on the enclosure.

(4) The generating facilities will be installed in such a manner that space will be left for maintenance of the existing KHD generating facilities in the planned construction site.

5-3-2 Facilities Plan

(1) Details of Plan

1) Decision on engine output and generator capacity

The rated output of the generator for this Project is 5 MW, and the required engine output and rated capacity of the generator can be calculated as follows:

(a) Engine output

$$Pe \geq \frac{P}{0.7355 \times \eta_G} \geq \frac{5,000}{0.7355 \times 0.96} \geq 7,090 \text{ (P.S)}$$

Pe : Engineer output (P.S. HP)

P : Generator output (kW)

η_G : Generator efficiency assumed To be 96%

(b) Generator capacity

$$P_G = \frac{P}{Pf} = \frac{5,000}{0.8} = 6,250 \text{ (kVA)}$$

P_G : Generator capacity (kVA)

P : Generator output (kW)

Pf : Generator power factor 0.8

2) Mechanical equipment

(a) Fuel supply facilities

Although the existing heavy oil and diesel oil tanks have already been used for about 25 years since their construction, no damage or breakage detrimental can be found. Since it is considered that these tanks can continue to be used, they will be used for the project.

However, the existing fuel piping is considered unfit for use for the project because of oil leaks and extensive oil stains. Thus, fuel piping needs to be newly installed for the project. The new piping will be connected with the existing fuel system within the existing tank yard where the above tanks are located.

(b) Lubricant oil facilities

Since no lubricant oil facilities that can commonly be used are available at this power station, lubricant oil facilities exclusively for the project generating facilitates need to be installed.

(c) Cooling water facilities

At this power station, common cooling water facilities that use sea water exist for the existing generating facilities (MAN and SULZER diesel generating facilities located in the power house). However, these cooling water facilities are included in NPA's future rehabilitation and improvement plan because of their deterioration, damage, etc. From this, it is concluded that the existing cooling facilities cannot be used under the project because of possible effect on other plans. Consequently, cooling facilities exclusively for the project generating facilities will be installed.

A radiator cooling system will be used for following reasons:

① The existing KHD generating facilities use the radiator system and NPA's operating personnel are familiar with control of this cooling system.

② The running cost is low because the radiator system requires only about 1/10 of the volume of make-up water that cooling tower system uses.

(d) Steam facilities

The existing boiler built in 1964 is still in operation for the existing SULZER generating facilities and heavy oil storage tank. However, its deterioration is much advanced.

For this reason, NPA plans to replace or repair major components of the boiler proper under the rehabilitation plan of the existing facilities planned to be implemented with the help of EIB. However, NPA's plan is not expected to be finished by the year operations commence at the subject generating facilities.

Therefore, steam facilities exclusively for the generating facilities will be installed to increase the viscosity of the main fuel of heavy oil. For the following reasons, exhaust gas boiler type will be employed:

① Considering the acute power shortage in the project area, an electric heater type could not be used because power consumption in the power station must be held down to the minimum.

② NPA's operation personnel are familiar with control of exhaust gas boiler type because the existing SULZER generating facilities use this type in their auxiliary boiler facilities.

For effective utilization of energy, surplus steam generated from the exhaust gas boiler of the project will be supplied to the existing steam piping header for use in the heater of the fuel storage tanks.

(e) Compressor

The existing compressor, built in 1978, is in advanced stage of absoluteness and is not being operated in a satisfactory condition. This requires installation of a compressor exclusively for the generating facilities of the project. It is planned to renew this compressor under the rehabilitation plan of the existing facilities but this work is not expected to be finished by the time local construction of the project begins.

(f) Air supply and exhaust facilities

Since no connection with the existing facilities and integral system is required, ordinary facilities needed for this project will be installed.

(g) Sludge treatment facilities

No sludge treatment facilities for processing waste water and waste oil exist in the Power Station. These wastes are discharged into the Sierra Leone River with rain water through the storm water drain in the compound, thereby causing a serious adverse effect on the environment in the vicinity. GTZ Report, referred to in 2-3-2, already pointed out the need for installation of an oil separator tank at the terminal point of the drain system before wastes are discharged into the River.

Under the project, to prevent the installation of the generating facilities from polluting the environment, a sludge separation tank and an oil separation tank will be installed in the waste oil system to separate oil from water and discharge only waste water into the existing drain channel.

NPA is required to properly process separated sludge and waste oil so that they will not cause environmental pollution.

h) Piping route

The project requires the pipes shown below. These pipes will be installed along the existing piping lines for each maintenance control because the maintenance personnel at the Power Station are believed to be familiar with the existing piping lines.

The pipes will be laid with the necessary protective devices such as support. Particularly, in sections where pipes cross roads, the pipes will be protected by providing piping trenches of concrete in the underground portion of such sections.

- Heavy oil pipes
- Diesel oil pipes
- Steam pipes
- Water supply pipes

3) Electric equipment

Since power generated by the project generating facilities is supplied through the existing 11 kV distribution system, particular care will be taken to conform

voltage, etc. of this power to the existing facilities. Major items of electric equipment will be designed in the following manner:

(a) 11 kV switchgear for connection with existing 11 kV distribution system

To connect power to be generated by the project generating facilities with the existing 11 kV distribution system, necessary protective relays, etc., for protection of the 11 kV switchgear and cables will be provided on the ground floor of the power house.

Since this 11 kV switchgear is installed in line with the existing 11 kV switchgear, its configuration will be the same as that of the existing board. DC power for operation of this new 11 kV switchgear will be supplied from the existing DC power source facility. The voltage will be 220V DC, the same as the voltage of power supplied from the existing facilities.

(b) 11 kV switchgear on generator side

A switchgear for the generator set will be installed within the enclosure for the outdoor generating facilities.

(c) Local control panel

A control board will be installed within the enclosure to start, stop, control, and monitor the generating facilities as well as to give warning.

(d) Remote control panel

All the existing generating facilities in the Power Station are monitored and controlled by the remote control located in the existing central control room. Consequently, the project generating facilities also need to be controlled in the same manner. For this purpose, a remote control panel for remote monitor and load control of the project generating facilities will be installed on the existing remote control panels.

(e) Excitation system

A brushless thyristor type excitation system will be installed on the local control panel.

(f) DC power source unit

A dedicated DC power source unit will be installed within the enclosure for operation of the switchgear, etc. at the generating facilities side.

(g) Transformer for auxiliary equipment

An outdoor type transformer will be installed near the enclosure for the

auxiliary equipment which is necessary for operation of the generating facilities.

(h) Grounding facilities

Grounding facilities required for the project are as follows:

① Grounding facilities for protection of power systems (As in the case with the existing facilities, neutral point resistance grounding system will be used.)

② Grounding facilities for prevention of shock from metal arts or electric equipment

③ Grounding electrode for common use by (①) and(②) above

The existing grounding protection facilities do not function properly and require modification work. There is a rehabilitation project with the help of EIB but to date the completion time has not been indicated.

Therefore, an outdoor type neutral point grounding resistance board for the project will be installed near the covering.

For the grounding electrode, the existing ones will be used because the Power Station employs a common grounding pole system.

(i) Communication system for maintenance

An interphone system for maintenance purposes will be installed both within the enclosure of the project outdoor generating facilities and in the existing central control room.

(j) Cable laying route

Cables will be installed by using the existing cable pits in the generator building because it is believed space is available for installation of cables for the project in the existing cable pits. Openings will be provided in the part of the outer walls of the generator building to draw in cables from the outside the building. Cables will be protected outdoors by conducting them through underground conduits.

4) Basic specifications of major items of equipment

Considering the aforementioned design policy and design criteria, and the performance of generating facilities similar in size to the Project, basic specifications of major items of equipment are defined as follows:

Table 5-4 Basic Specifications of Major Items of Equipment

Main equipment	Specifications	
(1) Diesel engine	Rating	Continuous
	Output	Generator output 5,000 kW (7,090 PS)
	Revolution speed	Not more than 750 rpm
	Type	Four stroke cycle, trunk piston type diesel engine with supercharger and air cooler
	Cooling system	Closed cycle water cooling with radiator
	Fuel	Diesel oil for starting and stopping Heavy oil for normal rating
	Elastic fastening equipment with common baseplate	
(2) Generator	Rating	Continuous
	Rated output	5,000 kW
	Phase	3 phase
	Rated voltage	11 kV
	Revolution speed	Same as engine
	Power factor	0.8 (lag)
	Frequency	50 Hz
	Winding connection	Y connection, with neutral drawout
	Excitation	Brushless thristor system
	Insulation	Class F
(3) Enclosure for D/G set	Structure	Steel structure
	Noise insulation	Approx. 75 dB(A) at point 1 m from the outside
	Hook for maintenance	The strength of structure must be enough to overhaul piston.
	Illumination	Approx. 300 lux
	Fire fighting equipment	Two (2) sets of "ABC" dry chemical fire extinguishers, portable type (all electrical equipment must be installed according to the Fire Fighting Law)
	Automatic fire alarm system	Ionization type smoke sensor, connecting panel in powerhouse ventilation blower and duct

Main equipment	Specifications
(4) Mechanical equipment	
1) Fuel oil system	
a) Heavy oil transfer pump	Electric motor, gear pump, and filter included (spare parts included)
b) Heavy oil buffer tank	1,000*l*
c) Diesel oil transfer pump	Electric motor, gear pump, and filter included (spare parts included)
d) Diesel oil service tank	1,000*l*
e) Heavy oil purifier unit	Electric motor, automatic sludge discharge (spare parts included)
f) Heavy oil service tank	1,000*l*
g) Fuel oil mixing tank	100*l*, fuel oil changeover cock included
h) Fuel oil feed pump	
i) Fuel oil flow meter	
j) Fuel oil filter	Primary and secondary filter
k) Fuel oil heater	Steam regulating valve and viscometer included
l) Fuel oil pressure regulating valve	
m) Fuel oil drain discharge pump	Electric motor, gear pump and filter included
n) Fuel oil drain tank	100*l*
2) Lubricating oil system	
a) Lubricating oil sump tank	About 7000*l*
b) Lubricating oil priming pump	Electric motor, gear pump
c) Lubricating oil cooler	Lubricating oil temperature regulating valve included
d) Lubricating oil main filter	50μ max.
e) Back-washing oil filter	
f) Lubricating oil purifier unit	Electric motor, automatic sludge discharge type
g) Lubricating oil pressure regulating valve	
h) Lubricating oil transfer pump	

3) Cooling water system	
a) Water feed pump	Electric motor, centrifugal pump
b) Jacket water expansion tank	250*l*
c) Jacket cooling water pump	Electric motor, centrifugal pump water pump (spare parts separately sold)
d) Jacket cooling water temperature regulating valve	
e) Cooling water radiator	
f) Secondary cooling water pump	Electric motor, centrifugal pump (spare parts separately sold)
g) Chemical feed unit	50*l*
4) Steam system	
a) Exhaust gas boiler	Steam evaporation : 1 t/h
b) Feed water pump	Electric motor, centrifugal pump (spare parts separately sold)
c) Feed water tank	3 k*l*
d) Softener	1.63m^3/h
e) Softener feed water pump	Electric motor, centrifugal pump
5) Compressed air system	
a) Air compressor	Electric motor-driven
b) Air receiver	Volume for three times start-up
c) Air pressure reducing valve	
6) Air intake and exhaust gas system	
a) Exhaust gas outlet	Tail pipe included, noise level approx. 100 dB(A) at silencer
b) Exhaust gas ducts	
c) Intake air ducts	
d) Intake air filter	
e) Intake air silencer	
7) Sludge treatment system	
a) Sludge tank	300*l*
b) Sludge discharge pump	Electric motor, screw pump
c) Sludge separator tank	2,000*l*
d) Oily water transfer pump	Electric motor, screw pump
e) Oily water separator	1m^3/h
f) Waste oil transfer pump	Electric motor, screw pump
g) Waste oil tank	1,000*l*

(5) Electrical equipment	
a) 11k gear for line connection	12kV, 1200A, 50Hz, 25kA, Brush type, vacuum circuit breaker
b) Switch-gear for auxiliary control panel	12kV, 1200A, 50Hz, 25kA, vacuum circuit breaker generator
c) Local control panel	Generator control panel and auxiliary control panel
d) Remote control panel	Desk type panel (same shape as the existing panel)
e) Excitation system	Including AVR panel
f) DC power supply unit	Lead-acid battery, 110V
g) Auxiliary transformer	11kV/400V, 300kVA, including primary disconnecting switch (12kV, 200A)
h) Neutral ground panel	6.9kV, 10.2 ohm
i) Communication panel and control system for maintenance	Interphone, to be installed in local control panel and remote control panel

(2) Basic Design Drawings

The Power Station for the project is as shown in Fig. SLB-01 and contents of the basic design of the generating facilities are as shown in Figs. SLB-02 to -11.

SLB-01 General Arrangement Drawing

SLB-02 Generating Facilities Layout Drawing

SLB-03 Fuel Oil System Drawing

SLB-04 Lubricant Oil System Drawing

SLB-05 Cooling Water System Drawing

SLB-06 Steam System Drawing

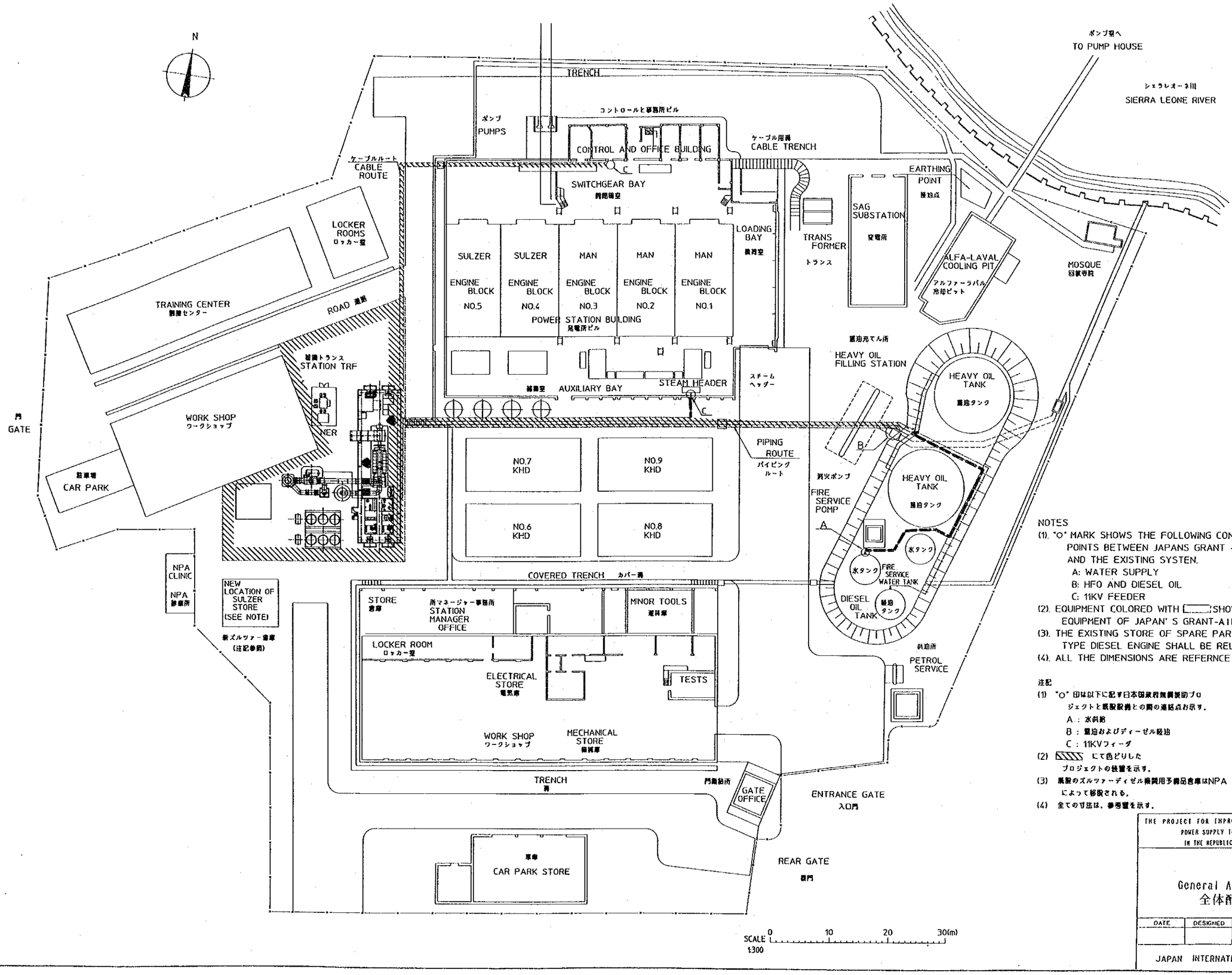
SLB-07 Compressed Air System Drawing

SLB-08 Sludge Treatment System Drawing

SLB-09 Single Line Connection Diagram

SLB-10 11 kV Switchgear Layout Drawing

SLB-11 Remote Control Layout Drawing



NOTES

(1). "O" MARK SHOWS THE FOLLOWING CONNECTING POINTS BETWEEN JAPANS GRANT -AID PROJET AND THE EXISTING SYSTEN.
- A: WATER SUPPLY
- B: HFO AND DIESEL OIL
- C: 11KV FEEDER

(2). EQUIPMENT COLORED WITH ▨ SHOWS EQUIPMENT OF JAPAN' S GRANT-AID PROJET.

(3). THE EXISTING STORE OF SPARE PARTS FOR SULZER TYPE DIESEL ENGINE SHALL BE RELOCATED BY NPA.

(4). ALL THE DIMENSIONS ARE REFERNCE ONLY.

