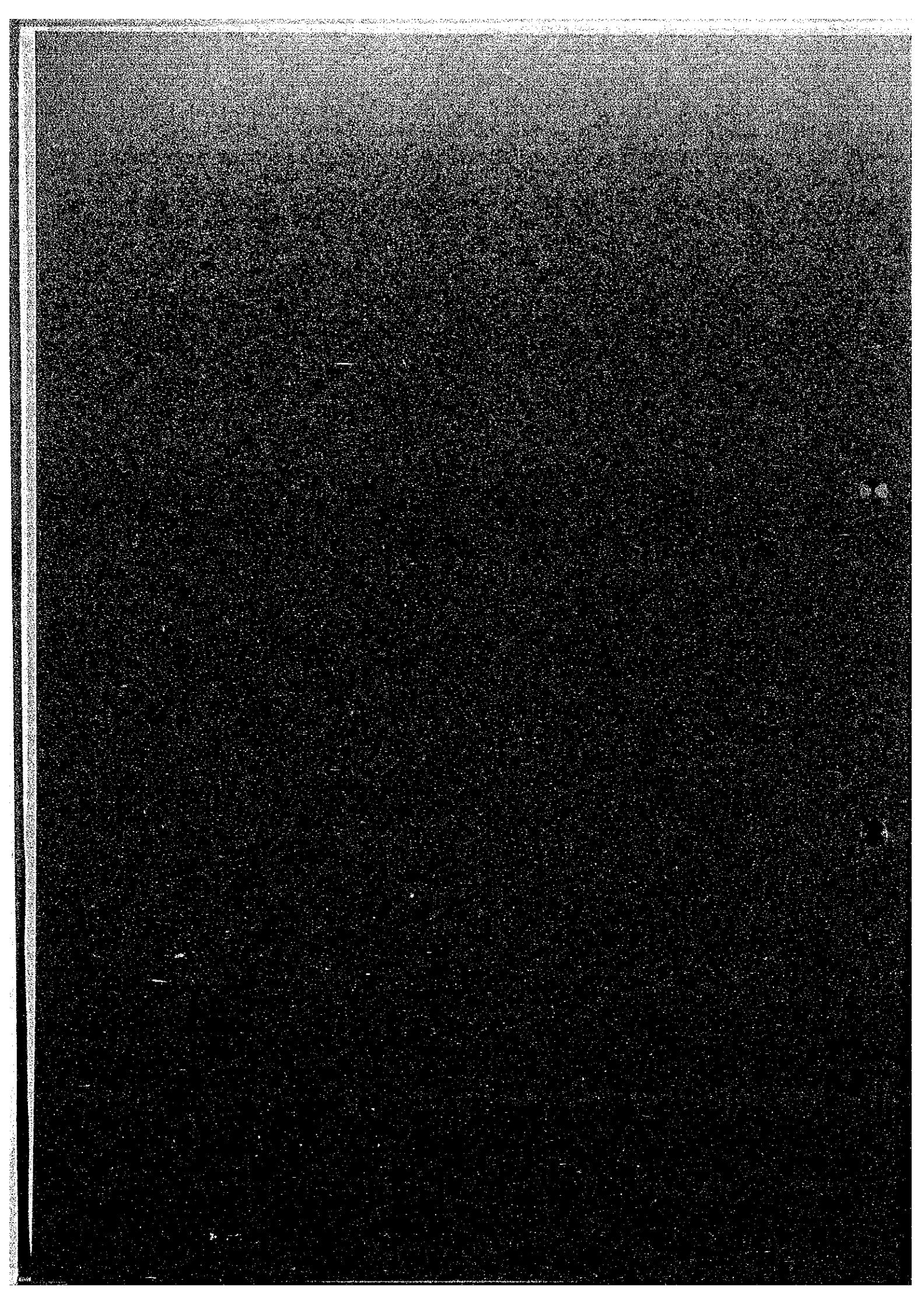
CHAPTER-V

REPAIR SCHEDULE



CHAPTER-V REPAIR SCHEDULE

5.1 Overall Schedule

With an assumption that the repair is scheduled to be completed by March 15, 1982, the overall time schedule would be as follows:

