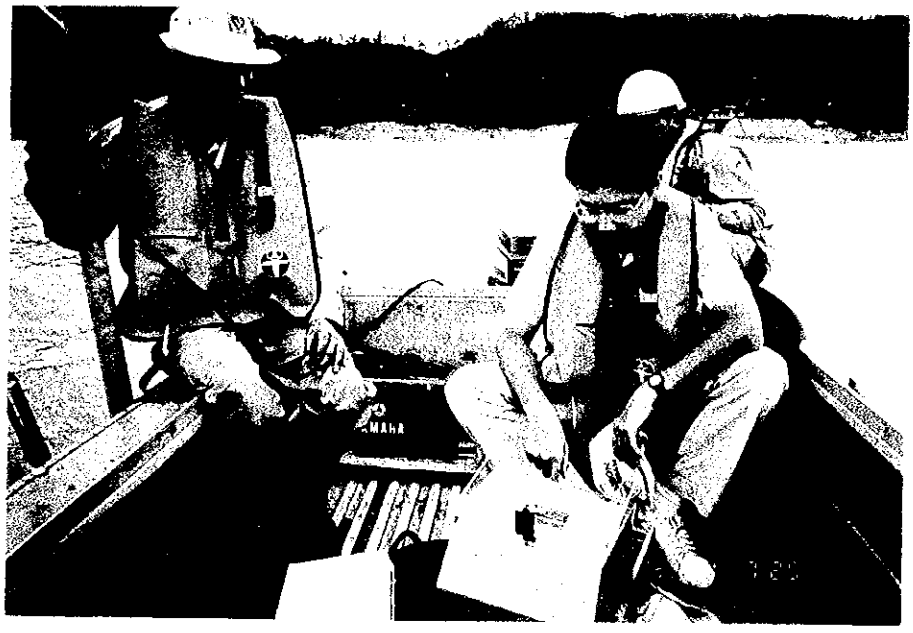
CHAPTER 4

DAM, CIVIL STRUCTURES AND HYDROLOGICAL DATA ACQUISITION SYSTEM

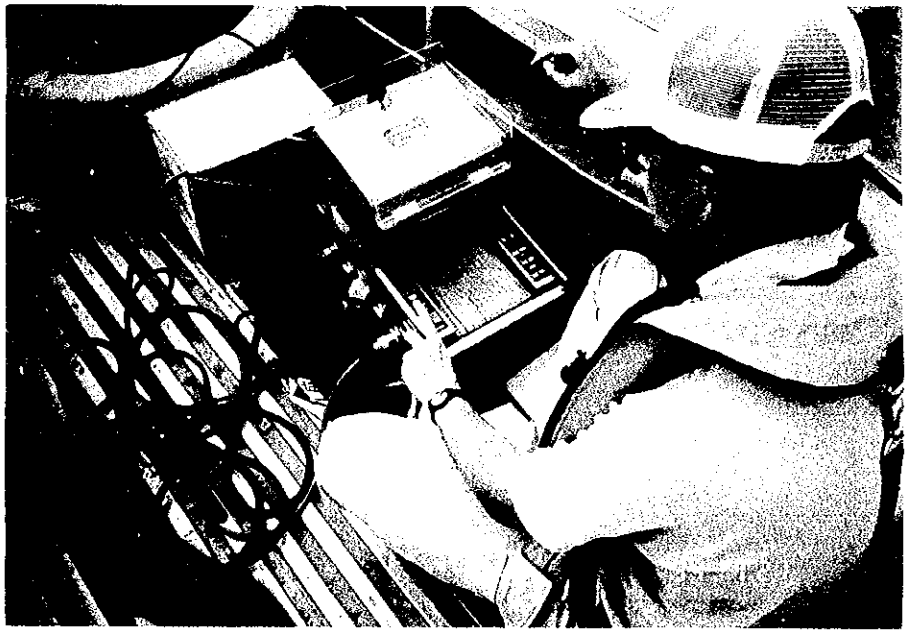
1. Reservior Cross Section Survey with a Set of Echo-Sounder (1/2)