注記

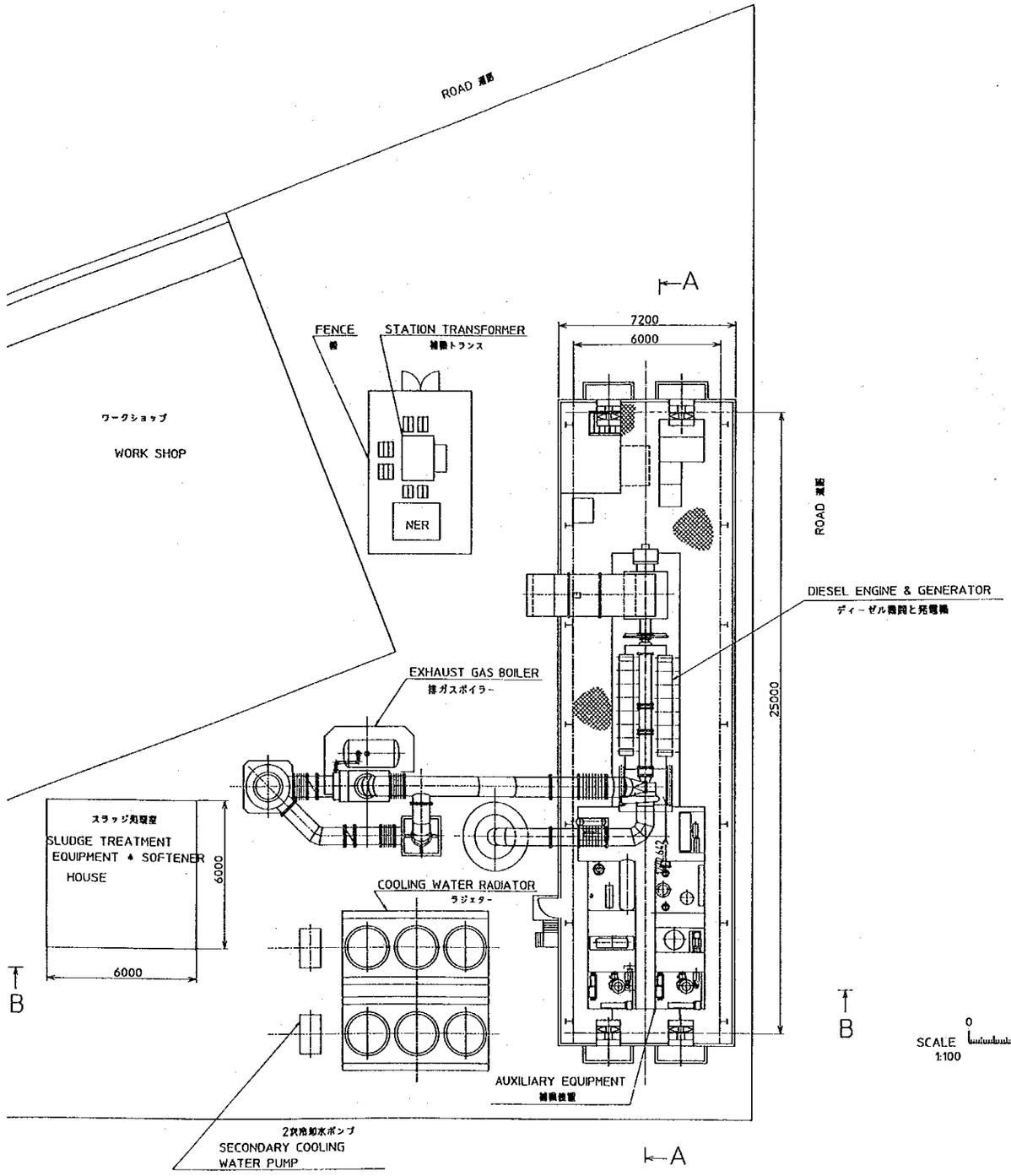
(1) "O" 印は以下に記す日本国政府無償援助プロジェクトと既設設備との間の連結点お示す。
- A：水供給
- B：重油およびディーゼル軽油
- C：11KVフィーダ

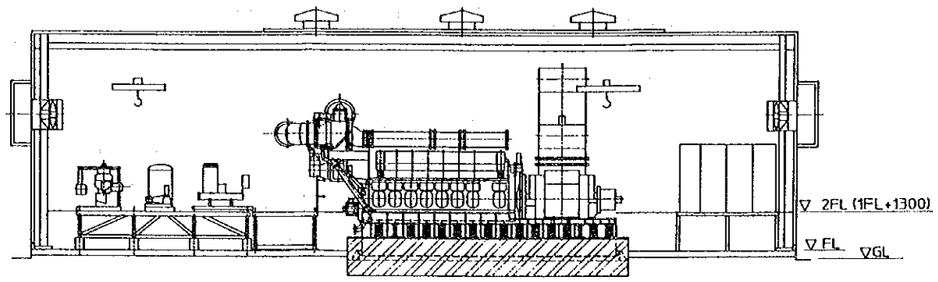
(2) ▨ にて色どりした プロジェクトの装置を示す。

(3) 既設のズルツァーディゼル機関用予備品倉庫はNPAによって移設される。

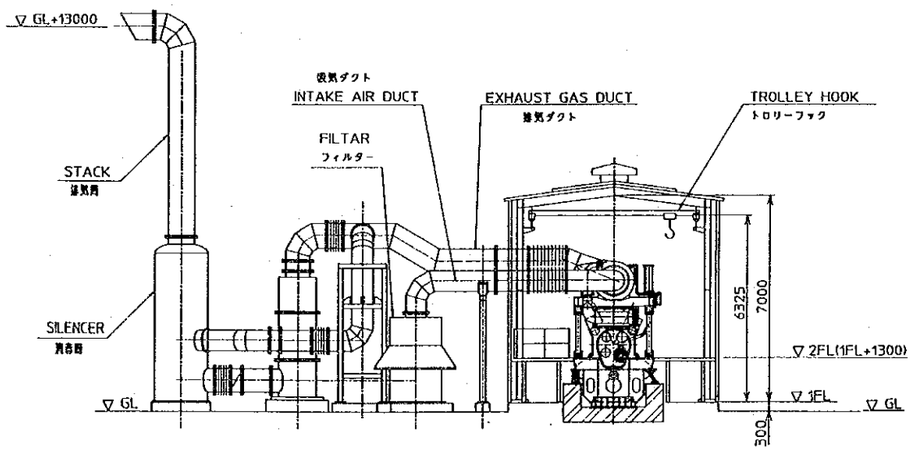
(4) 全ての寸法は、参考値を示す。

THE PROJECT FOR IMPROVEMENT OF ELECTRICITY POWER SUPPLY TO GREATER FREETOWN IN THE REPUBLIC OF SIERRA LEONE	SCALE
General Arrangement 全体配置図	DWG NO. SLB-01
DATE / DESIGNED / CHECKED / APPROVED	REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY	





SECTION A-A
断　面 A-A

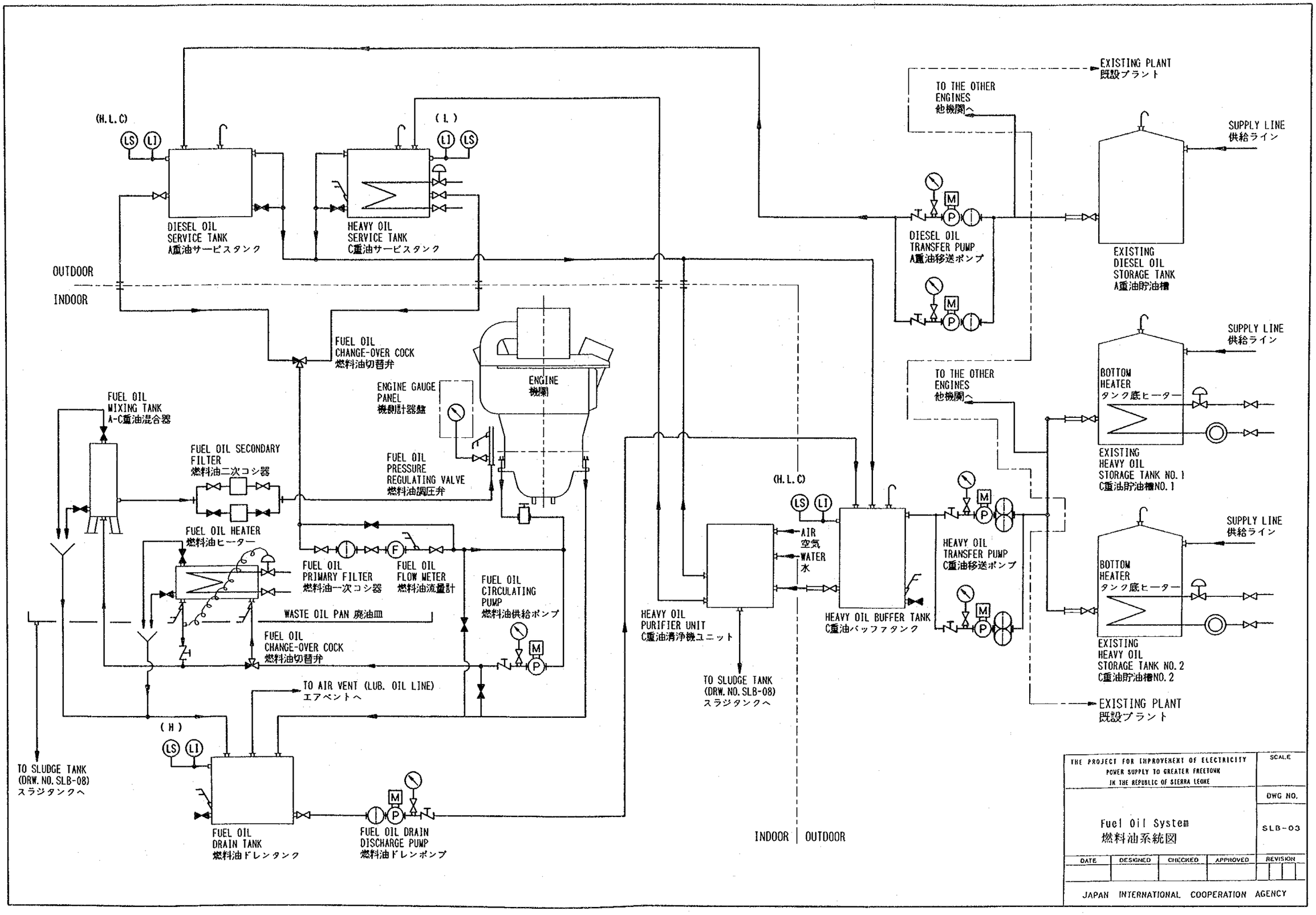


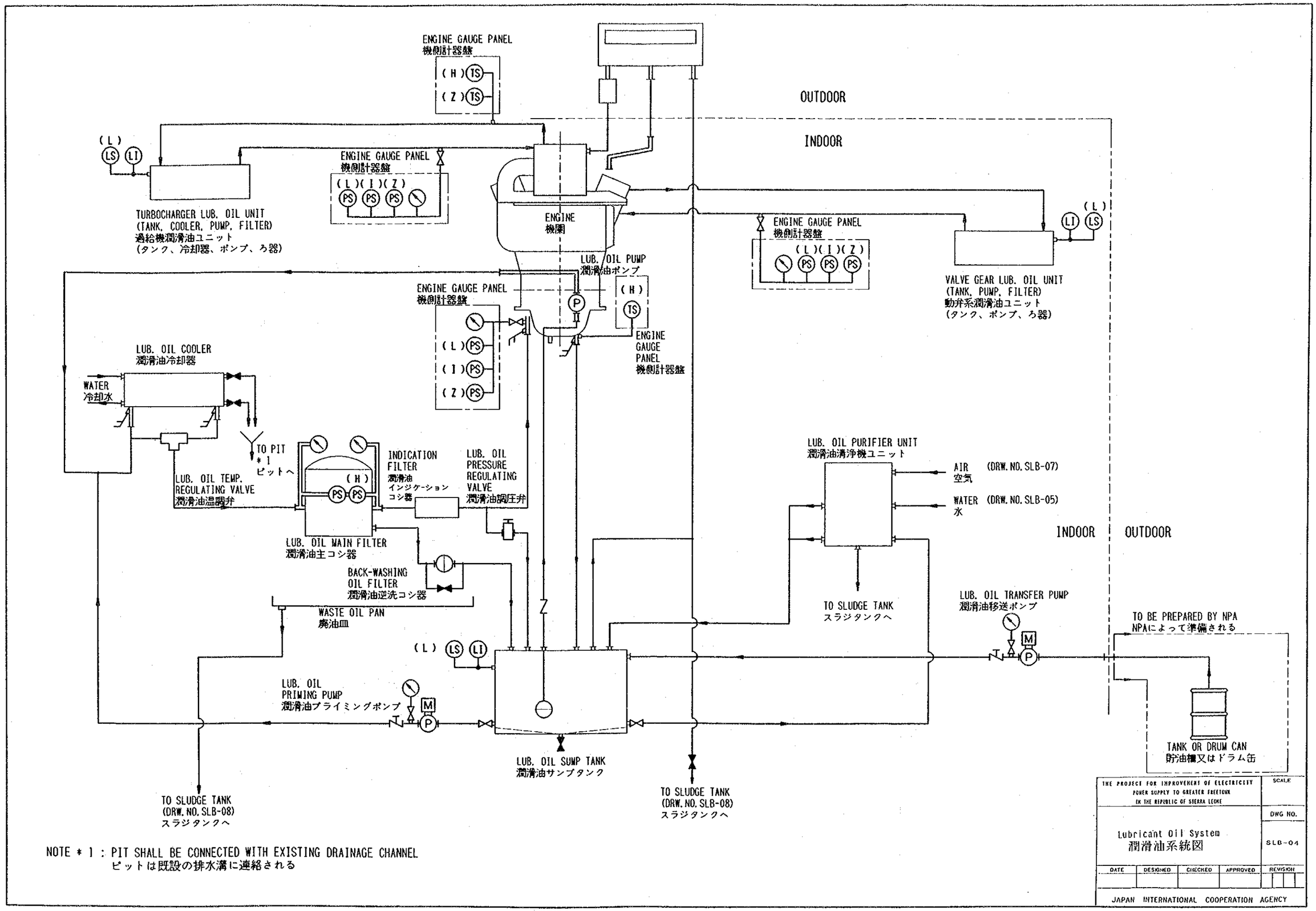
SECTION B-B
断　面 B-B

注記
(1)すべての寸法は参考値を示す
NOTE
(1)ALL DIMENSIONS ARE REFERENCE ONLY

SCALE 1:100
0 5 10 15

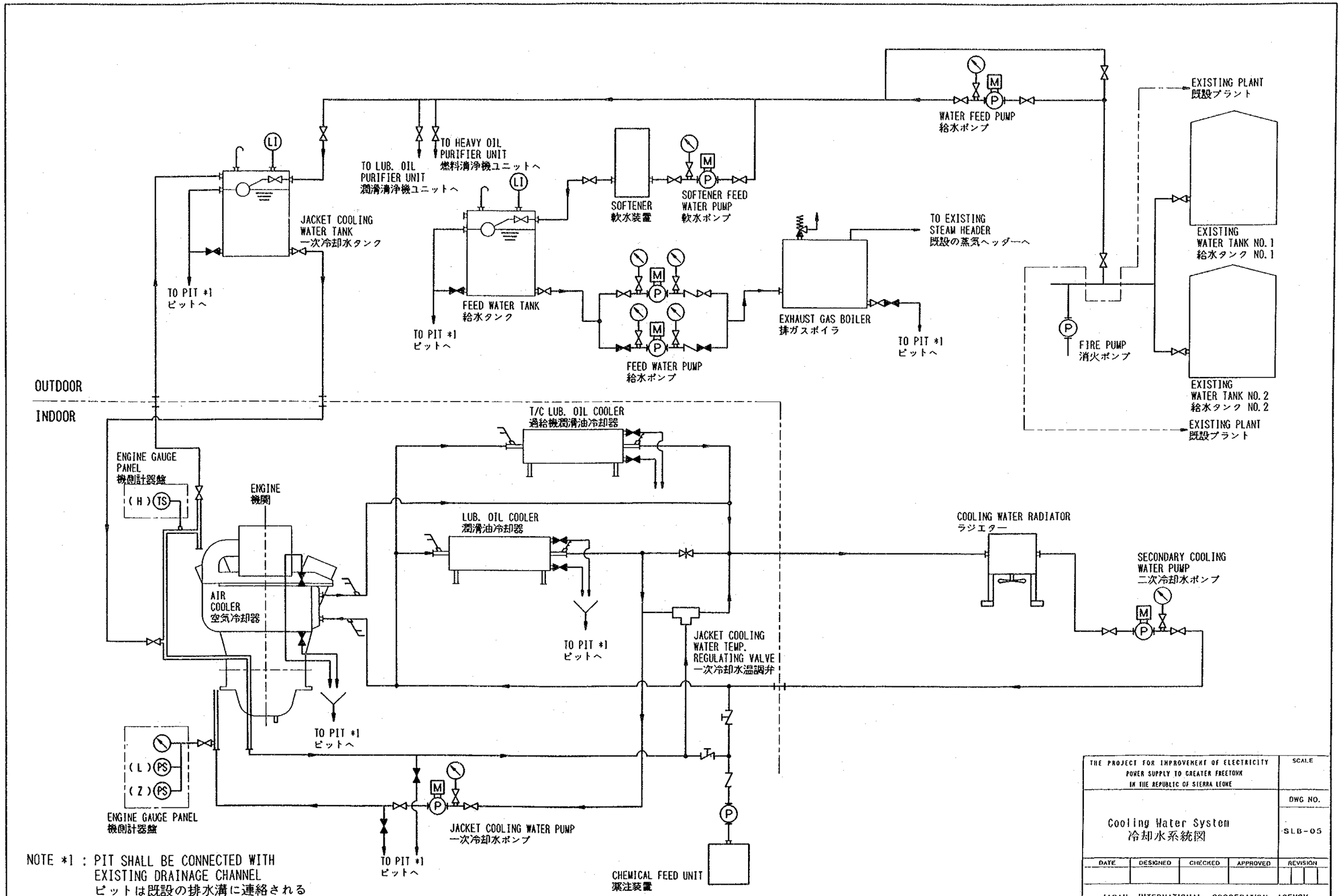
THE PROJECT FOR IMPROVEMENT OF ELECTRICITY POWER SUPPLY TO GREATER FREETOWN IN THE REPUBLIC OF SIERRA LEONE	SCALE
	DWG NO.
Generating Facilities Layout 発電設備配置図	SLB-02
DATE / DESIGNED / CHECKED / APPROVED / REVISION	
JAPAN INTERNATIONAL COOPERATION AGENCY	