- Period of manufacture:
  From October 1, 1980 to June 30, 1981 (9 months)
- Period of transportation:
  From July 1, 1981 to August 31, 1981 (2 months)
- Period of site work:
  From September 1, 1981 to March 15, 1982 (6.5 months)

Explanation on the above time schedule is given below:

5.2 Manufacturing Schedule

Manufacturing of guide vanes which will be made of stainless steel in order to obtain a high anti-corrosive character against water constitutes a principal item of repair work. Besides the guide vanes, several items have also to be manufactured. At the present, considering the usual action of heavy equipment manufacturers in Japan, it would take about nine months for the said manufacture. It is noted, however, that this period may not always be so tightly fixed, and it is recommended to arrange with manufacturer to shorten this period in order to allocate some time allowance to site work schedule.

5.3 Transportation Period

Based on the actual time consumption for transportations during the first and second stages of project construction, a period of two months is considered necessary for transportation of necessary equipment to the site.

5.4 Site Work Schedule

The repair has to be done for both the No.1 and No.2 units.

As to the site work schedule, the following three alternatives can be considered:

i) After completion of repair of one unit, repair of another unit will be commenced in series.

ii) Repair of two units will be done simultaneously in parallel.

iii) After progress of repair for one unit to certain extent, repair of another unit will be started. Then, the latter unit will be completed some time after the completion of the first one.

Naturally, these three cases have merits and demerits in view of possible influence of stoppage of generating equipment upon power system operation, number of personnel to be mobilized, etc.

Results of investigation carried out this time revealed that there are few Laotian enterprises and organizations capable of executing overhaul and/or repair of the generating equipment at the present. On the other hand, the number of experienced and qualified staff who can execute such peculiar works is not always sufficiently available in the Nam Ngum Power Station. In this sense, it is judged that the alternative iii) would be the most realistic one after due examination. The Field Work Schedule A attached hereto has therefore been prepared based on this concept. This Schedule A shows also variation of number of personnel by lapse of time.

For the purpose of repair of the hydraulic turbines, rotors of the generators have to be taken out. In other words, a large scale disassembly (overhaul) must be carried out. In fact, this overhaul has never been carried out since completion of the first stage development of the Nam Ngum Power Station. Therefore, no staff experienced in overhaul work is available now in the power station. From this fact, execution of repair work will be more meaningful for Laotian personnel in view of so-called "Tranfer of Knowledge" as an opportunity of overhaul will be actualized.

On the other hand, a special field machining work will be needed to take a narrow gap between rotating part and stationery part precisely.

Then, the site work schedule becomes somewhat longer apparently.

5.5 Site Manning Schedule

The Field Work Schedule B shows the manning schedule. To execute many peculiar items, a fairly large number of supervisory personnel, instructors and skillful technicians is to be required.

Classification of Japanese participants will be as follows:

i) Members who control and manage the repair work and give instruction to Laotian personnel for making progress of the work smooth and efficient.

ii) Members who carry out special work items which require very high technique.

iii) Members who will carry out adjustment and test of generating equipment after completion of the repair.

Viewed from peculiarity of work and from distribution of work, the number of required personnel becomes so much characteristic as shown in the Field Work Schedule B attached hereto.

Erection Schedule A
工 事 工 程 表

E·D·C (Laos) 殿

Nam Ngum P/S.

MAF. NO. 作番

15MW/17.5MVA WATER-TURBINE/GENERATOR × 2 UNITS.

	項目 ＼ 年月日
A	Erection Schedule
	UNIT NO.1 { WATER-TURBINE / GENERATOR
	UNIT NO.2 { WATER-TURBINE / GENERATOR
B	Mobilization & Schedule of Japanese Staff
	1. Engineer for Technical Superintendence
	(1) Chief Engineer
	(2) Engineer for Water Turbine
	(3) Engineer for Generator
	(4) Engineer for Welding
	(5) Engineer for Mechanical Equipment
	(6) Testing Engineer for Generator
	(7) Testing Engineer for Electrical Equipment
	(8) Testing Engineer for Mechanical Equipment
	(9) Engineer for Auxiliary of Turbine
	(10) Testing Engineer for Transformer
	2. Erection Engineer
	(1) Site Manager
	(2) Chief Erection Engineer
	(3) Erection Engineer for Generator
	(4) Erection Engineer for Turbine
	(5) Chief Administrator
	3 Technician
	(1) Mechanical (Rigger)
	(2) Mechanical (Fitter)
	(3) Electrical
	(4) Crane Operator
	(5) Welder
	(6) Painter