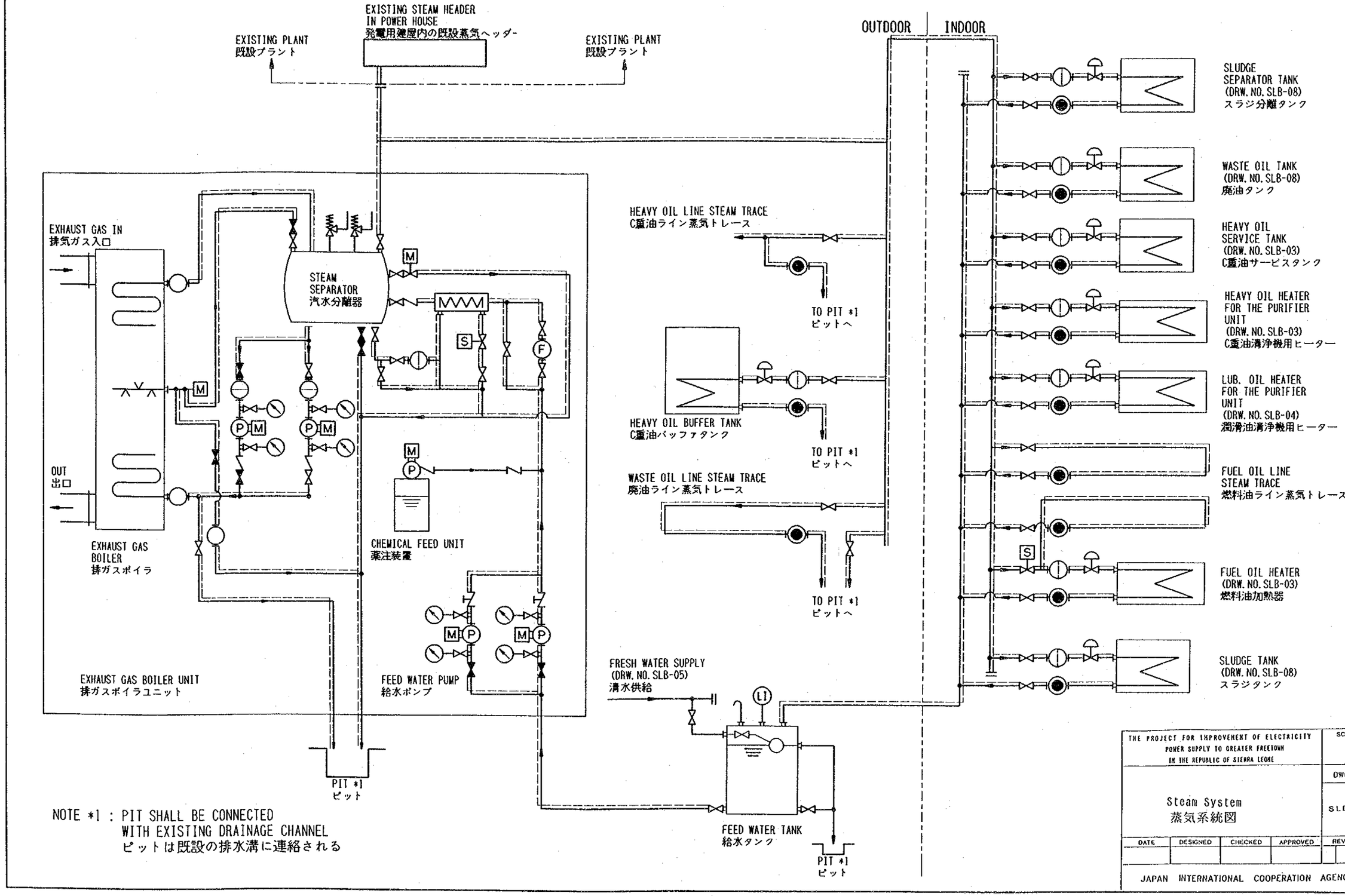

(H.L.C)
LS
LI
DIESEL OIL
SERVICE TANK
A重油サービスタンク
(L)
LI
LS
HEAVY OIL
SERVICE TANK
C重油サービスタンク
OUTDOOR
INDOOR
FUEL OIL
CHANGE-OVER COCK
燃料油切替弁
FUEL OIL
MIXING TANK
A-C重油混合器
ENGINE GAUGE
PANEL
機側計器盤
ENGINE
機関
FUEL OIL SECONDARY
FILTER
燃料油二次コシ器
FUEL OIL
PRESSURE
REGULATING VALVE
燃料油調圧弁
FUEL OIL HEATER
燃料油ヒーター
FUEL OIL
PRIMARY FILTER
燃料油一次コシ器
F
FUEL OIL
FLOW METER
燃料油流量計
FUEL OIL
CIRCULATING
PUMP
燃料油供給ポンプ
WASTE OIL PAN 廃油皿
FUEL OIL
CHANGE-OVER COCK
燃料油切替弁
TO AIR VENT (LUB. OIL LINE)
エアベントへ
(H)
LS
LI
TO SLUDGE TANK
(DRW. NO. SLB-08)
スラジタンクへ
FUEL OIL
DRAIN TANK
燃料油ドレンタンク
FUEL OIL DRAIN
DISCHARGE PUMP
燃料油ドレンポンプ
EXISTING PLANT
既設プラント
TO THE OTHER
ENGINES
他機関へ
SUPPLY LINE
供給ライン
DIESEL OIL
TRANSFER PUMP
A重油移送ポンプ
EXISTING
DIESEL OIL
STORAGE TANK
A重油貯油槽
TO THE OTHER
ENGINES
他機関へ
SUPPLY LINE
供給ライン
BOTTOM
HEATER
タンク底ヒーター
EXISTING
HEAVY OIL
STORAGE TANK NO. 1
C重油貯油槽NO. 1
(H.L.C)
LS
LI
AIR
空気
WATER
水
HEAVY OIL
PURIFIER UNIT
C重油清浄機ユニット
HEAVY OIL BUFFER TANK
C重油バッファタンク
HEAVY OIL
TRANSFER PUMP
C重油移送ポンプ
SUPPLY LINE
供給ライン
BOTTOM
HEATER
タンク底ヒーター
EXISTING
HEAVY OIL
STORAGE TANK NO. 2
C重油貯油槽NO. 2
TO SLUDGE TANK
(DRW. NO. SLB-08)
スラジタンクへ
EXISTING PLANT
既設プラント
INDOOR
OUTDOOR
THE PROJECT FOR IMPROVEMENT OF ELECTRICITY
POWER SUPPLY TO GREATER FREETOWN
IN THE REPUBLIC OF SIERRA LEONE
SCALE
DWG NO.
Fuel Oil System
燃料油系統図
SLB-03
DATE
DESIGNED
CHECKED
APPROVED
REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY



NOTE * 1 : PIT SHALL BE CONNECTED WITH EXISTING DRAINAGE CHANNEL
ピットは既設の排水溝に連絡される

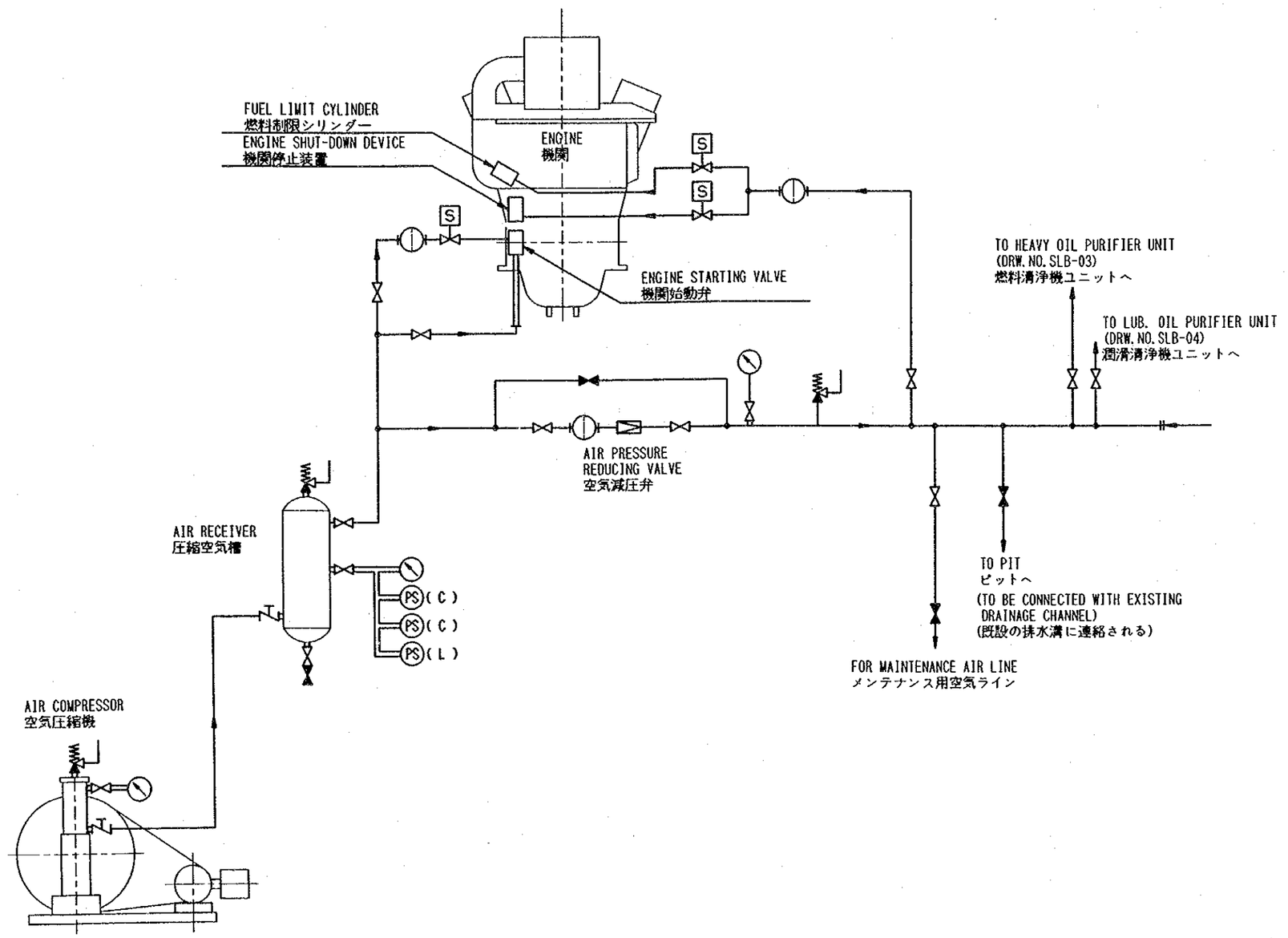
THE PROJECT FOR IMPROVEMENT OF ELECTRICITY POWER SUPPLY TO GREATER FREETOWN IN THE REPUBLIC OF SIERRA LEONE	SCALE
Lubricant Oil System 潤滑油系統図	DWG NO. SLB-04
DATE / DESIGNED / CHECKED / APPROVED	REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY	


OUTDOOR
INDOOR
JACKET COOLING WATER TANK
一次冷却水タンク
TO PIT *1
ピットへ
TO LUB. OIL PURIFIER UNIT
潤滑清浄機ユニットへ
TO HEAVY OIL PURIFIER UNIT
燃料清浄機ユニットへ
FEED WATER TANK
給水タンク
SOFTENER
軟水装置
SOFTENER FEED WATER PUMP
軟水ポンプ
FEED WATER PUMP
給水ポンプ
EXHAUST GAS BOILER
排ガスボイラ
TO EXISTING STEAM HEADER
既設の蒸気ヘッダーへ
WATER FEED PUMP
給水ポンプ
EXISTING PLANT
既設プラント
EXISTING WATER TANK NO. 1
給水タンク NO. 1
EXISTING WATER TANK NO. 2
給水タンク NO. 2
FIRE PUMP
消火ポンプ
T/C LUB. OIL COOLER
過給機潤滑油冷却器
ENGINE GAUGE PANEL
機側計器盤
(H) (TS)
ENGINE
機関
LUB. OIL COOLER
潤滑油冷却器
AIR COOLER
空気冷却器
COOLING WATER RADIATOR
ラジエター
SECONDARY COOLING WATER PUMP
二次冷却水ポンプ
JACKET COOLING WATER TEMP. REGULATING VALVE
一次冷却水温調弁
(L) (PS)
(Z) (PS)
ENGINE GAUGE PANEL
機側計器盤
JACKET COOLING WATER PUMP
一次冷却水ポンプ
CHEMICAL FEED UNIT
薬注装置
NOTE *1 : PIT SHALL BE CONNECTED WITH EXISTING DRAINAGE CHANNEL
ピットは既設の排水溝に連絡される
THE PROJECT FOR IMPROVEMENT OF ELECTRICITY POWER SUPPLY TO GREATER FREETOWN IN THE REPUBLIC OF SIERRA LEONE
SCALE
DWG NO.
Cooling Water System
冷却水系統図
SLB-05
DATE
DESIGNED
CHECKED
APPROVED
REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY

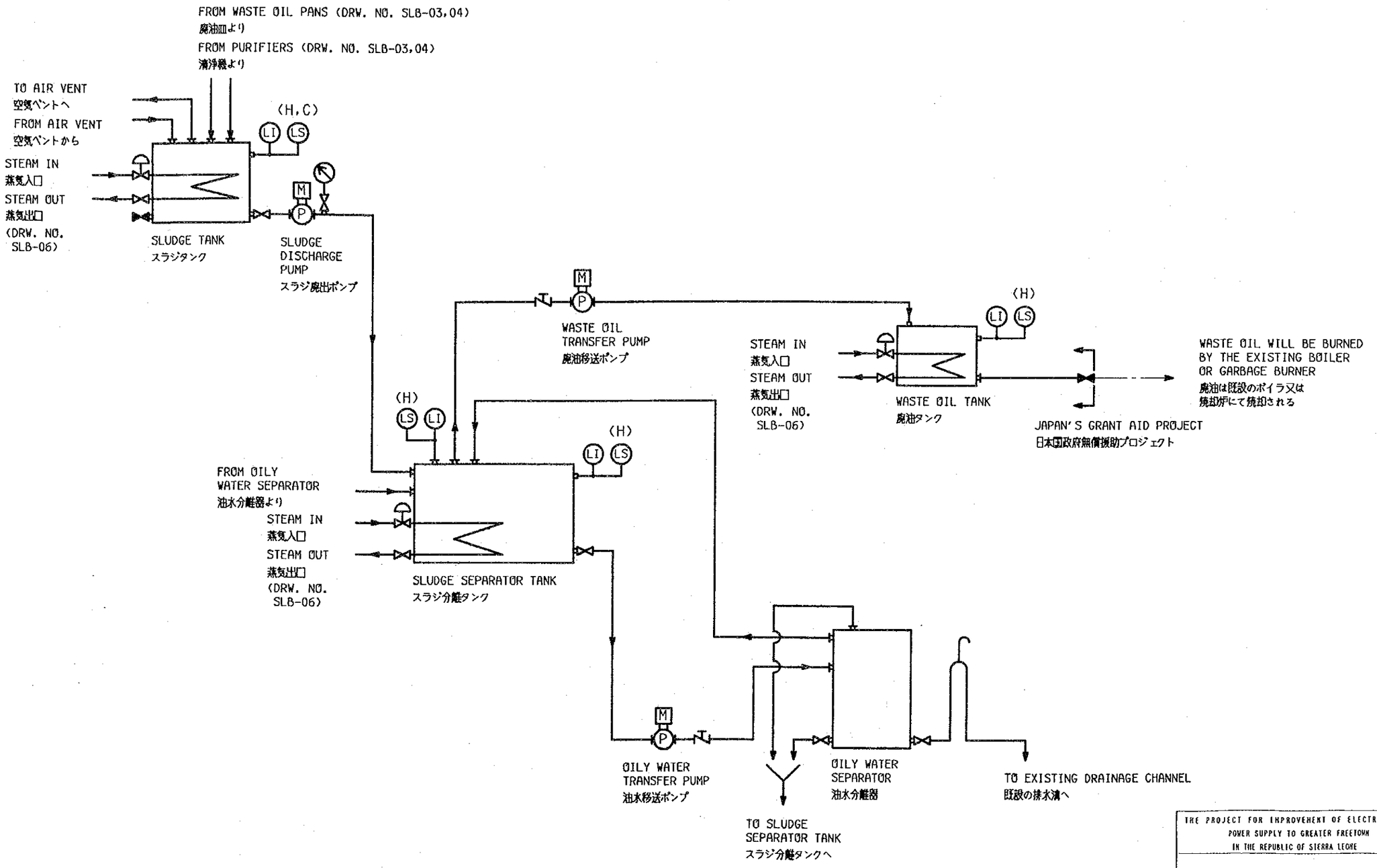


NOTE *1 : PIT SHALL BE CONNECTED
WITH EXISTING DRAINAGE CHANNEL
ピットは既設の排水溝に連絡される

THE PROJECT FOR IMPROVEMENT OF ELECTRICITY POWER SUPPLY TO GREATER FREETOWN IN THE REPUBLIC OF SIERRA LEONE	SCALE
Steam System 蒸気系統図	DWG NO. SLB-06
DATE / DESIGNED / CHECKED / APPROVED	REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY	



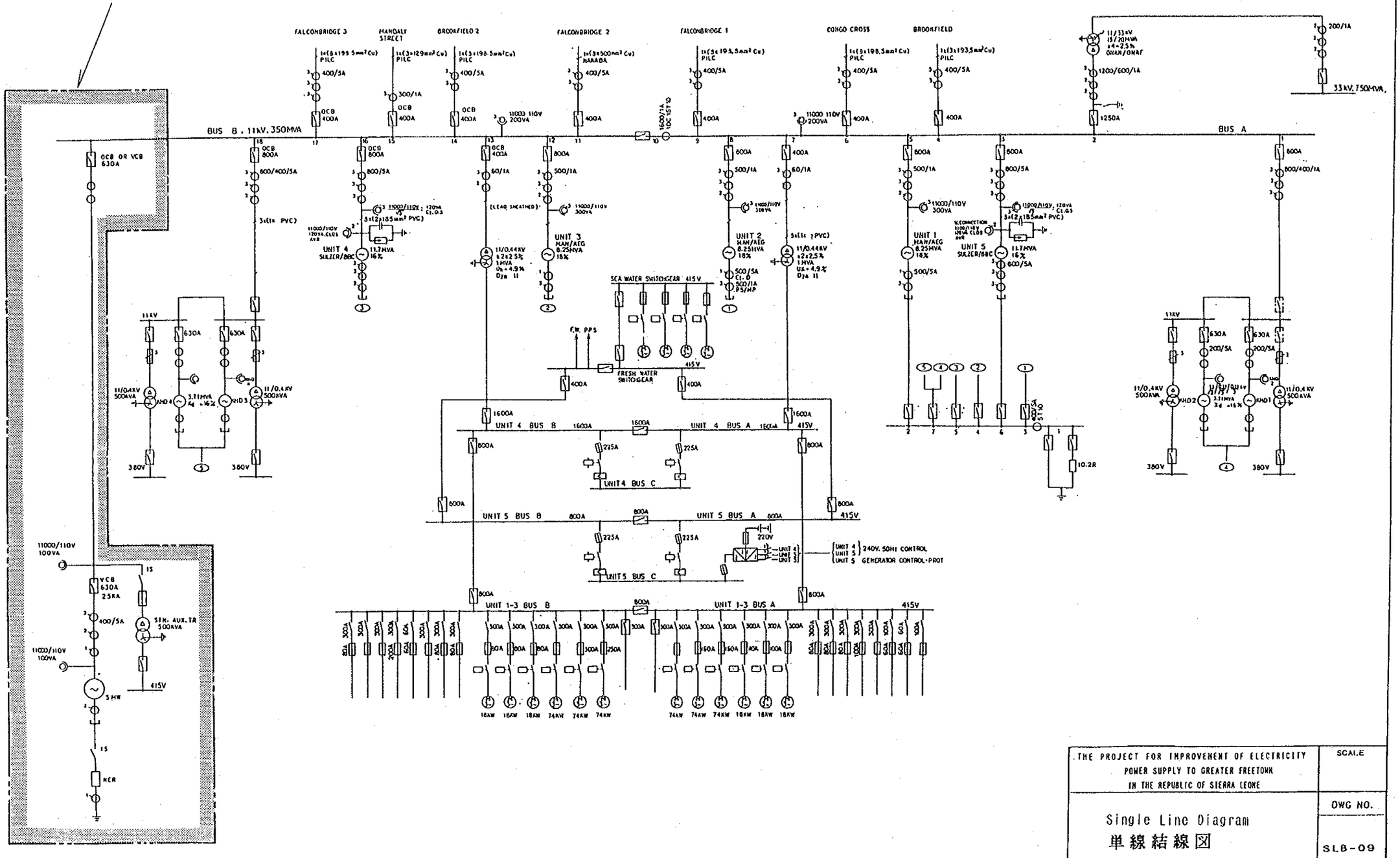
THE PROJECT FOR IMPROVEMENT OF ELECTRICITY POWER SUPPLY TO GREATER FREETOWN IN THE REPUBLIC OF SIERRA LEONE				SCALE
Compressed Air System 圧縮空気系統図				DWG NO. SLB-07
DATE	DESIGNED	CHECKED	APPROVED	REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY				



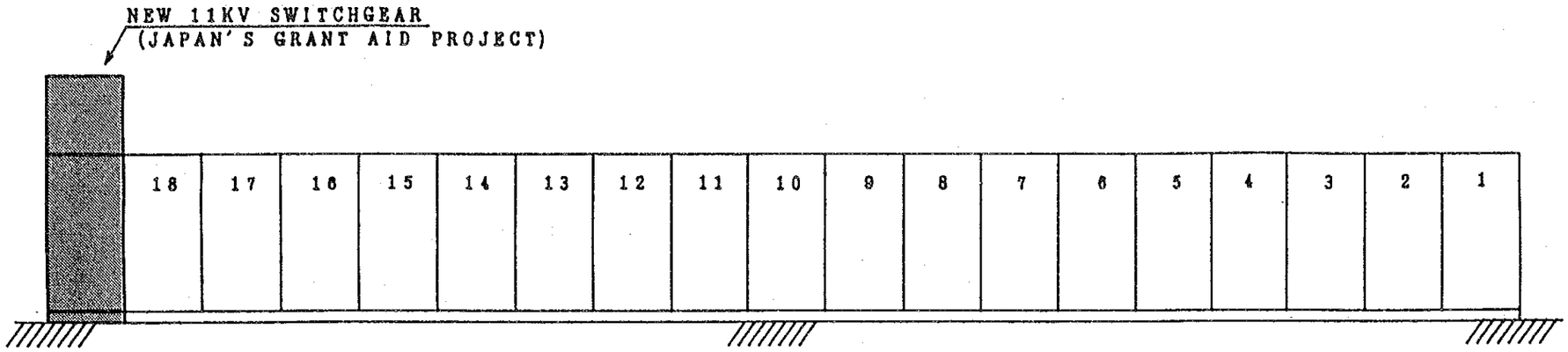
THE PROJECT FOR IMPROVEMENT OF ELECTRICITY POWER SUPPLY TO GREATER FREETOWN IN THE REPUBLIC OF SIERRA LEONE	SCALE
	DWG NO.
Sludge Treatment System スラッジ処理系統図	SLB-08
DATE / DESIGNED / CHECKED / APPROVED	REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY	

DP3,SLB-08J
PLOT = 0859P00 - 03/15/90

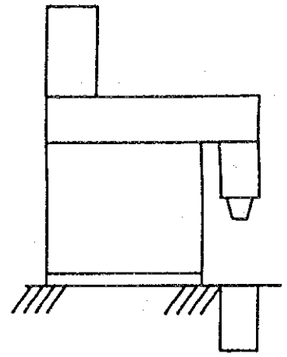
当該プロジェクト範囲



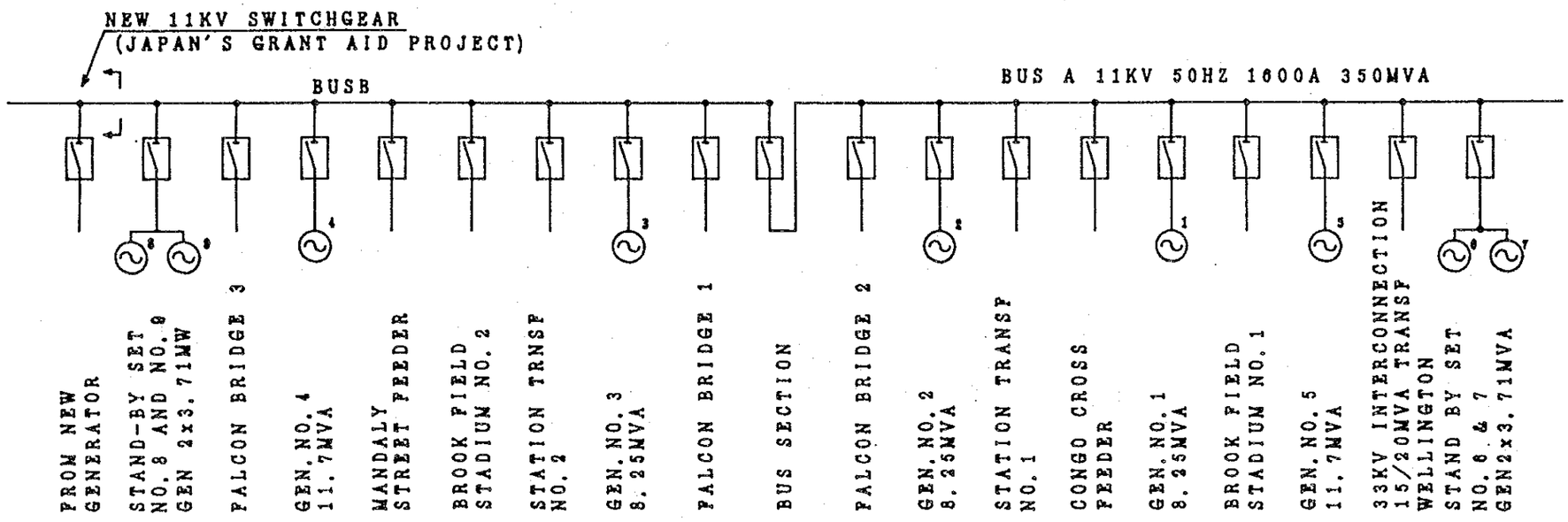
THE PROJECT FOR IMPROVEMENT OF ELECTRICITY POWER SUPPLY TO GREATER FREETOWN IN THE REPUBLIC OF SIERRA LEONE				SCALE
Single Line Diagram 単線結線図				DWG NO. SLB-09
DATE	DESIGNED	CHECKED	APPROVED	REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY				



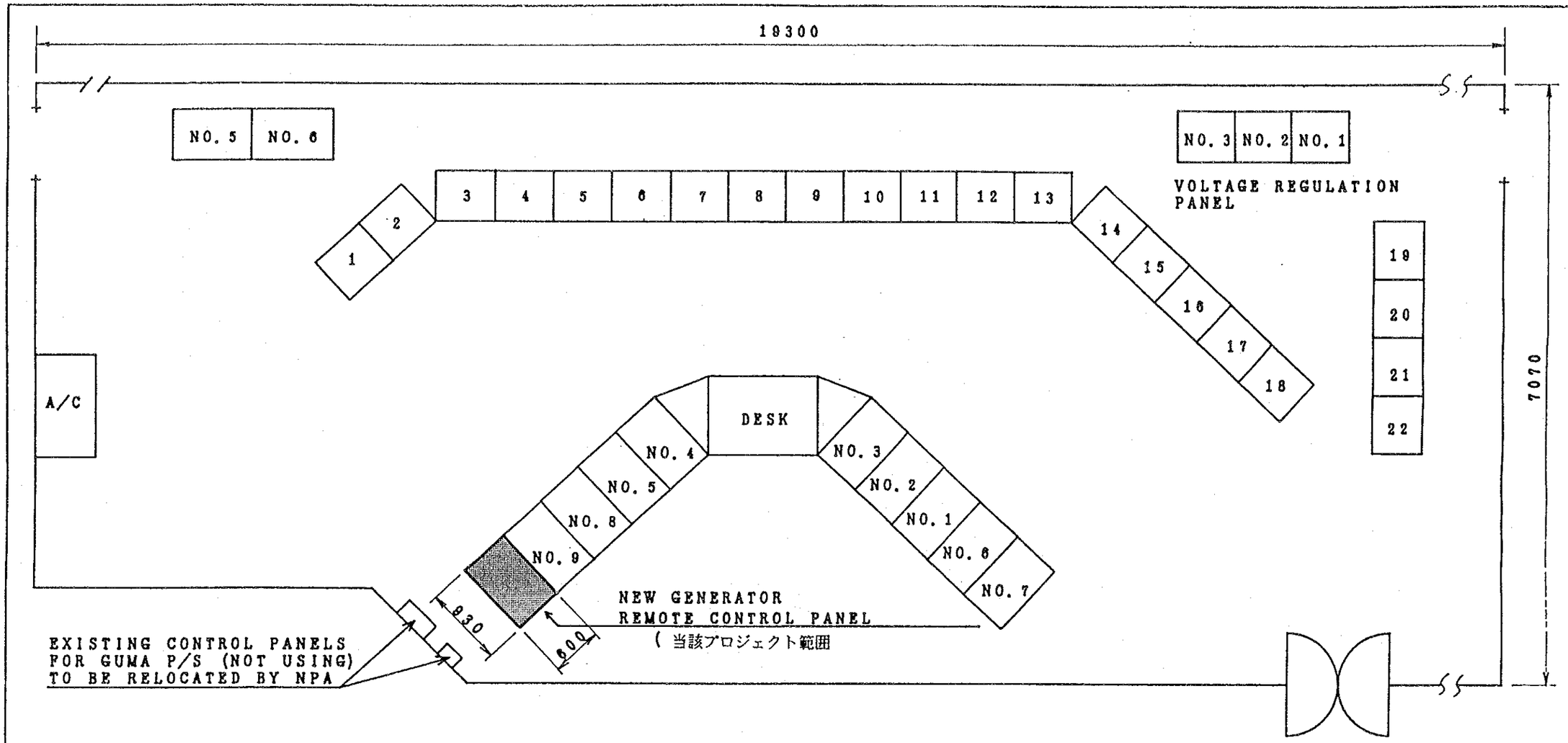
FRONT VIEW OF EXISTING 11KV SWITCHGEAR



SIDE VIEW



THE PROJECT FOR IMPROVEMENT OF ELECTRICITY POWER SUPPLY TO GREATER FREETOWN IN THE REPUBLIC OF SIERRA LEONE				SCALE
Layout of 11 kV Switchgear 11KVしゃ断器盤配置図				DWG NO. SLB-10
DATE	DESIGNED	CHECKED	APPROVED	REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY				



1	15/20MVA 33/11KV TRANSFORMER	9	STATION TRANSFORMER NO. 2	17	GENERATOR NO. 1
2	FALCON BRIDG NO. 3	10	GENERATOR NO. 3	18	BROOK FIELD STADIUM NO. 1
3	GENERATOR NO. 5 CONTROL	11	FALCON BRIDGE NO. 1 FEEDER	19	METERING AND RECORDING PANEL
4	GENERATOR NO. 5 PROTECTION	12	BUS SECTION	20	ALAMES PANEL
5	GENERATOR NO. 4 CONTROL	13	FALCON BRIDGE NO. 2 FEEDER	21	STANDARD TIME PANEL
6	GENERATOR NO. 4 PROTECTION	14	GENERATOR NO. 2	22	BUS ZONE PROTECTION PANEL
7	MANDALAY STREET	15	STATION TRANSFORMER NO. 1		
8	BROOK FIELD STADIUM NO. 2	16	CONGO CROSS FEEDER		

THE PROJECT FOR IMPROVEMENT OF ELECTRICITY POWER SUPPLY TO GREATER FREETOWN IN THE REPUBLIC OF SIERRA LEONE

SCALE

Layout of Remote Control Panel
遠方制御盤配置図

DWG NO.
SLB-11

DATE	DESIGNED	CHECKED	APPROVED	REVISION

JAPAN INTERNATIONAL COOPERATION AGENCY

5-3-3 Equipment and Materials Procurement Plan

(1) Contents of Plan

According to the aforementioned basic policy in 4-3-2, the equipment and material procurement plan will be formulated as follows:

1) To procure spare parts for 16,000 hours of operation
(for 1 major overhaul cycle)
2) To procure tools for maintenance and inspection
3) To procure training materials for OJT

(2) Major Items of Equipment and Materials

1) Spare parts
(a) Diesel engine parts
(b) Auxiliary equipment and its parts
(c) Generator parts
(d) Electric equipment parts

2) Tools for maintenance

Tools required for work such as periodical inspection and overhauls of the generating facilities, as well as for replacement of parts

3) Materials for OJT

Contents and quantity of OJT materials are as follows:

(a) Training materials : 20 copies
(b) O & M manual : 20 copies

5-3-4 OJT Plan

(1) Details of OJT Plan

According to the basic policy as stated in 4-3-2, OJT will be conducted as follows:

1) Period for conduct of OJT

Classroom training : About one week

Practice for maintenance and operation: about four months at the time of construction work

2) Instructor

One engineer will be sent by a Japanese contractor as a trainer.

3) Trainees

Engineers who will be directly engaged in operation and maintenance of the generator after the completion of the Project, as appointed by Sierra Leone, should participate in the training.

(a) One general coordinator

(b) Maintenance engineers

- One mechanical engineer
- One electrical engineer

(c) Maintenance technicians

- Three mechanical technicians
- Two electrical technicians

4) Detail of training

(a) Classroom training

① Basic technology for O & M

- O & M schedule control (conception for preventive maintenance, functional analysis of facilities, effective scheduling for O & M work)
- Control of spare parts and tools
- Documents control for O & M

② Technology related to maintaining of generating facility

(b) Practice of operation and maintenance work for generating facility

① Maintenance of cylinder head

② Dismantling and maintenance of fuel valve

③ Grinding finish of inlet and outlet valve

④ Dismantling and maintenance of piston

⑤ Overhaul and inspection of crank pin bearings

⑥ Maintenance of motor pump

⑦ Cleaning of air inlet filter, radiator filter and so on

⑧ Starting and stopping procedures

⑨ Emergency stop procedures

⑩ Monitoring procedures

5) Training materials

(a) After the conduct of OJT, training materials will be provided to trainees for practical use as O & M.

(b) O & M manual for generating facility will be provided to use as practice related to maintenance and inspection.

5-4 Implementation Plan

5-4-1 Construction Condition

(1) Situation of Local Construction

1) Engineers and workers capable of executing civil works such as foundations can be employed in Sierra Leone.

2) No engineers capable of executing installation, adjustments, etc., of such large generating facilities as for the project can be locally employed, dispatching such engineers from Japan is planned.

3) It is believed construction equipment and machinery for the Project are locally available except for special items such as large-sized cranes, trailers and welding machines.

(2) Instructions to be Followed in Execution

1) Queen Elizabeth II Port will be selected for unloading equipment and materials for the Project because it is the nation's largest unloading port. However, since no large cargo handling equipment is available at this port, heavy derricks need to be used.

2) For inland transportation for about 5 km from the port to the project site, roads can be used if care is taken in transport although they have many potholes in the pavement.

However, many low overhead utilities lines and telephone cables (about 4 ma above the ground) run over roads and these lines and cables must be temporarily relocated by NPA during transport.

3) The rainy season runs from June to September. No local work can be undertaken during this period, particularly in July and August, because the monthly rainfall may reach as high as about 900 mm. It is therefor necessary to conduct installation of equipment, concrete work, underground installation work, etc., other than in this period.

4) Installation of the generating facilities should be started promptly after completion of the foundation work. Installation work for machinery and electric equipment should also be conducted in parallel.

5) The following work is needed to connect the project generating facilities with the existing ones and involves the shutdown of the existing generating facilities. Therefore, this work must be executed by carefully studying specific methods including the sequence of execution and construction period.

   (a) Work for branching and connecting flows of heavy oil, diesel oil and cooling water in the existing tank yard
   (b) Work for installing the switchgear for line connection with the existing 11 kV distribution facilities in the power house
   (c) Work for installing cables in the existing cable pits in the power house
   (d) Work for connecting the steam pipe from the Project exhaust gas boiler to the steam header of the existing steam facilities

5-4-2 Implementation Method

This project will be executed under the framework of Japan's grant aid. The project will proceed to execution after it has been approved by both governments and Exchange of Notes (E/N) concluded between them. Subsequently, the Japanese consulting firm will be selected by the Sierra Leone government and detailed design work will be started. Upon completion of documentation for the detailed design, the Japanese contractor selected by holding a tender will construct facilities and procure equipment and materials. In executing the project, basic points, particularly those requiring particular attention, are as follows:

(1) Executing Agency

NPA, which is the power sector in Sierra Leone, is the agency in Sierra Leone responsible for execution of this project. At NPA, Power Generating Division of Kingstom Power Station, is responsible for this execution as shown in 2-2-1. The Sierra Leone government is required to appoint a full-time official in charge of this project in order to maintain close contact and conduct discussion with the Japanese consultant and contractor, and smoothly carry out all the work under the project.

The director of the Kingtom Power Station is considered best suited as this responsible official because the director should be most familiar with the condition of the proposed construction site. This official must fully explain to his staff at the Power Station and have them thoroughly understand contents of the project, and

remind them to ensure safety during execution of construction work, and instruct them to cooperate in smooth progress of the project.