'81: 8 9 10 11 12 — '82: 1 2 3 4

#1 '82.2.11

#2 '82.3.15

1. PREPARATION WARK
2. PAINTING FOR STREAM SURFACE
3. DISASSEMBLY OF TURBINE
4. CLEAN UP AND REPAIN OF TURBINE PART
5. REPAIN OF STAY RING AND STAY VANE
6. PROCESSING OF BOTTOM RING AND STAY RING
7. CLEAN UP OF STAY RING
8. ASSEMBLING OF RUNNER
9. ASSEMBLING OF HEAD COVER
10. ASSEMBLING OF MAIN SHAFT
11. ASSEMBLING OF METAL CASE AND PACKING BOX
12. ASSEMBLING OF GIDE RING
13. ASSEMBLING OF OVERALL SMALL PART OF TURBINE
14. INSPECTION OF AUX. EQUIPMENT
15. TEST WITHOUT WATER
16. TEST WITH WATER
17. COMMERCIAL OPERATION
18. DISASSEMBLY OF GENERATOR
19. CLEAN UP AND REPAIN OF GENERATOR PART
20. CHANGING OF SMALL PART FOR STATOR
21. CLEAN UP AND REPAIN OF GENERATOR PART
22. CENTERING OF GENERATOR
23. RE-ASSEMBLINGOF GENERATOR

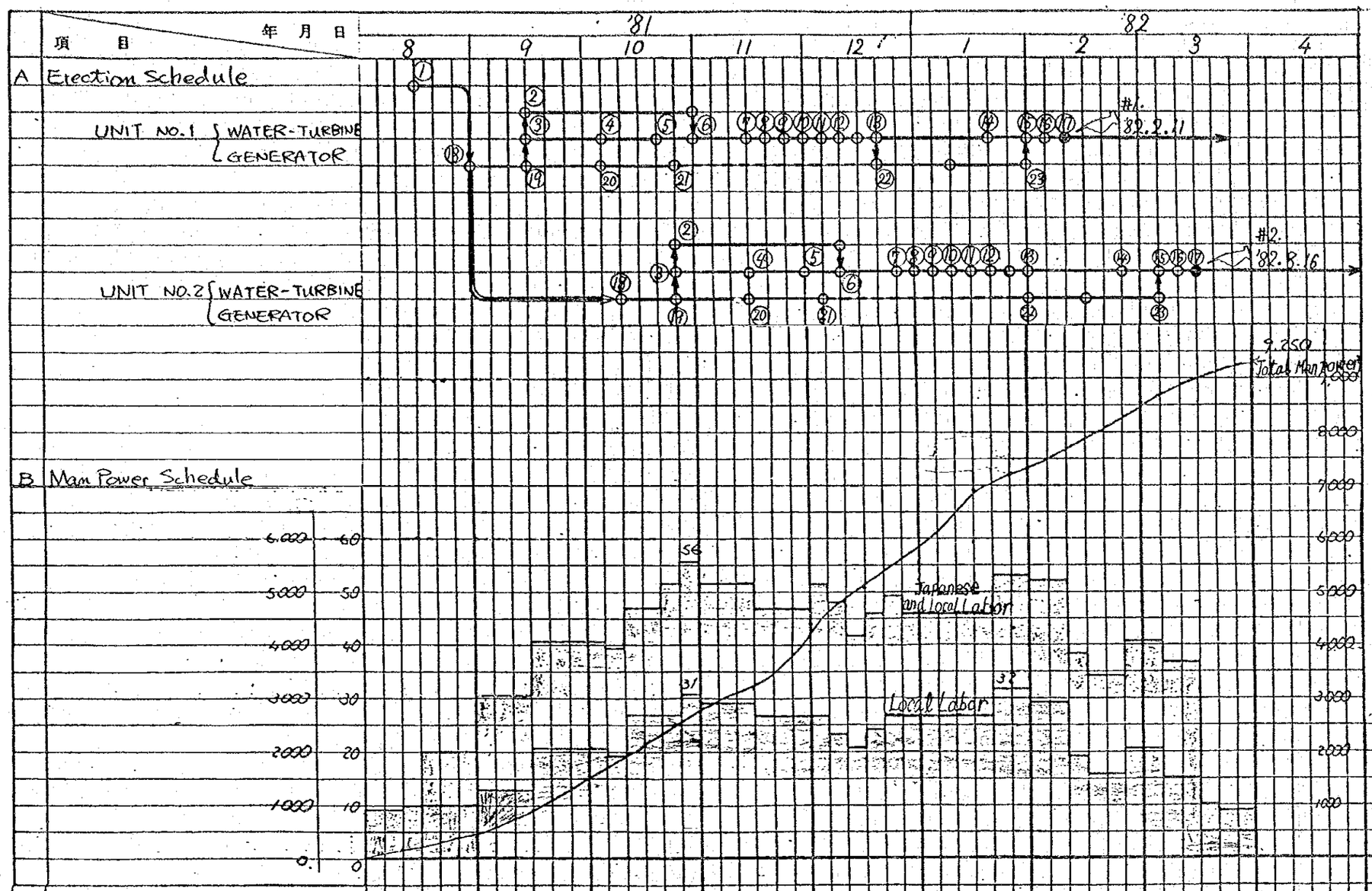
E·D·L (Laos) 殿

Nam Ngum P/S

MAF. NO. 作番

Erection Schedule B
工事工程表

15MW/17.5MVA WATER-TURBINE/GENERATOR × 2 UNITS



1. PREPARATION WARK
2. PAINTING FOR STREAM SURFACE
3. DISASSEMBLY OF TURBINE
4. CLEAN UP AND REPAIN OF TURBINE PART
5. REPAIN OF STAY RING AND STAY VANE
6. PROCESSING OF BOTTOM RING AND STAY RING
7. CLEAN UP OF STAY RING
8. ASSEMBLING OF RUNNER
9. ASSEMBLING OF HEAD COVER
10. ASSEMBLING OF MAIN SHAFT
11. ASSEMBLING OF METAL CASE AND PACKIN BOX
12. ASSEMBLING OF GIDE RING
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14. INSPECTION OF AUX. EQUIPMENT
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17. COMMERCIAL OPERATION
18. DISASSEMBLY OF GENERATOR
19. CLEAN UP AND REPAIN OF GENERATOR PART
20. CHANGING OF SMALL PART FOR STATOR
21. CLEAN UP AND REPAIN OF GENERATOR PART
22. CENTERING OF GENERATOR
23. RE-ASSEMBLINGOF GENERATOR

No.	REVISIONS	DATE	REVISED	CHECKED
A	REVISED BY KOEI LETTER NHE-899/69			
B	ADDED COUPLING COVER			
C	CHANGED DIMENSIONS			

PARTS NAME AND MATERIAL LIST

NO.	NAME OF PARTS	MATERIAL	NO. REQ'D
110-01	SPIRAL CASE WITH STAYRING	SM41A	1
135-01	LOWER PROTECT LINER	STEEL PLATE	1
160-01	DRAFT PIPE	STEEL PLATE	1
210-01	TOP COVER	SM41A	1
215-01	WEARING RING AND FACING PLATE FOR TOP COVER	SUS50HP	1
230-01	BOTTOM RING	SM41A	1
235-01	WEARING RING AND FACING PLATE FOR BOTTOM RING	SUS50HP	1
250-01	GUIDE VANE ADJUSTING PLATE	BC2	20
310-01	BEARING HOUSING	SM41A	1
330-01	MAIN GUIDE BEARING	SM41A+WJ-6 (BABBIT LINING)	1
335-01	OIL COOLER	DCuT1-H (COPPER TUBE)	1
340-01	SEALING BOX	SM41A	1
410-01	TURBINE SHAFT	SF55	1
415-01	SHAFT SLEEVE	SUS50HP	1
510-01	RUNNER	SCS-1 (13% Cr ST.S.C)	1
515-01	WEARING RING FOR RUNNER	SUS50HP	2
520-01	RUNNER CONE	SM41A	1
525-01	RUNNER KEY	SF55	1
610-01	GUIDE VANE (WITH SPINDLE SLEEVE)	SC46 (+SUS27HP)	20
615-01	GUIDE VANE LEVER	SC46	20
710-01	GATE OPERATING RING	SM41A	1
720-01	GATE LINK	SM41A	20
730-01	EYE END PIN	SUS50B	2
730-02	GATE RING PIN	SUS50B	20
730-03	SHEAR PIN	SF55	20
810-01	PIT LINER	STEEL PLATE	1