(2) Consultant

To construct the facilities and procure equipment and materials under the grant aid for this project, the Japanese consultant firm will conclude a consultant contract with the Sierra Leone government and conduct the detailed design for the construction and procurement and carry out supervision and control of the construction work. The consultant firm will also prepare tender documentation and promote the tender on behalf of the Sierra Leone side.

(3) Contractor

Under Japan's grant aid, the Japanese contractor selected in a public tender will construct the facilities and procure necessary equipment and materials.

It is considered necessary for the contractor to continue to supply spare parts and render services at the time of failures even after completion of the project. Therefore, the contractor should give due consideration to communications and coordination between the Sierra Leone side and the Japanese manufacturers after completion of the project.

(4) Necessity for Dispatch of Engineers

The construction work for the generating facilities requires special, experienced engineers who are well versed in the configuration and functions of these facilities. The manufacturer of the generating facilities in Japan are required to send engineers well versed in installation,testing commissioning, etc., of the generating facilities to the site because no such technically qualified engineers are available in Sierra Leone.

(5) Instructions to be Followed in Execution

In view of the fact that construction work for the generating facilities is carried out in the compound of the Power Station in operation and that it is a project under grant aid, due consideration should be given to the following points:

1) The execution methods and construction machinery should be carefully selected to avoid damage to existing facilities in the Power Station.
2) Temporary facilities and equipment and materials stock yard required for construction work should be located in areas where they will neither interfere with existing traffic lines of the Power Station nor adversely affect NPA's future rehabilitation and improvement plans for the existing facilities.

3) For work requiring interruption of the Power Station's operation such as connection with the existing facilities, the contractor should confirm the date, required number of hours for stoppage of operation, etc. with NPA in advance and strictly adhere to these points.

4) To strictly meet the extremely short implementation period, several works should be executed simultaneously under an overlapped schedule.

5-4-3 Supervisory Control Plan

Under the role for Japan's grant aid and the main objectives of the basic design, the consultant firm will organize a consistent project team for detailed design and supervisory work and smoothly perform all the consultant services. In the supervisory control stage, the consultant firm will send to the site technically qualified field supervisory personnel for liaison and inspection of the execution of work. The field supervisory personnel will be dispatched according to the construction schedule as follows:

First half (about 3 months before the rainy season)	1 civil engineer (supervision of foundation work for major equipment)
Second half (about 5 months after the rainy season)	1 mechanical engineer (supervision of equipment installation work)
(about 2 months before construction)	1 electrical engineer (same as above)

In addition, the consultant firm will send an engineer responsible for a short period of time as required according to the progress of work to supervise execution and witness inspection.

(1) Basic Policy for Supervisory Control of Execution

The consultant firm is required to perform appropriate supervisory control over the entire work so that the construction work can be positively and safety executed within the required construction period. For this purpose, the consultant firm will render its service under the following basic policy:

1) Schedule control

(a) To perform control over the manufacture and delivery of equipment and materials, and progress of work, all based on actual performance by comparing respective plans and actual work progress

(b) To control the schedule for each item of work by month, week and day and give guidance to the contractor to rigidly keep the work progress under the

contract

2) Quality control

(a) To control quality of equipment and materials by checking them based on the detailed design documentation

(b) To witness accuracy inspection, construction method, and various performance tests, regarding installation work, piping work, wiring work, connection work, etc., that are undertaken in the field

3) Safety control

(a) To give guidance to the contractor so that workers down to those at the lowest level will be conscious about prevention of various accidents while the foreman class will be trained in how to prevent hazards

(b) To make efforts to prevent accidents by always checking condition of heavy equipment and machines such as cranes etc.

(c) When transport vehicles, construction equipment, etc. travel within the construction site, slow driving will strictly instructed and every caution will be taken to prevent traffic accidents which may cause injuries or damage existing facilities.

(2) General Relations When Supervision is Performed

The following chart shows general relations of the supervisory control system and related organizations when supervision is performed.

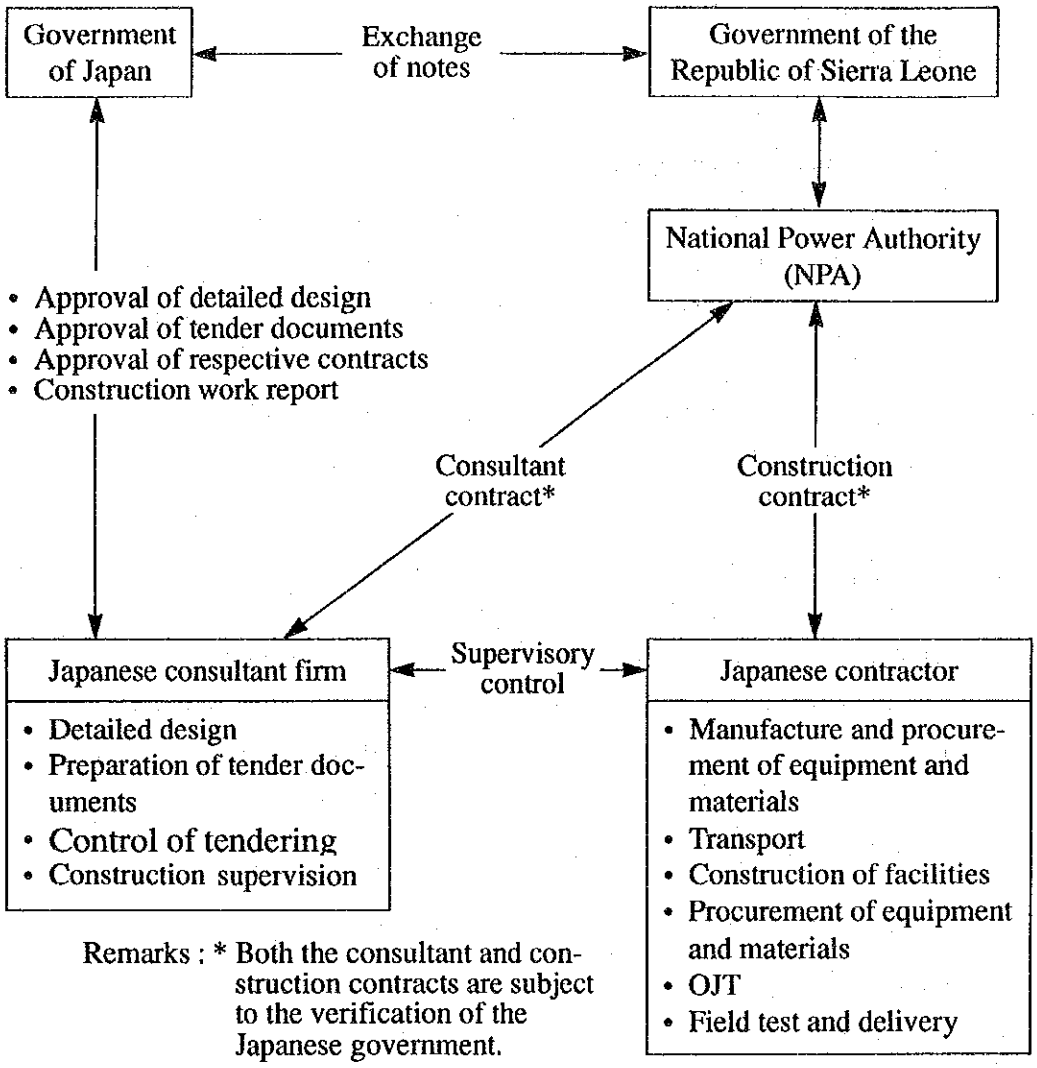


Figure 5-1 Chart Showing Relations in Execution of Project

(3) Staffing of the Japanese Contractor

For the contractor to complete construction of the facilities conforming to the detailed design documents within the construction period, the Engineers despatched by the Japanese contractor requires the ability to smoothly manage joint work with local execution contractors and give adequate technical guidance to such local contractors. Additionally, it is desirable that the such engineers have experience in similar projects in order to secure a higher quality of work.

According to the scale and contents of the Project, it is assumed that the contractor shall despatch the following class and number of staff in the field:

Site manager	:	1 person To supervise whole work and conduct OJT
Mechanical supervisor	:	1 person To supervise installation of mechanical equipment and manage progress of work

Aside from the above, engineers should be sent to the site for supervision of performance test, adjustment, civil engineering, equipment installation, pipeline, welding, panel installation and cable wiring as required for each item of work according to the progress of work.

5-4-4 Procurement Plan

(1) Source of Equipment and Materials

Equipment and materials for both construction and procurement for this project will be supplied from Japan or third countries with the exception of aggregate for concrete. This is because such equipment and materials are not locally available. Sierra Leone imports some of these items but such imports cannot be used because they would have difficulty in meeting delivery or quality requirements.

As a result of a comparative study in standards, specifications, quality, production, stability of supply and delivery, equipment and materials for the project will be obtained from following sources:

Table 5-5 Sources of Equipment and Materials

Source	Equipment and Materials	Remarks
Sierra Leone	Sand and gravel Fuel oil	
Third countries	11 kV switchgear for line connection	Required to conform to existing BRUSH unit (UK) in configuration and mechanism
Japan	Diesel engine Generator Enclosure Transformer 11 kV switchgear on generator side Mechanical auxiliary equipment Electrical auxiliary equipment Piping facilities Cabling facilities Steel products Cement Paints Special tools for maintenance Spare parts	

The radiator may be procured in a third country for quality and delivery considerations because Japanese manufacturers do not have much experience in production of large capacity radiators.

(2) Transport Method

Considering conditions at the unloading port in Sierra Leone and the project site, construction equipment and materials will be in principle shipped from Japan as container cargo. However, separate transport methods will be studied for large equipment such as engines that cannot be loaded into container.

As described earlier (see 3-3-1), freight vessels fitted with cranes will be used for shipment from Japan because no cargo handling equipment capable of handling heavy loads is available at Queen Elizabeth II Port. Trailers, etc., will be used for inland transport over a distance of about 5 km from the port to the Kingtom Power Station.

5-4-5 Implementation Schedule

In the event this project is executed under the Japan's grant aid, the facilities will be constructed and equipment and materials procured in following three stages after conclusion of the Exchange of Notes (E/N) between both governments: ① Preparation of

detailed design document, ② tender and contract of the construction work, and ③ execution of construction work.

(1) Detailed Design Work

After conclusion of E/N, the Japanese consultant firm will immediately conclude the consultant contract with the Sierra Leone government and start detailed design work.

Based on confirmation results of basic and detailed design study, the consultant firm will prepare the tender document (including tender specifications and detailed design drawings). The consultant firm will hold thorough discussion with responsible organizations in Sierra Leone in both the initial and final stages of detailed design, and proceed to the tendering upon approval of the detailed design documents by the Sierra Leone side.

This work is expected to take a total of 3 months.

(2) Awarding of Contract

Acting for the Government of Sierra Leone, the consultant firm will make tender announcement, accept applications for participation in tender, evaluate tenders for prequalifications, hold briefings on the tender, and distribute tender documentation. After allowing a certain period of time for preparation of the tender, the consultant firm will accept tenders and promptly examine them, and promote conclusion of a construction contract between the Government of Sierra Leone and a Japanese contractor.

The tender is opened in the presence of all parties concerned and the participant who tendered the lowest price will become the successful bidder if contents of the tender are found appropriate and will conclude the construction contract with the Sierra Leone government.

The period from the tender call to conclusion of the contract is expected to be 2 months.

(3) Construction Work and Procurement of Equipment and Materials

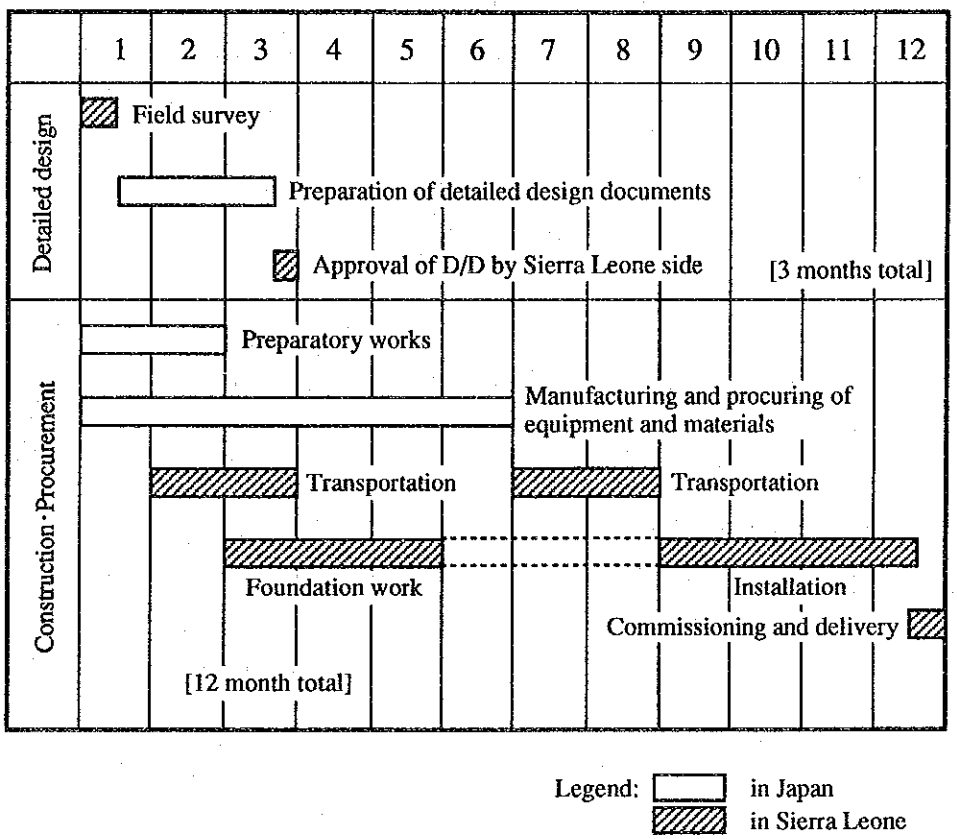
After signing the construction contract, the contractor will start to work upon verification by the Japanese government. Judging from the scale of the project and contents of the facilities, if preparatory work for which the Sierra Leone side is responsible smoothly proceeds, the detailed design work is expected to be

completed in 3 months, procurement of equipment and materials in 6 months and site construction from the commencement of foundation works to the completion of the project in 10 months.

However, no field work will be undertaken during the June – September rainy season, which has an average monthly rainfall of as high as about 900 mm, especially in July and August, because it is considered difficult to ensure safety in the field work under such condition. To strictly meet delivery for the whole work, foundation work for major items of equipment should be completed before the rainy season sets in.

The consultant firm shall hold discussions with the contractor before commencement of work, give guidance and supervisory instructions to the contractor on the delivery of equipment and materials to the site, execution methods and construction schedule, perform process and quality control, and complete all the work within the period set forth in E/N.

Table 5-2 Implementation Schedule



5-4-6 Scope of Work

(1) Scope of Work

1) Scope of work to be borne by the Government of Japan

(a) To undertake construction work for diesel generating facilities (5 MW)

(b) To procure equipment and materials including spare parts

(c) To provide OJT

2) Scope of work to be borne by the Government of Sierra Leone

(a) To relocate or remove existing structures in the construction site and secure land for construction

(b) To construct a noise-proof wall.

(c) To bear the cost of opening an account at a foreign exchange bank authorized by the Japanese government and all other costs and expenses,

other than those met by the grant, necessary for execution of the project

(d) To promptly unload equipment and materials necessary for execution of the project, exempt taxes on their import and re-export, internal taxes, customs duties and other levies on Japanese corporations and Japanese involved in execution of the project, and extend other facilities to Japanese or other foreign nationals dispatched for execution of the project.

(e) To secure necessary approval for execution of the project from relevant Sierra Leone government agencies

(f) To assign OJT trainees

(g) To secure the stoppage of power supply of the existing generating facilities as well as the suspension of fuel oil supply to the facilities as required during the construction period

(h) To give permission to enter the Kingtom Power Station and provide necessary information materials

(i) To provide the land for temporary site office, warehouse and stock yard during implementation period, as well as disposal places for waste oil and waste water that will be discharged during implementation period

(j) To witness and confirm by authority concerned when the test run and commissioning for the project are carried out, and supply power and water required for execution of construction work

(k) To provide adequate maintenance control to the generating facilities after completion of the project and secure the necessary budget for this operation

(l) To arrange traffic and remove obstacles during inland transport of equipment and facilities from the port to the Project Site

(m) To provide preventive measures for rainfall leaks from the ceiling of the existing control room

(2) Approximate Project Cost to be Borne by Sierra Leone Government

Construction cost to be borne by the Sierra Leone government is as follows:

• Relocation and removal of existing structures in construction site	:	10,000,000 leones
• Noise-proof wall construction	:	13,000,000 leones
• OJT expenses		4,000,000 leones
Total	:	27,000,000 leones

Additionally, the following expenses will be incurred:

• Commission for banking arrangements		0.1% of E/N value
• Advising commission of Authorization to Pay (A/P) :	:	About ¥6,000 when A/P is issued

CHAPTER 6 PROJECT EVALUATION AND CONCLUSION

CHAPTER 6 PROJECT EVALUATION AND CONCLUSION

6-1 Effects;

The direct effect of project implementation will be improved power generation capacity at Kingtom Power Station which supplies power to the western area centered on greater Freetown area and increased revenues from electricity.

As long as the improvement power supply can be given a firm foundation, its indirect effect is expected to be stable operation, establishment of educational and social welfare facilities as well as stimulation of social and economic activities. Table 6-1 explains those effects.

Table 6-1 Current Condition of the Power Supply and Effects from Execution of the Project;

Current condition/problems	Project measures	Effect and improvements
1. The current available capacity of the generating facilities owned by the power cooperation (National Power Authority) in the western area of Sierra Leone, has plunged due to aging and lack of maintenance. The total available output in March 1993 was 11.0MW against a peak demand of 33.9MW, i.e. a shortage of of 22.9MW. 2. For this reason, this area has to face constant power outages which are a serious problem to civic life, economic activities and operation of such facilities as hospitals and schools. 3. Appropriate operation and maintenance cannot be provided due to the lack of operation and maintenance technologies required for running power generating facilities.	1. A diesel generating facility (a 5MW unit) will be installed in the existing Kingtom Power Station to provide welfare facilities including hospitals and schools in the western area with a stable supply of power. 2. Technology transfer concerning the operation and maintenance of the these generating facilities will be carried out during the construction period of the project.	1. Power supply (5MW) to welfare facilities including hospitals and schools in the western area centered on greater Freetown area can be ensured and this will improve education, medical activities and living standards. 2. Street lighting will no longer have to be turned off due to power shortages, so it will be easier to maintain law and order. 3. A stable power supply will stimulate economic activities. 4. The project contributes to fundamental infrastructure which is one of targets of the national development program of Sierra Leone. 5. Technology transfer concerning the operation and maintenance of the subject generating facilities will improve the technical skill of the staff and thereby assure the implementation and efficiency of the appropriate maintenance.