REMARKS

▨ STAINLESS STEEL

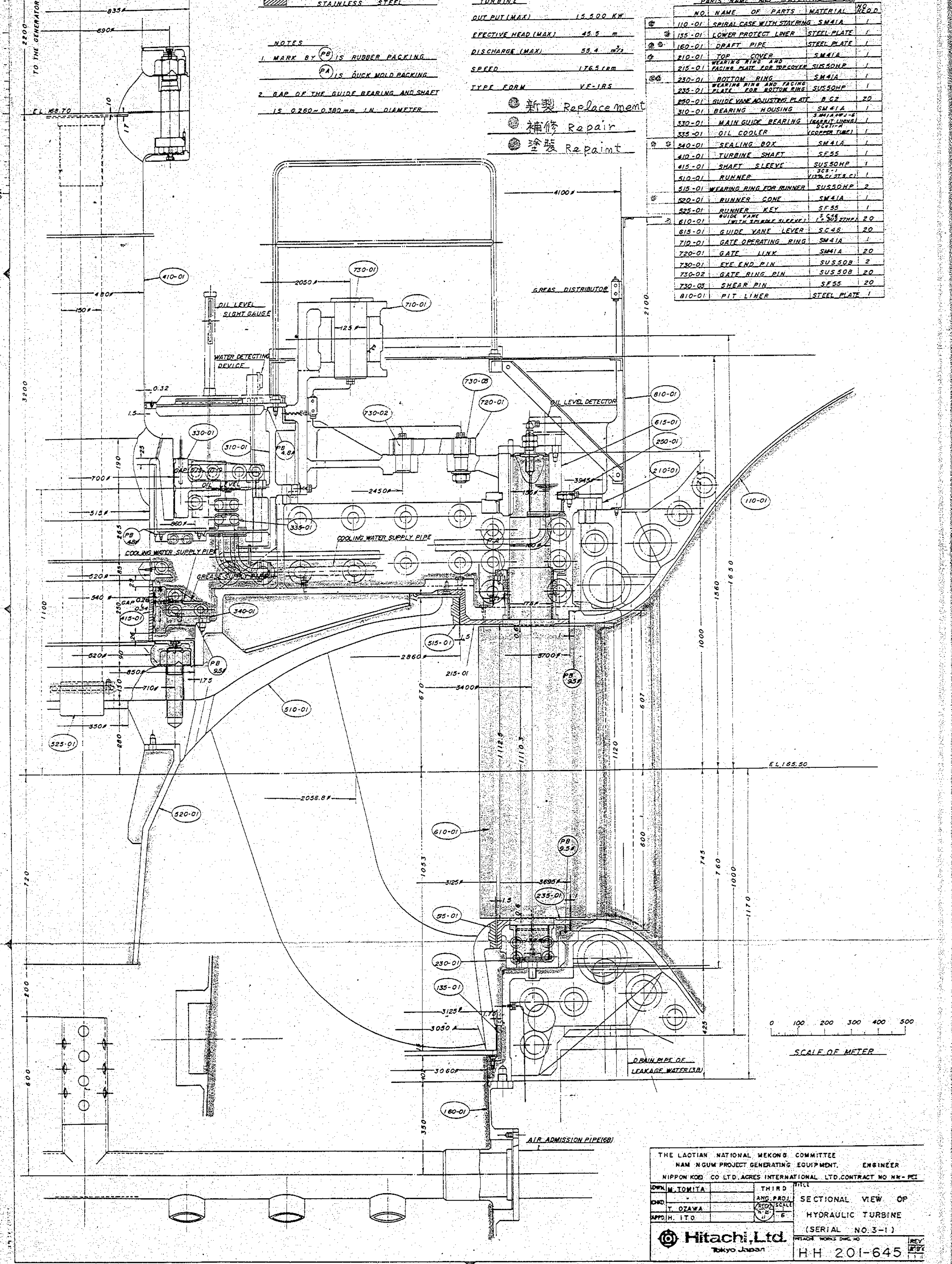
NOTES

1. MARK BY (PB) IS RUBBER PACKING.
   (PA) IS DUCK MOLD PACKING
2. GAP OF THE GUIDE BEARING AND SHAFT IS 0.260~0.380mm I.N. DIAMETER

TURBINE

OUT PUT (MAX)	15,500 KW
EFECTIVE HEAD (MAX)	45.5 m
DISCHARGE (MAX)	55.4 m³/s
SPEED	176.5 rpm
TYPE FORM	VF-1RS

新製 Replacement
補修 Repair
塗装 Repaint



THE LAOTIAN NATIONAL MEKONG COMMITTEE
NAM NGUM PROJECT GENERATING EQUIPMENT. ENGINEER
NIPPON KOEI CO LTD. ACRES INTERNATIONAL LTD. CONTRACT NO NN-PCI

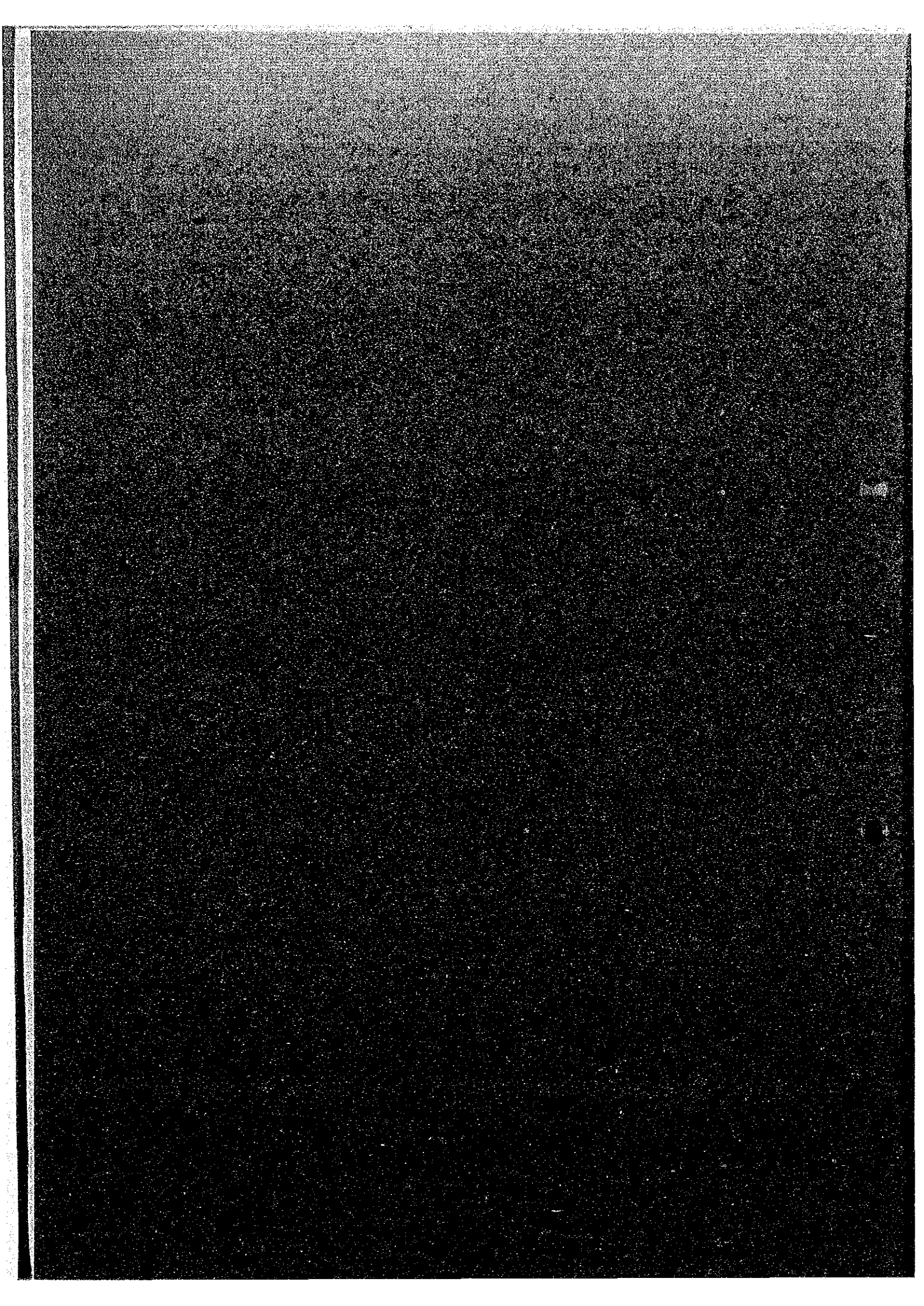
DWN.	M. TOMITA	THIRD ANG. PROJ.	TITLE SECTIONAL VIEW OF HYDRAULIC TURBINE (SERIAL NO.3-1)
CHKD.	T. OZAWA	REDUCE SCALE 1/6	
APPD.	H. ITO		