6-2 Conclusion;

As described earlier (see 3-4), the greater Freetown area suffers from a difficult power supply situation because of obsolete generating facilities, lack of proper operation and maintenance technology and acute shortage of spare parts due to scarce funds. These various problems have reduced the output of the generating facilities or stopped their operation. In 1992, the difference between the peak power demand (about 33 MW) and total available capacity (14.5 MW) widened to as great as about 27.3 MW. The resulting daily power cut has seriously affected the lives of the people, operation of social welfare facilities and industrial and economical activities in the area. However, the difference between demand and supply can not be improved in a short period of time in view of Sierra Leone's financial condition. It is desired that the situation be gradually improved by implementing medium and long range plans.

This project is intended to serve as an emergency power supply improvement measure based on the power sector rehabilitation project planned by the World Bank . Thus, the generating facilities to be constructed under the project are expected to stabilize activities of social welfare facilities and improve civic life in the western area centered on greater Freetown area. Furthermore, the scale of the project is considered the most ideal as a result of study on the planned installed capacity from technical, financial, operation and maintenance aspects.

The project conforms to Sierra Leone's national development plan as an emergency measure for the establishment of the social foundation and improvement of relief of poverty and social welfare which are the major measures in the 3-year public investment programme project planned to be started in 1992/1993 in Sierra Leone with the cooperation of the World Bank.

Kingtom Power Station, where the generating facilities for the project will be constructed, is the sole supplier of power to the western area centered on greater Freetown area. Considering this fact, the implementation of the project will have a great beneficial effect on stable civic life in Sierra Leone, particularly those of residents in the community, as well as economic and industrial activities.

Based on the above, it is considered that the implementation of the project under Japan's Grant Aid is highly significant and proper.

6-3 Recommendations;

6-3-1 Recommendations on Implementation of the Project;

The generating facilities for the project will become an integral part of Sierra Leone's stable power supply system. To secure and maintain this function over a long period, the Sierra Leone side should take following measures:

(1) Engineers in Sierra Leone should review the operation plan for the whole of Kingtom Power Station including the generating facilities for the project and its other generating facilities. Based on this review, they should develop a specific operation and maintenance control plan for the project generating facilities and establish highly reliable power supply system.

(2) To effectively implement the project and attain its objectives and goals, the Sierra Leone side should appoint full-time engineers who will actually carry out control operation and maintenance of the generating facilities, and have them participate in OJT from classroom training until completion of the construction work.

(3) The Sierra Leone engineers assigned to OJT should acquire O & M technology from Japanese engineers and strive to improve their technical level by continuing their study even after completion of the construction work.

(4) Engineers assigned to OJT should transfer acquired technology to other Sierra Leone engineers who could not participate in OJT, thereby striving to spread this technology and raise technical level in Sierra Leone.

6-3-2 Recommendations on Future Power Supply Operation;

For the future power supply operation, it is considered necessary that Sierra Leone take following measures:

(1) To secure reliability in power supply (to secure reserve generating capacity)

In power supply service, efficient and stable operation of generating facilities is an essential requirement. To cope with the uncertainty element of a drop in supply capacity due to equipment breakdown, accidents, etc., efforts should be made to secure adequate reserve capacity and increase reliable facilities.

When the 2 on-going projects (Power Sector Rehabilitation Plan and Bumbuna Hydroelectric Power Station Construction Plan) are completed (scheduled for 1997), the total generated energy in the greater Freetown area (52.5 MW) is expected to surpass the peak demand (38.5 MW). However, firm capacity (total

generated energy minus output of the largest generating facilities) will be short of peak power demand (about 28.5MW). As a result, stoppages owing to a breakdown or maintenance at a single power facility can still cause frequent outage.

To cope with such situation, provision of adequate reserve generating capacity is considered necessary.

(2) Improvement of Technical Capabilities

Sierra Leone should develop both short- and long- range plans to improve technical capabilities for planning, operation and maintenance control of power supply, and conduct follow-up efforts on these plans. Particularly, it is considered an urgent task to train engineers for operation and maintenance.

For this purpose, Japan's technical cooperation in the following specific areas is considered most effective. It is thus believe desirable that the Sierra Leone government make a request for this cooperation separately from the request for the project.

1) To provide training in generating facilities in Japan
2) To send experts in O & M of the generating facilities for the project after completion of this project
   (Electric and mechanical engineers: 1 each)

Appendices

1. Basic Design Study Team
2. Field Survey schedule
3. List of Interviewees
4. Minutes of Discussions
5. Detailed Minutes of Meeting (Supplementary Study)
6. Terms of Evaluation for the Indoor Electric Generation Facilities
7. Country Data
8. Estimated Generation Supply of Freetown Area
9. Estimated Operating Revenue and Expenditure of the Power Generating Plant Concerned

Appendix 1 Basic Design Study Team

Original Basic Design Study Team

Fiscal 1989

Assignment	Name	Position
Toshimichi Aoki	Team Leader	First Basic Design Division, Grant Aid Planning and Survey Department, JICA
Mitsuhisa Nishikawa	Power plant planner	Yachiyo Engineering Co,.Ltd.
Kenji Miwa	Generator Facility and Auxiliary Planner	Yachiyo Engineering Co,.Ltd.
Masatsutsugu Komiya	Diesel Engine Facility planner	Yachiyo Engineering Co,.Ltd.

Supplementary Basic Design Study Team

Fiscal 1992

Assignment	Name	Position
Yasuhiro Morimoto	Team Leader	Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs
Mitsuhisa Nishikawa	Power plant planner	Yachiyo Engineering Co,.Ltd.

Appendix 2 Field Survey Schedule

Original Field Survey Schedule

Fiscal 1989

1	Nov. 26	Sun	Fine	In airplane	Lv. Narita SR-163 21:00	Departure of Basic Design Study Team from Tokyo.
2	Nov. 27	Mon	Cloudy	Zurich	Ar. Zurich 5:30	Internal meeting of Study Team
3	Nov. 28	Tue	Fine	Monrovia	Lv. Zurich SR-248 12:30 Ar. Monrovia 20:20	
4	Nov. 29	Wed	Fine	Monrovia		Internal meeting of the Study Team. Study Team paid a courtesy call to the Embassy of Japan in Liberia and had a meeting.
5	Nov. 30	Thu	Fine	Freetown	Lv. Monrovia KL-580 21:45 Ar. Freetown 22:50	Courtesy call to the Embassy of Japan in Freetown.
6	Dec. 1	Fri	Fine	Freetown		Study Team paid a courtesy call to the Ministry of Foreign Affairs, the Ministry of Energy and Power, and the National Power Authority (NPA) and had meetings.
7	Dec. 2	Sat	Fine	Freetown		Inspection of Kingtom Power Station (K.T/P.S), Falcon Bridge Power Station (F.B/P.S) and Black Hall Road Power Station (B.H/P.S) Meeting of NPA
8	Dec. 3	Sun	Cloudy	Freetown		Internal meeting of the Study Team. Preparation of Minutes of Discussions (M/D). A Team member Komiya's arrival in Freetown
9	Dec. 4	Mon	Fine	Freetown		Meeting of NPA Explanation of Inception Report, Questionnaire and Japan's Grant Aid Program
10	Dec. 5	Tue	Light rain	Freetown		Signing of M/D.

11	Dec. 6	Wed	Fine	Freetown		Curtsey call to EEC, Collection of data and information and study of K.T/P.S. A visit to NPA, collection of data and information. The Team leader Aoki left Freetown for Japan
12	Dec. 7	Thu	Fine	Freetown		Study of K.T./P.S. A call to NPA
13	Dec. 8	Fri	Light rain	Freetown		Study of K.T/P.S Study of data and information
14	Dec. 9	Sat	Cloudy	Freetown		Study of K.T/P.S. Study of data and information
15	Dec. 10	Sun .	Fine	Freetown		Preparation of Field Report Internal meeting of the Study Team
16	Dec. 11	Mon	Fine	Freetown		Study of K.T.P.S Collection of data and information
17	Dec. 12	Tue	Fine	Freetown		Study of K.T.P.S. Collection of data and information
18	Dec. 13	Wed	Fine	Freetown		Study of K.T.P/P.S. A call to EEC office and preparation of Field Report
19	Dec. 14	Thu	Fine	Freetown		Study of K.T/P.S. Collection of data and information
20	Dec. 15	Fri	Fine	Freetown		Study of ports and transportation routes, and of B.H/P.S. and of data and information
21	Dec. 16	Sat	Fine	Freetown		Study of data and info. (Collection of Questionnaire) Preparation of Field Report
22	Dec. 17	Sun .	Fine	Freetown		Preparation of Field Report
23	Dec. 18	Mon	Fine	Freetown		Study of K.T.P.S and explanation of Field Report
24	Dec. 19	Thu	Fine	Freetown		Call to N.P.A and explanation of Field Report
25	Dec. 20	Wed	Fine	Freetown		Call to the Ministry of Energy and Power and explanation of Field Report. Call to N.P.A. and approval of Field Report

26	Dec. 21	Thu	Fine	Monrovia	Lv. Freetown KL-579 19:25 Ar. Monrovia 20:40	The Study Team called to the Ministry of Energy and Power and to the Ministry of Foreign Affairs
27	Dec. 22	Fri	Fine	Monrovia		Call to the Embassy of Japan in Liberia with the Final Report
28	Dec. 23	Sat	Fine	London	Lv. Monrovia BA-083 9:40 Ar. London 20:10	
29	Dec. 24	Sun.	Cloudy	In airplane	Lv. London BA-007 14:30	
30	Dec. 25	Mon.	Cloudy	Tokyo	Ar. Tokyo 11:30	Arrival at Tokyo

Supplemental Field Survey Schedule

Fiscal 1992

No.	Date	Survey items and travel schedule		Place to stay
		Official members	Consulting members	Official: London
01	Mar. 16 (Tue)	ANA flight no. 201 from Tokyo (11:05) to London (14:55)	Air France flight no. 275 from Tokyo (12:50) to Paris (17:35)	Official: Accra Consulting team: Freetown
02	Mar. 17 (Wed)	BA flight no. 79 from London (11:40) to Accra (20:05)	Air France flight no. 7268 from Paris (11:45) to Freetown (18:30)	Official: Accra Consulting team: Freetown
03	Mar. 18 (Thu)	Prior consultation with Japanese embassy to Ghana	Meeting with supervising persons from the World Bank and NPA.Call Japanese consulate to explain status of procedures.	Official: Accra Consulting team: Freetown
04	Mar. 19 (Fri)	Same as the above	Submitting the inception report, adjusting the survey schedule, survey of the current condition of the power station and construction status.	Both: Freetown
05	Mar. 20 (Sat)	Ghana Airline flight no. 560 from (10:30) to Freetown (13:50)	Survey of the current condition of the power station and meeting with the chief of the power station. (Welcome of the official members)	Both: Freetown
06	Mar. 21 (Sun)	Survey of Kingtom, Falcon bridge and Black Hole power station and substation. Study of data and information.		Both: Freetown
07	Mar. 22 (Mon)	Call to Economic and Technical Co-operation Division of Department of Foreign Affairs. Explanation of the inception report and Japan's Grant Aid program.		Both: Freetown
08	Mar. 23 (Tue)	Call to EEC resident office and collection of information about supporting projects, records and general information about Sierra Leone. Clarifying exchange rate. Meeting of Japan's Grant Aid program (operation, organization, technology, management, etc)		Both: Freetown

09	Mar. 24 (Wed)	Study of data and info. Checking of the items of the minutes of discussions.		Both: Freetown
10	Mar. 25 (Thu)	Confirmation and modifying of the items of the minutes of discussions. Signing on the minutes of the discussion.		Both: Freetown
11	Mar. 26 (Fri)	Call to the Department of Finance and the Minister of Finance. Call to the Minister of the Department of Labor, Energy and Power. Call to EEC resident office (confirmation of the co-operation plan, etc) Observation of the mechanical and electrical engineer training facility and survey of actual condition.		Both: Freetown
12	Mar. 27 (Sat)	Study of data and information. KLM flight no. 579 from Freetown (21:15)	Study of data and information. Preparation of the remind letter.	Official: On the plane Consulting team: Freetown
13	Mar. 28 (Sun)	Arrived at Amsterdam (06:20)	Reconfirmation of the transportation route. Study data and information.	Official: Amsterdam Consulting team: Freetown
14	Mar. 29 (Mon)	KLM Airline flight no. 861 from Amsterdam (14:50)	Submitting of the remind letter and discussions. Collecting of the construction unit price.	Official: On the plane Consulting team: Freetown
15	Mar. 30 (Tue)	Arrived at Tokyo (09:10	Survey in detail of tie-in points in Kingtom Power Station	Official: Tokyo Consulting team: Freetown
16	Mar. 31 (Wed)		Call to NPA and the Economic and Technical Co-operation Division Air France flight no. 7269 from Freetown (20:35)	Consulting team: On the plane
17	Apr. 1 (Thu)		Arrived at Paris (06:50) Air France flight no. 276 from Paris (16:00)	Consulting team: On the plane
18	Apr. 2 (Fri)		Arrived at Tokyo (10:45) Consulting team: Paris	Consulting team: On the plane

Appendix 3 List Of Interviewees

List of Inteviewees (Original Basic Design Study on 1989)

Place of Work and Name	Position
Embassy of Japan in Liberia	
H.E. Hirosuke Oshima	Ambassador Extraordinary & Plenipotentiary
Mr. Mikio Morimoto	Counselor
Mr. Hideki Yamazaki	Second Secretary
Mr. Masaru Hattori	Third Secretary
Mr. Kimitosi Yamaguchi	Administrative Officer
JICA	
Mr. Minoru Yoshimura	Coordinator
Ministry of Foreign Affairs	
Mr. W.A.Jones	Acting Secretary to the Minister of Foreign Affairs
Mr. S.S.S.Sankoh	Acting Director of Economic Affairs and Technical Cooperation Division
Mr. J.A.Goodwayll	Assistant Secretary
Ministry of Energy and Power	
Hon.Dr. Sheku Sesay	Minister
Mr. E.C.S.Kargbo	Acting Permanent Secretary
Mr. S.Garber	Deputy Secretary
Ministry of Finance	
Mr. Sylvanus Taylor	Principal Deputy Financial Secretary
National Power Authority (NPA)	
Mr. Dumbuya	General Manager
Mr. S.S.Labor	Deputy General Manager
Mr. A.Conteh	Chief Engineer
Mr. Mustapha Kargbo	Distribution Manager
Mr. A.S.Kanu	Acting Finance Director
Mr. S.T.Powers	Commercial Director
Mr. J.A.M.Wilkinson	Assistant Superintendent
Mr. M.Kamara	Assistant Commercial Manager
Mr. A.F.Yartch	Acting Planning Manager
Mr. A.Timbo	Planning Officer (Electrical)
Mr. M.Dumbuya	Planning Officer (Mechanical)
Mr. A.S.Jabba	Planning Officer (Electrical)
Kingtom Power Station	
Mr. Mahdi	Acting Generation Manager
Mr. Lowson	Electric Engineer
Mr. Macauley	Maintenance Engineer
Mr. A.Vandi	Mechanical Engineer

Ministry of Lands, Housing and The Environment

Mr. I.O.K.Otoo	Senior Surveyor of Topographical Survey Division

Falconbridge Power Station (NPA)

Mr. E.O.Jarrett	Senior Superintendent

Central Statistics Office

Mr. M.Williams	Statistician of Demographic Section

Consulate of Japan in Sierra Leone

Mr. Kishore Shankerdas	Honorary Consul of Japan

EEC

Mr. J.Trestour	Delegate of the Commission
Mr. Hegarty	Engineering Advisor

Ministry of Development and Economic planning

Mr. Olabisi Taylor	Deputy director of Planning, Central Planning Unit

Connaught Hospital

Miss Fatmata Sankho	Forensic Analyst of Public Health Laboratory
Mrs. Rita Kamara	Laboratory Superintendent

(Supplementaly study on 1993)

List of Interviewees (1992)

Place of Work and Name	Position
1. Department of Labor, Energy and Power	
Mr. A.R.E. Brawne	Secretary of State
2. Department of Finance	
Dr. John Karimu	Secretary of State
3. Department of Foreign Affairs	
Lt. Col.Dr. Akim Gibril	Acting Secretary of State
Mr. S.S.A. Sankoh	Director of Economic and Technical Co-operation Division
4. National Power Authority (NPA)	
Mr. Mustapha Kargbo	Acting General Manager
Mr. Walter Klotz	Deputy General Manager
Mr. A. Conteh	Assistant to General Manager
Mr. Timbo	Generation Manager, Counterpart
Mr. Peter Hunert	Resident Manager of Kingtom Power Station
Mr. M. Mahdi	Principal of NPA Training Center
5. The World Bank	
Mr. Carlos A.Algandona	Power Engineer, Industry and Energy Operations, Western Africa
Mr. Per Dragsholt	D-Consultant (Advisor of NPA's G.M.)
6. Office of Delegation of EEC in Sierra Leone	
Mr. Friedrich W.Nagel	Delegate
Mr. John Simpson	Civil Engineering adviser
7. Sierra Leone Port Authority	
Mr. Helmut M.Friedrichs	General Manager
8. Consulate of Japan in Sierra Leone	
Mr. Kishore Shankerdas	Honorary Consul of Japan
Mr. Henry M. James	Public Relations Officer
9. Connaught Hospital (Dept. of Health)	
Mr. J.Stevens	Medical Electronics engineer
Mr. S. Owizz Koroma M.D.	Head of the National Laboratory Service
10. Construction Company	

Mr. Claudio Cavazzoni	President of GECC Ltd.
Mr. George Mattar	J. Matter & Co., Ltd.
Mr. Graziano Carboni	Deputy Director, SALCOST

Appendix 4 Minutes Of Discussion

MINUTES OF DISCUSSIONS
ON
THE PROJECT FOR
IMPROVEMENT OF ELECTRICITY POWER SUPPLY
TO GREATER FREETOWN
IN
THE REPUBLIC OF SIERRA LEONE

In response to the request of the Government of the Republic of Sierra Leone, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Electricity Power Supply to Greater Freetown and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to the Republic of Sierra Leone the study team headed by Mr. Toshimichi Aoki from November 30 to December 21, 1989.