Hitachi, Ltd. Tokyo Japan

HITACHI WORKS DWG. NO. HH 201-645

CHAPTER-VI

COST ESTIMATE



CHAPTER-VI COST ESTIMATE

Supposing that Group A in the repair items will be incorporated, cost required for the repair will be as follows:

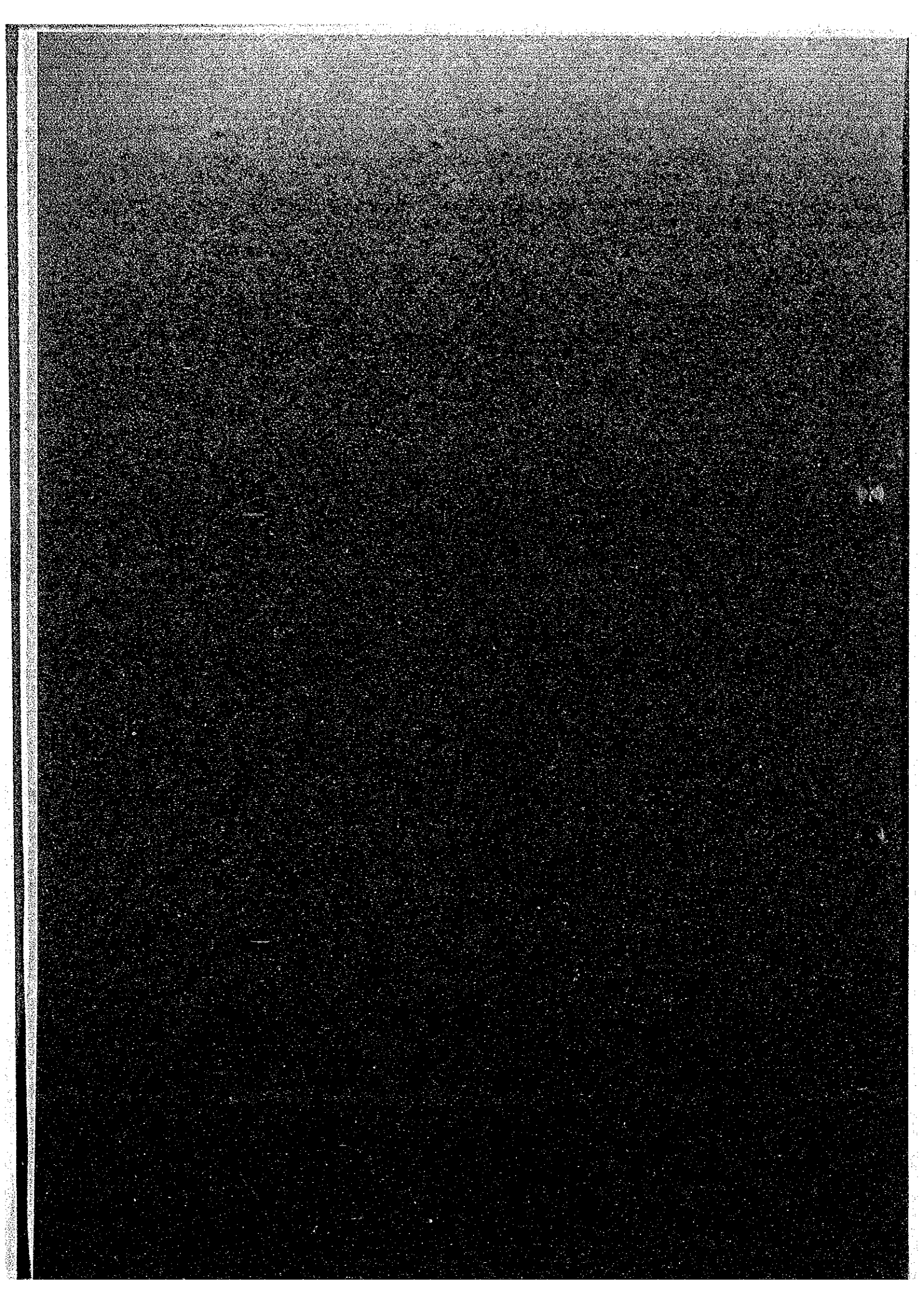
	(x 10^3 Yen)
1. Manufacturing of components (including transportation)	260,000
2. Despatch of personnel	130,000
3. Local cost	90,000
4. General expenses	30,000
5. Engineering service cost	40,000
Total	550,000