The Japanese team had a series of discussions and exchanged views on the Project with the authorities concerned of the Government of the Republic of Sierra Leone headed by Mr. Ahmed C. Dumbuya, General Manager, National Power Authority and conducted a field survey on the sites.

As a result of the study and discussions, both parties mutually agreed to recommend to their respective Governments that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

Freetown, December 5, 1989

Toshimichi Aoki
Leader
Basic Design Study Team
Japan International Cooperation Agency

Ahmed C. Dumbuya
General Manager
National Power Authority

S.S.A. Sankoh
Director
Economic and Technical Cooperation Division
Ministry of Foreign Affairs

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve electricity power supply to Freetown and Greater Freetown.

2. Description of the Project

The Project consists of the following items:

(1) Supply and installation of one(1) Diesel Engine Generator (approximately 5MW) with necessary auxiliaries, including On-the-Job Training for NPA's staff for operation and maintenance during the implementation period.

(2) Commissioning work for above (1)

(3) Supply of spare parts for above (1)

(4) Foundation work for above (1)

3. Executing Agency for the Project

National Power Authority (NPA)

4. Project Site

The Project site is located at Kingtom power station in Freetown as shown in Annex-1.

5. The Sierra Leone side understood contents of the inception report as explained by the study team.

6. The Sierra Leone side understood the Japan's Grant Aid system as explained by the study team in which contracts are to be concluded with a Japanese consulting firm and a Japanese contractor.

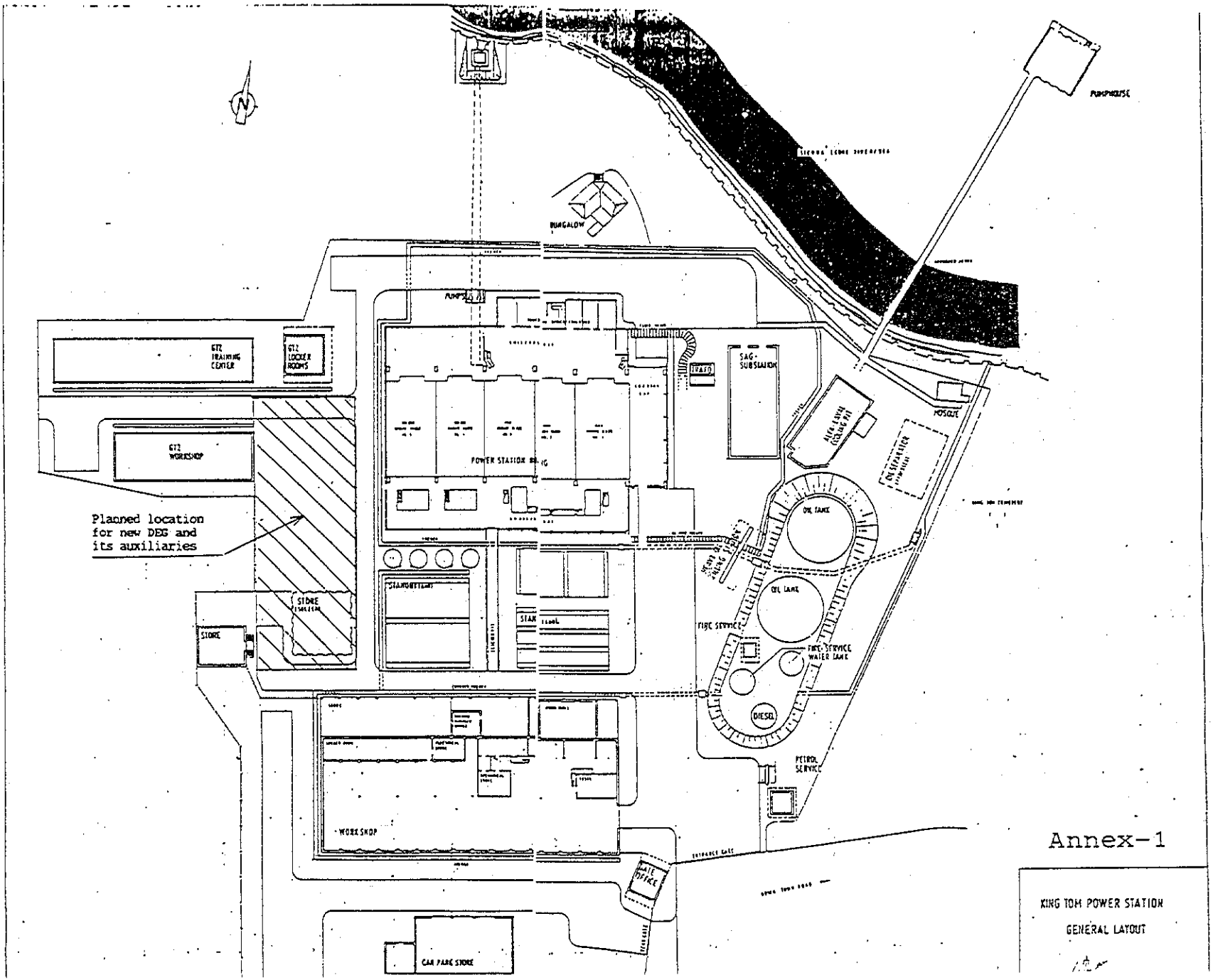
7. The basic concept of the Project will be described in the field report to be submitted to the Sierra Leone side by the Japanese side at the end of this field survey.

S.S.A.

8. The Sierra Leone side agreed to take necessary measures as listed in Annex-2 on condition that the Grant Aid would be extended to the Project.

9. The Sierra Leone side agreed to provide the necessary budget and personnel for proper and effective operation and maintenance of the Diesel Engine Generator (DEG) with auxiliaries to be installed under the Grant Aid.

10. Final Report (10 copies, in English) will be submitted to the Sierra Leone side before the end of April, 1990.



Annex-1

KING TOM POWER STATION

GENERAL LAYOUT

ANNEX-2 UNDERTAKINGS BY THE GOVERNMENT OF THE REPUBLIC OF SIERRA LEONE

(1) To provide cleared and leveled land for the new DEG and its auxiliaries to be installed.

(2) To provide the land for temporary site office, warehouse and stock yard during the implementation period.

(3) To ensure speedy unloading, tax exemption, custom clearance of the products purchased for the Project at the port of disembarkation in the Republic of Sierra Leone.

(4) To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts such facilities as may be necessary for their entry into the Republic of Sierra Leone and stay therein for the performance of their work.

(5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Sierra Leone with respect to the supply of the products and services under the verified contracts.

(6) To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.

(7) To bear all the expenses, other than those to be borne by the Grant Aid necessary for the execution of the Project.

(8) To provide proper arrangements for the construction, such as water supply, electricity, drainage, etc., if necessary.

(9) To assign exclusive counter part engineers/technicians for the Project in order to transfer the operation and maintenance technique for the new DEG and its auxiliaries to be installed.

(10) To provide proper disposal places of waste water and oil discharged during the implementation period.

(11) To provide necessary data for the Project, including samples of water, fuel oil, etc., and permission to take those to Japan.

(12) To secure the stoppage of electricity of the switchgear for the connection works of new power cables, when necessary.

MINUTES OF DISCUSSIONS

SUPPLEMENTARY STUDY OF BASIC DESIGN ON THE PROJECT FOR IMPROVEMENT OF ELECTRICITY POWER SUPPLY TO GREATER FREETOWN IN THE REPUBLIC OF SIERRA LEONE

To review the results of the Basic Design Study in 1989, the Japan International Cooperation Agency (JICA) decided to conduct a Supplementary Study of Basic Design on the Project for Improvement of Electricity Power Supply to Greater Freetown (hereinafter referred to as "the Project").

JICA sent to the Republic of Sierra Leone a study team, which is headed by Mr. Yasuhiro MORIMOTO, Grant Aid Div.,Economic cooperation Bureau,Ministry of Foreign Affairs,and is scheduled to stay in the country from March 17 to 31,1993.

The team held discussions with the officials concerned of the Government of Sierra Leone and conducted a field survey at the study area.

In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The team will proceed to further works and prepare the final report.

Freetown, March, 25, 1993

Mr. Yasuhiro MORIMOTO
Leader
Basic Design Study Team
(JICA)

Mr.Mustapha Kargbo
Acting General Manager
National Power Authority
(NPA)

Mr. S.S.A. Sankoh
Director
Economic and Technical Cooperation Division
Ministry of Foreign Affairs

ATTACHMENT

1. Objective

The objective of the Project is to improve electricity power supply to Freetown and Greater Freetown.

2. Project site

At the request of NPA, discussions were held to change the location of Japanese generating Unit from outdoor to indoor,i.e beside the two(2) existing Sulzer engines.
As the result of discussions, the original proposal had finally been retained as shown in Annex-1.

3. Executing organization

National power Authority (NPA)

4. Items requested by the Government of Sierra Leone

After discussions with the study team, the following items were finally requested by the Sierra Leone side.

(1) Supply and installation of one(1) Outdoor type Medium speed Diesel Engine Generator (approximately 5MW) with necessary auxiliaries, including On-the-Job Training for NPA's staff for operation and maintenance during the implementation period.
(2) Commissioning work for above (1)
(3) Supply of spare parts for above (1)
(4) Foundation Work for above (1)

5. Japan's Grant Aid system

(1) The Republic of Sierra Leone has understood the Japan's Grant Aid explained by the team in which contracts are to be concluded with a Japanese consulting firm and a Japanese contractor.
(2) The Government of Sierra Leone will take necessary measures described in Annex-2 for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

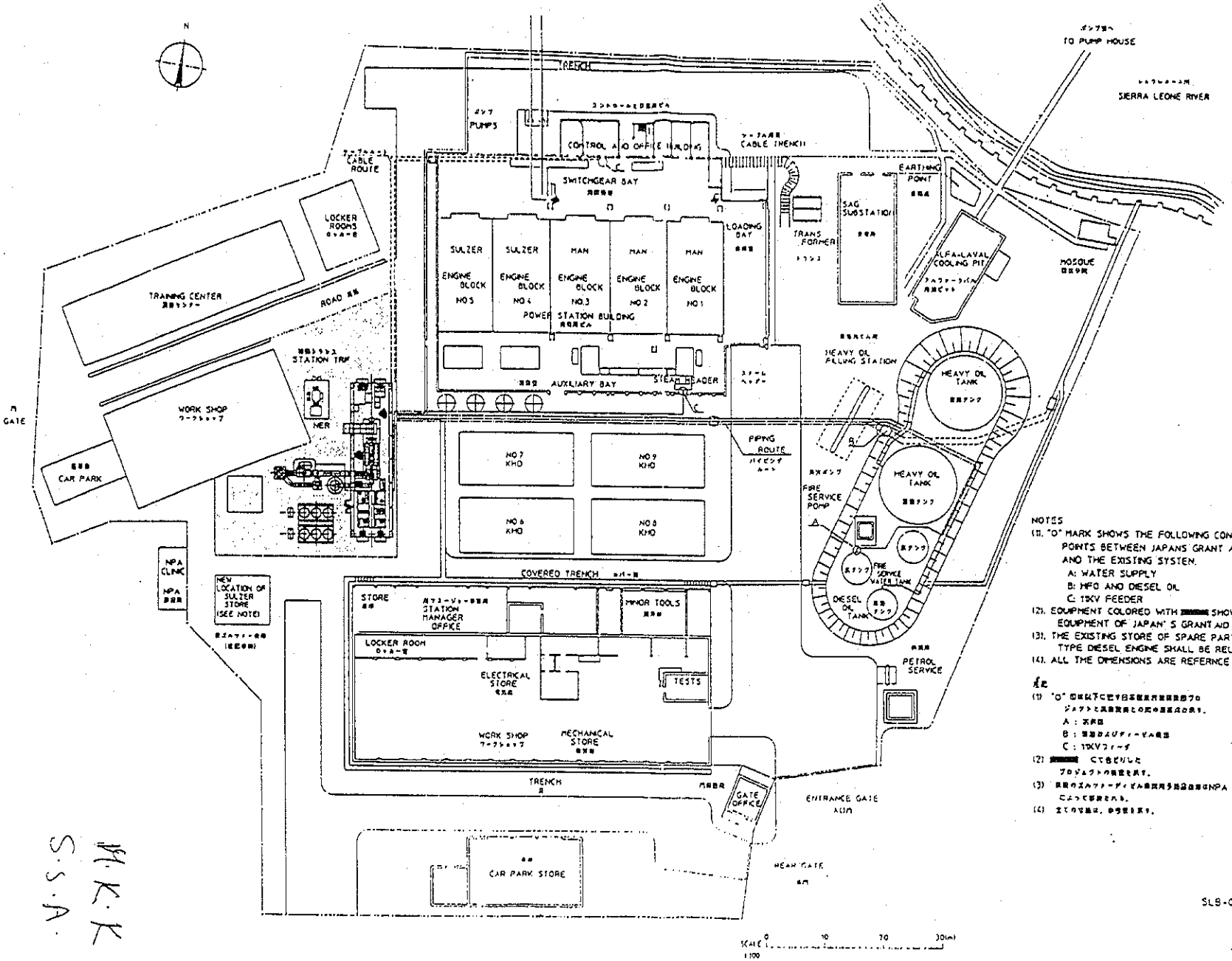
6. Operation and maintenance

The Sierra Leone side agreed to provide the necessary budget and personnel for proper and effective operation and maintenance of the Diesel Engine Generator (DEG) with auxiliaries to be installed under the Japan's Grant Aid.

7. Schedule of the Study

(1) The consultants will proceed to further study in Freetown until March 31, 1993.
(2) JICA will complete the final report and send it to the Government of Sierra Leone by the middle of June, 1993.

S.S.A.
M.K.K



NOTES

(1). "O" MARK SHOWS THE FOLLOWING CONNECTING POINTS BETWEEN JAPANS GRANT AID PROJECT AND THE EXISTING SYSTEM.
- A: WATER SUPPLY
- B: HFO AND DIESEL OIL
- C: 13KV FEEDER

(2). EQUIPMENT COLORED WITH ▬ SHOWS EQUIPMENT OF JAPAN' S GRANT AID PROJECT

(3). THE EXISTING STORE OF SPARE PARTS FOR SULZER TYPE DIESEL ENGINE SHALL BE RELOCATED BY NPA.

(4). ALL THE DIMENSIONS ARE REFERNCE ONLY.

SLS-01 PLOT PLAN

Annex-1

ANNEX-2 UNDERTAKINGS BY THE GOVERNMENT OF THE REPUBLIC OF SIERRA LEONE

(1) To provide cleared and leveled land for the new DEG and its auxiliaries to be installed.

(2) To provide the land for temporary site office, warehouse and stock yard during the implementation period.

(3) To ensure speedy unloading, tax exemption, custom clearance of the products purchased for the Project at the port of disembarkation in the Republic of Sierra Leone.

(4) To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts such facilities as may be necessary for their entry into the Republic of Sierra Leone and stay therein for the performance of their work.

(5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Sierra Leone with respect to the supply of the products and services under the verified contract.

(6) To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.

(7) To bear all the expenses, other than those to be borne by the Japan's Grant Aid necessary for the execution of the Project.

(8) To provide proper arrangements for the construction, such as water supply, electricity, drainage, etc., if necessary.

(9) To assign exclusive counter part engineers/technicians for the Project in order to transfer the operation and maintenance technique for the new DEG and its auxiliaries to be installed by the Japan's Grant Aid.

(10) To provide proper disposal places of waste water and oil discharged during the implementation period.

(11) To provide necessary data for the Project, including samples of water, fuel oil, etc., and permission to take those to Japan.

(12) To secure the stoppage of electricity of the switchgear for the connection works of new power cables, when necessary.

(13) To secure the stoppage of supply of fuel oil for the connection works of new fuel pipings,when necessary.

(14) To obtain necessary permission required for implementation of the Project.

(15) To witness and confirm by authority concerned when the test run and commissioning for the Project are carried out.

(16) To arrange necessary traffic control when equipment and facilities are transported from the port to the Project Site.

(17) To relocated temporarily the existing obstruction such as overhead wires and cables on the road from port to the Project Site.

M.K.K

S.S.A.

Y.M.

Appendix 5 Detailed Minutes of Meeting (Supplementary Study)

National Power Authority
(NPA)

DRAFT MINUTES OF MEETING

BASIC DESIGN STUDY, 5 MW - UNIT, JICA

Dates of meetings: 22nd March 1993, 15.00 - 17.00
23rd March 1993, 14.30 - 18.00

Place of meetings: NPA Headquarters

Participants:

on behalf JICA (Japan International Cooperation Agency)

Mr. Y.Morimoto, Ministry of Foreign Affairs, Japan
Mr. M. Nishikawa, Yachiyo Engineering Co,Ltd, Japan
Mr. H.M. James, Consulate of Japan, Freetown

for NPA

Mr. M. Kargbo, Ag. General Manager
Mr. W. Klotz, Deputy General Manager
Mr. A. Conteh, Asst. to General Manager
Mr. Timbo, Generation Manager, Counterpart
Mr. P. Hünert, Resident Engineer, Kingtom Power station

Project Reference:

Supplementary Study of Basic Design on the Project for Improvement of Electricity Power to Greater Freetown, Sierra Leone

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After the welcome procedure and presentation of all participants the discussion of the above-mentioned study was declared opened.

1. Introduction

The Japanese Delegation gave a detailed explanation on the reason of the supplementary Study including a briefing on the different procedures applicable for grants awarded by JICA towards Recipient Countries. It has been clearly pointed out that a firm commitment for the execution of the project is only given with the "Exchange of Notes". Detailed procedures are given in the leaflet in the study. NPA has confirmed to have received 10 copies of the a/m study.

2. Undertakings by the Government of Sierra Leone (GOSL)

Annex 2, Undertakings by the GOSL had been explained, line by line, observing comments from NPA as follows:

Item (1); generally agreed by NPA, subject to acceptance of final solution finally retained;

Item (2); drawings regarding space requirement for Japanese Contractor will be forwarded to NPA after the "Exchange of Notes". According to previous indications about 600 m2 had been requested;

Item (3); technical aspects of unloading, handling and forwarding will be the responsibility of the

Contractor; legal aspects such as tax exemption, custom clearance etc.. will be under the responsibility of GOSL;

Item (4); noted; subject to "Exchange of Notes" between governments

Item (5); noted; subject to "Exchange of Notes" between governments

Item (6); noted; subject to "Exchange of Notes" between governments

Item (7); noted

Item (8); accepted by NPA

Item (9); accepted by NPA, specified in further details in "Basic Design, page -94-

Item (10); accepted by NPA

Item (11); generally accepted, delegation to note that fuel oil quality is subject to variations.

Item (12); accepted By NPA

Item (13); accepted By NPA

Item (14); noted, subject to "Exchange of Notes" between governments

Item (15); Accepted by NPA, details of tests to be submitted in due time (detailed study)

Item (16); accepted by NPA, NPA will endeavour to receive the necessary approvals from Ministry concerned

Item (17); accepted by NPA

3. NPA has brought to the attention of the Japanese Delegation its serious concern towards the location and type of generating unit. Outdoor type, proposed location of generating unit (near training school) and other operation-related reasons, type of engine (in-line type instead V-type, proposed nominal speed are in NPA's opinion not to be considered as an optimal solution.

The Japanese Delegation has pointed out that the present study is to be considered as a supplementary study to complete the information required for the next stage and to reconfirm at same time the general layout of the proposal submitted in the "Field Survey" of December 1989.

Any change or major deviation in the proposed location would have an impact on the following subjects:

- additional field survey, reports required;
- delay of the entire project by at least one (1) year since JICA's project performances are bound to fiscal years (April to March),
- possible diplomatic consequences

It would furthermore require:

- guarantee of availability until end of 1993 of required space in power house Kingtom,
- reasonable finishing of civil works on the power house to allow erection works,

Detailed explanations had been raised from NPA for following subjects:

- preference of indoor type (instead of outdoor type) gen-set by

reasons of operational aspects and conditions: (a) the critical aspect of human resource, - mainly basing on present experience with nearly non-interchangeable "Sulzer-crew" and "KHD-crew" and the outlook towards a future "Japanese-crew" as well as depending on the solution for the future "WB-unit"- , (b) the technical implication and NPA's capabilities to operate correctly a mixture of possibly 4 different generating sets, do not induce any sign of comprehension,

- the second 5MW unit to be financed by World Bank will be installed in the power house on the location presently occupied by the obsolete MAN-Units, thus giving additional credit to the indoor solution,

- it has been stressed, that NPA will undertake all actions to expedite the removal of all MAN-Units, providing sufficient space,

- it has been pointed out that the rehabilitation/replacement of old foundations are covered under a different project component EIB which then could be activated in due time,

- it was also pointed out that NPA will investigate and apply at World Bank to reach a deviation from procurement guidelines for the 2nd generating set to be financed under WB-funds allowing competitive shopping in Japan in order to attract harmonisation/standardisation of generating sets procured and handed over for successful operation by NPA,

- A "In-Line Mover" engine would be preferred having a nominal speed of up to 500 rpm since technology is considered more appropriate for prevailing local conditions (influence of fuel oil quality available in Sierra Leone, technology already known to engineers/technicians in NPA etc..),

In the absence of a final commitment from the World Bank, no final decision could be taken with regard to the indoor solution.

The Japanese Delegation has reconfirmed that detailed technical discussions will be carried out when presenting the "Detailed Design Study" of the project in draft version. Subjects to be discussed are preliminary those as stated thereafter:

- confirmation of in-line type instead of V-type engine
- review of speed to be 500 to 600 rpm and not 750 rpm
- consideration of MFO quality with given kinematic viscosity
- reduction of noise level (especially for outdoor solution in vicinity to training school which probably will then seriously be disturbed)
- provision of spare pumps for important component of the various system included in the project.

Signed on behalf of NPA

Date .....

Mr. R. Kargbo
(A/General Manager NPA)

Signed on behalf of JICA

Mr. M. Nishikawa
(Yachiyo Engineering Co. Ltd. Japan)

Appendix 6 Terms of Evaluation for the Indoor Electric Generation Facilities

Date;March27,1993

SUPPLEMENTARY STUDY OF BASIC DESIGN ON THE PROJECT FOR IMPROVEMENT OF ELECTRICITY POWER SUPPLY TO GREATER FREETOWN IN THE REPUBLIC OF SIERRA LEONE

NPA's Responsibility

Attention ; Mr.M,Kargbo, Acting General Manager of NPA
Mr.W,Klotz, Deputy General Manager of NPA

Subject ; The letter from the World Bank to secure the conditions

Dear sirs,

Please be informed that Japanese Government needs the letter from the WB(the Letter) satisfied with the following items in order to commence the study to change the location of Japanese Diesel Engine Generating unit(DEG) from outdoor to indoor by the end of March 1993.

1. The Letter shall manifest the official commitment of the WB to complete the following works by the end of 1993 even if the management contract and/or other conditionalities are not completed when the Letter is issued.
   (1) removal of three(3)Man Engines and their auxiliaries.
   (2) demolition of all foundations of Man Engines including auxiliaries and making leveled & clear land for Japanese new DEG.
   (3) rehabilitation of the overhead crane and the power house.

2. The Letter shall be issued in the name of the representative who has the right to make the commitment and can bear the responsibility for the execution of the items shown above.

3. The Letter shall be addressed to the Ambassador of Japan to the U,S, and the copy of the Letter shall be sent to the Basic Design Study Team in Japan. The Letter shall reach to the Japanese Embassy in Washington by March 31,1993.

4. The Letter shall be accompanied with the detailed implementation plan(s) and schedule(s) for the above items 1.(1)(2)and (3) as follows,
   (1) the plan(s) and schedule(s) shall be commonly acceptable ones.
   (2) the plan(s) and schedule(s) shall include all necessary procedures, e.g. a series of tendering procedures, shipping of the wrecks of Man's engines etc,.
   (3) Delay of implementation which may occur by bureaucratic procedures shall be taken into account in planning and scheduling.

5. In addition to the foregoing, it is most important that the Letter shall clearly explain the World Bank's official commitment to procure the DEG which is compatible with that of Japan's Grant Aid.

Received on 29/8/93 at 12 noon

AG. G.M.

for Mr.Yasuhiro MORIMOTO
Team Leader
JICA Basic Design Study Team

Appendix 7 Country Data

1. Basic index

①	Republic of Sierra Leone	: Capital : Freetown	
②	Land area	: 71,740km^2	
	Population	: Approx 4,200,000	(1991 World Bank report)
	Population density	: 49 persons/km^2	(same source)
	Population increase ratio	: 2.6%/year	(same source)
③	Form of government	: Presidential system (Sierra Leone became a sovereign republic in the Commonwealth of Nations)	
	Political party	: Single party system. The All People's Congress became the only political party with the revision of the constitution in May 1978. The head of the nation changed with the political change in April 1992.	
		: Head of the nation, Chairman of the National Supreme Council : Captain Valentine Exerakubo Melvein Stracer (inaugurated in 1992)	
	Fiscal year	: April 1st ~ March 31st	
④	Religion	: 50% Muslim (Islamic) in the north, many Christians in the urban areas and others practice traditional animism.	
⑤	Language	: English is the official language but Crio, the mother tongue of the Creole, is Seirra Leone's lingua franca. The major indigenous languages are Mande in the south and Temne in the north area.	
⑥	Race	: Mende, Temne, small number of Caucasians and Indians	
⑦	Education	: 40% of children 5 ~ 11 years old attend school (1970)	
⑧	Currency	: 1 leone = 100 cents, $1 = 550 leone (as of March 1993)	
⑨	Geography and land	: The rainy season is from June to September, and rainfall is an almost daily occurence, especially during July and August. The rainy season usually begins and ends with a series of violent line squalls marked by thunder and lightning. The dry season spans October to May.	
⑩	Land form	: Flat interior plains (savanna) extend 112 km inland from the Atlantic coast. The only exception to this are the thickly wooded Sierra Leone Penisula Mountains, home to the capital Freetown. Eight rivers flow through the forested central part of the country. The eastern area is bounded by highlands or mountains.	
	Latitude and longitude	: Lat 7° ~ 10° N , Long 11° ~ 13° W	

Origin of name of country : The name Sierra Leone comes from the original Portugese word *Serra Lyoa*, meaning Lion Mountain, used by the Portuguese explorer Pedro de Cintra when he first saw Freetown harbor, which is ringed by sheer cliff faces.

2. Social and economical index

① Gross domestic product (GDP) Approximately $1.01 billion (1991 : The 1992/93 Budget Statement)

② Income per person : Approximately $240 (as of 1990/1991, World Bank Report 1992)

③ Industrial structure : The major industry is agriculture but the country is rich in mineral resources such as diamonds, iron ore, bauxite, etc. Sierra Leone's major trading partners are Belgium, West Germany, U.S.A, England, etc.

④ Inflation ratio

Change of GDP and the consumer price index of Sierra Leone

Item	'87 / '88	'88 / '89	'89 / '90	'90 / '91	'91 / '92
GDP (increase ratio : against previous year)	1.9	3.5	2.8	2.8	-5.0
Consumer price index against the previous year	71.2	45.6	90.9	101.0	95.0

[Source : World Bank Report : 1992]

⑤ Financial balance

[Unit : Million leones]

Item	Record 1991 / 1992	Projected 1992 / 1993
1. Annual revenue		
Income tax	5,566	2,590
Other taxes	24,529	60
Ore	2,241	—
Other	1,570	850
[Subtotal]	33,906	3,500
2. Annual expenditures		
Ordinary expenditures	26,438	4,350
Development costs	16,600	1,980
Other expenditures	16,600	300
[Subtotal]	59,038	6,630
3. Total deficit	–25,133	–3,130
4. External financing		
Withdrawal	800	1,000
Depreciation	–1,368	–1,500
[Subtotal]	–568	-500
5. Change in nonpayment (decreased amount)		
Domestic	–1,500	—
Abroad	4,345	2,180
[Subtotal]	2,845	2,180
6. Domestic finance		
Cash and deposits in bank accounts	192	—
Financial sources other than banks	26	150
Banking system	1,229	1,300
[Subtotal]	1,447	1,450

(Source : Sierra Leone, Estimates Of Revenue And Expenditure 1988/1989)

3. Other

① National holidays (1990)

New Years Day	January 1st
Good Friday	April 13th
Easter Monday	April 16th
Independence Anniversary Day	April 27th
Feast of Eid-ul-Fitri	not determined
Feast of Eid-ul-Adha	not determined
Feast of Moulid-un-Nabi	not determined
Christmas Day	December 25th
Boxing Day	December 26th

② Office hours (M ~ Th)	8:30 ~ 16:30
Lunch break	12:00 ~ 13:00
Friday	8 : 30 ~ 3:00
Saturday and Sunday	OFF

Appendix 8 Estimated Generation Supply to Freetown Area

WESTERN AREA SYSTEM LOAD DISPATCH AND FUEL CONSUMPTION

	FY 1991 Actual	FY 1992 Estimated	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000
			Projection							
Load Dispach (GWH):										
Sulzer #4 (8.5MW)	27.0	0.4	19.7	30.3	59.6	59.6	3.0	3.0	3.0	4.0
Sulzer #5 (8.5MW)	0.0	0.0	0.0	29.9	59.6	59.6	3.0	3.0	3.0	4.0
New MSD #1 (5 MW)	0.0	0.0	0.0	0.0	35.0	35.0	2.0	2.0	3.0	3.0
New MSD #2 (5 MW)	0.0	0.0	0.0	0.0	0.0	17.5	2.3	2.3	3.5	3.0
KHD Units (12MW) a/	28.5	20.5	61.8	63.2	13.3	3.5	0.0	0.0	0.0	0.0
Falconbridge (1.5 MW)	0.4	1.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Bumbuna (47 MW)							175.0	185.0	195.0	200.0
Other New Generation (10MW)										5.0
Total Gross Generation (GWh)	56.0	22.0	81.5	123.4	167.5	175.2	185.3	195.3	207.5	219.0
Station Use (%)	6.3	6.3	5.5	5.3	5.0	5.0	5.0	5.0	5.0	5.0
Net Generation Available (GWh)	52.7	20.7	77.3	117.2	159.5	166.9	176.5	186.0	197.6	208.6
Fuel Consumption (Tons):										
Fuel Oil	14118.1	5344.6	20775.2	30625.2	37565.2	38834.3	2268.3	2268.3	2743.5	4162.0
Diesel Oil	1169.1	587.4	2016.8	2557.2	2618.5	2776.4	173.7	173.7	226.5	358.0
Lube Oil	226.8	77.0	308.0	417.5	292.5	303.9	19.0	19.0	24.7	39.0

a/ KHD units are retired at the end of 1996, when they will have reached the end of their useful life.

SIERRA LEONE – POWER SECTOR REHABILITATION PROJECT

WESTERN AREA SYSTEM ENERGY AND POWER BALANCE

	FY 1991 Actual	FY 1992 Estimated	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000
			Projection							
emand for Energy (GWh)	122.7	126.7	131.7	137.4	143.6	150.2	158.9	167.4	177.8	187.8
emand Growth Rate (%)		3.3	3.9	4.3	4.5	4.6	5.8	5.4	6.2	5.6
echnical Losses (%)	15.0	15.0	15.0	13.0	10.0	10.0	10.0	10.0	10.0	10.0
eneration Required (GWh) a/	144.4	149.1	154.9	157.9	159.5	166.9	176.5	186.0	197.6	208.6
eneration Available (GWh) a/	52.7	20.7	77.3	117.2	159.5	166.9	176.5	186.0	197.6	208.6
eneration Deficiency (GWh)	91.7	128.4	77.6	40.7	0.0	0.0	0.0	0.0	0.0	0.0
on-technical Losses (%)	20.0	20.0	19.0	18.0	17.0	16.0	15.0	15.0	15.0	15.0
ales (GWh)	34.2	13.5	51.0	80.8	116.4	123.5	132.4	139.5	148.2	156.4
aximum Demand (MW)	31.9	32.9	33.9	34.5	34.8	36.4	38.5	40.5	43.1	45.5
vailable Capacity (MW)	16.5	14.5	19.5	28.0	35.5	40.5	52.5	52.5	52.5	62.5
irm Capacity (MW)	7.5	1.5	13.5	16.5	27.0	32.0	28.5	28.5	28.5	38.5
ax Demand – Firm Capacity (MW)	24.4	31.4	20.4	18.0	7.8	4.4	10.0	12.0	14.6	7.0

a/ Net Generation defined as Gross Generation – Station Use

Appendix 9 Estimated Operating Revenue and Expenditure of the Concerned Power Generating Plant

Table 1 Estimated Operating Revenue and Expenditure of Concerned Power Generating Plant

Items	Unit	Operating Ratio			
		75%	80%	85%	90%
I. Revenue					
1. Plant capacity	MW	5	5	5	5
2. Annual operating time	Hr	6,480	6,912	7,344	7,776
3. Unit generated	MWh	32,400	34,560	36,720	38,880
4. Power loss rate in plant		0.03	0.03	0.03	0.03
5. Power loss rate of transmission line		0.15	0.15	0.15	0.15
6. Sales units	MWh	26,568	28,339	30,110	31,882
7. Average tariff	Leone/kWh	65	65	65	65
8. Sales value	1,000 Leone	1,726,920	1,842,048	1,957,176	2,072,304
II. Expenditure					
1. Fuel cost	1,000 Leone	1,165,175	1,242,844	1,320,514	1,398,184
2. Lubricating oil cost	1,000 Leone	65,318	69,673	74,028	78,382
3. Cooling water cost	1,000 Leone	3,638	3,881	4,123	4,366
4. Labor cost	1,000 Leone	2,509	2,509	2,509	2,509
5. Maintenance cost	1,000 Leone	90,720	90,720	90,720	90,720
6. Administration cost	1,000 Leone	120,885	128,944	137,002	145,061
(Total expenditures)	1,000 Leone	1,448,245	1,538,571	1,628,896	1,719,222
III. Profit/loss	1,000 Leone	278,675	303,477	328,280	353,082

Assumed Conditions of Examination

(a) The tariff has been set at the average unit price (65 Leone/kWh) based on the new tariff NPA is now requesting the Sierra Leone Government to approve.
(b) Power loss rate within the plant and transmission line loss rate are based on the data supplied by NPA.
(c) The fuel, lubricating oil, waterworks and personnel costs have been set to the drastic prices prevalent as of December 1989 in Sierra Leone.
(d) Respective consumptions have been set as follows:
Fuel consumptions: 0.21g/kWh Lubricating oil consumption : 2.Og/kWh water or radiators: 0.5m^3/day (about 20% of initial supply volume) Water for exhaust gas boiler: 24m^3/day
(e) Average starting and stopping operations per year were set at 10 times and the time needed for one start-stop was set at 30 minutes.
(f) Assuming that about 1/10 of the staff of Generation Section in Technical Division of NPA (total of 155 staffers) would be assigned to management and maintenance of the power generating plant concerned, personnel costs for 3 engineers and 12 workers (total of 15) were appropriated as labor cost.
(g) As maintenance cost, about 3% of the unit prices of equipment was estimated for the annual cost of component parts.
(h) As management cost about 7% of the power sales revenue was estimated on the basis of actual record of NPA for 1987.
(i) No depreciation was estimated.

Table 2 Estimated Operating Revenue and Expenditure of the Concerned Power Generating Plant with Depreciation Taken into Account

Items	Unit	Operating Ratio			
		75%	80%	85%	90%
I. Revenue					
1. Plant capacity	MW	5	5	5	5
2. Annual operating time	Hr	6,480	6,912	7,344	7.776
3. Unit generated	MWh	32,400	34,560	36,720	38,880
4. Power loss rate in plant		0.03	0.03	0.03	0.03
5. Power loss rate of transmission line		0.15	0.15	0.15	0.15
6. Sales units	MWh	26,568	28,339	30,110	31,882
7. Average tariff	Leone/kWh	65	65	65	65
8. Sales value	1,000 Leone	1,726,920	1,842,048	1,957,176	2,072,304
II. Expenditure					
1. Fuel cost	1,000 Leone	1,165,175	1,242,844	1,320,514	1,398,184
2. Lubricating oil cost	1,000 Leone	65,318	69,673	74,028	78,382
3. Cooling water cost	1,000 Leone	3,638	3,881	4,123	4,366
4. Labor cost	1,000 Leone	2,509	2,509	2,509	2,509
5. Maintenance cost	1,000 Leone	90,720	90,720	90,720	90,720
6. Administration cost	1,000 Leone	120,885	128,944	137,002	145,061
7. Depreciation	1,000 Leone	273,600	273,600	273,600	273,600
(Total expenditures)	1,000 Leone	1,721,845	1,812,171	1,902,496	1,992,822
III. Profit/loss	1,000 Leone	5,075	29,877	54,680	79,482

Remarks

1) Assumed conditions for examination are identical with those of the previous table.
2) The depreciations in the table were calculated under the fixed price method with the life of the power plant concerned set at 15 years and the residual price taken as zero.