Above amount does not include taxes and duties. And conditions concerning inland transportation is assumed as same as in case of the first and second stage of project construction.

As to execution of Group B, which are recommended to be carried out simultaneously with execution of the Group A, it is desirable to negotiate and settle in the course of contract placement because necessary expense for the Group B will not always be costly.

CHAPTER-VII

EFFECT OF REPAIR



CHAPTER-VII EFFECT OF REPAIR

Usually, runner tends to be subject to corrosion and errosion by water. Then, anti-corrosive metallic material such as stainless steel is often selected. In case of the Nam Ngum Power Station, integral cast of stainless steel (13 percent Chrome) was used for the runner.

No corrosion is observed on the runner at present. It means that the stainless steel is very durable against corrosion. This report has proposed to replace the existing guide vanes, which were made of regular cast steel, with stainless steel made ones. By employment of the said guide vanes, it can be expected that their anti-corrosive character will be drastically strengthened, and a large scale repair would be unnecessary for a coming period of 20 to 25 years, even though the present operating pattern of the Nam Ngum Power Station should continue for a long time in future.

Furthermore, the extent of generation of hydrogen sulfide is decreasing with lapse of time. In fact, bad smell of such gas remains very faint now. It is considered that decay of the plants in the reservoir water may have almost disappeared.

Although regular maintenance will have to be carried out properly and periodically, the Nam Ngum Power Station will change expectedly from "power station with headache problem" to "power station without any problem" after completion of the repair work mentioned in this report.

On the other hand, stable voltage, constant frequency and continuity are fundamental factors for good electric power supply. Although authorities concerned in Thailand are very active in power development at present, chronic power shortage is still prevailing. However, consumers in the northeastern district of the country which has very scanty hydropower potential and is very far from large-size power plants located in Bangkok area are sharing the benefit of stable and abundant electricity supplied from the Nam Ngum Power Station. In this sense, it would be significant to make the generating equipment of the Nam Ngum Power Station more resistant against water and easier for periodical inspection and maintenance in order to minimize and to shorten frequency of trouble and required time for repair.

Realization of repair and partial improvement of the generating equipment in accordance with the basic design derived from results of the site investigation this time will be practically advantageous and effective for modernization and industrialization of the northeastern zone in Thailand and in Laos as well.