音響測探機による貯水池探浅測量（1/2）



2. Reservior Cross Section Survey with a Set of Echo-Sounder (2/2)

音響測探機による貯水池探浅測量（2/2）

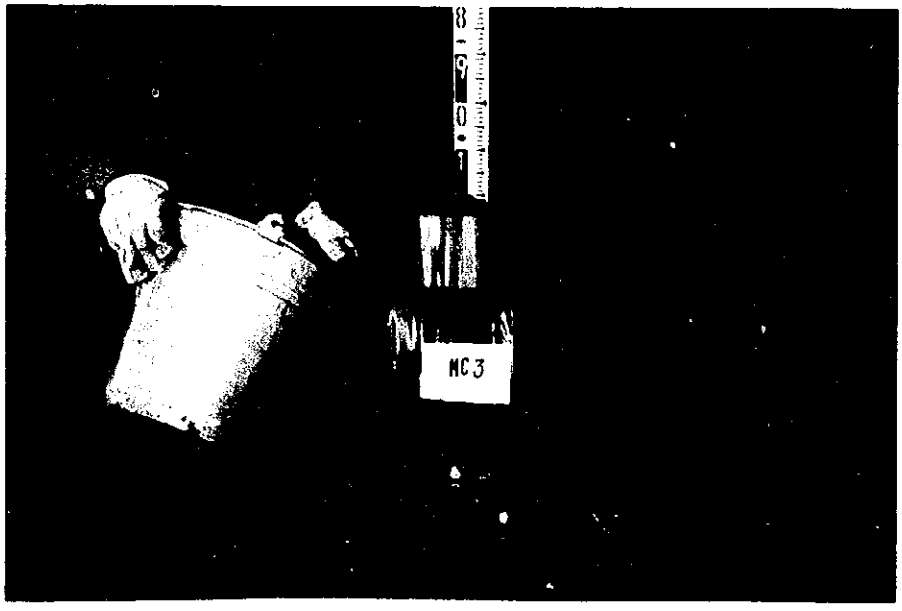


3. Reservior Cross Section Survey of Expased Ground below HWL (Leveling Measurement)

常時満水位以下の地上部分の貯水池横断測量（水準測量）

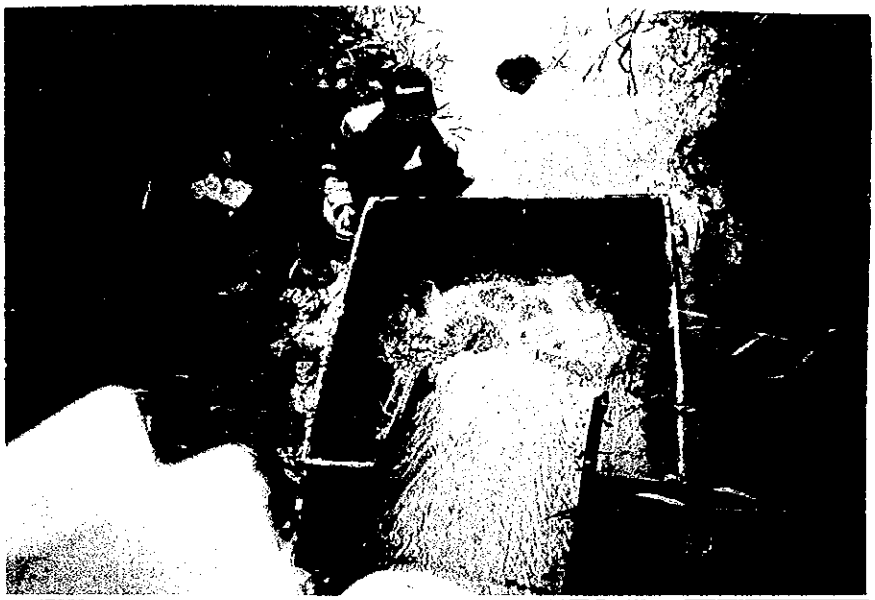
4. Installation of the Concrete-made Base Points for Checking the Condition of the Reservoir Sedimentation

貯水池の堆砂状況確認の為のコンクリート製測量杭の設置



5. Measurement of the Seepage through the Dam (1/2)
(Total Seepage through the Dam)

ダム提体からの漏水量測定（1/2）
（総漏水量測定）



6. Measurement of the Seepage through the Dam (2/2)
(Measurement of Seepage Volume from Relief Well)

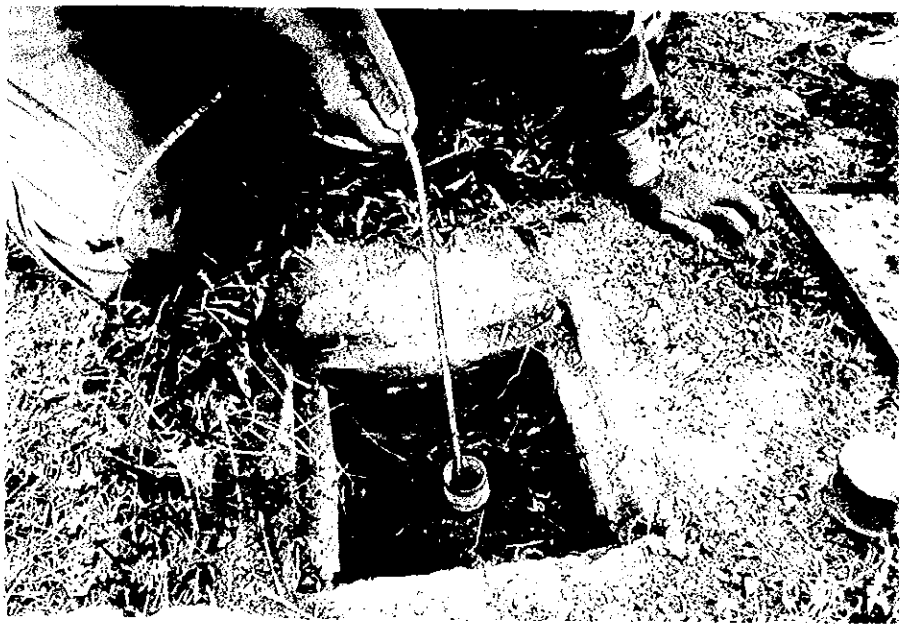
ダム提体からの漏水量測定（2/2）
（観測井戸からの漏水量測定）

7. Mesurement of Water Level in the Dam Body (1/2)

ダム提体内の水位測定（1/2）

8. Mesurement of Water Level in the Dam Body (2/2)

ダム提体内の水位測定（2/2）

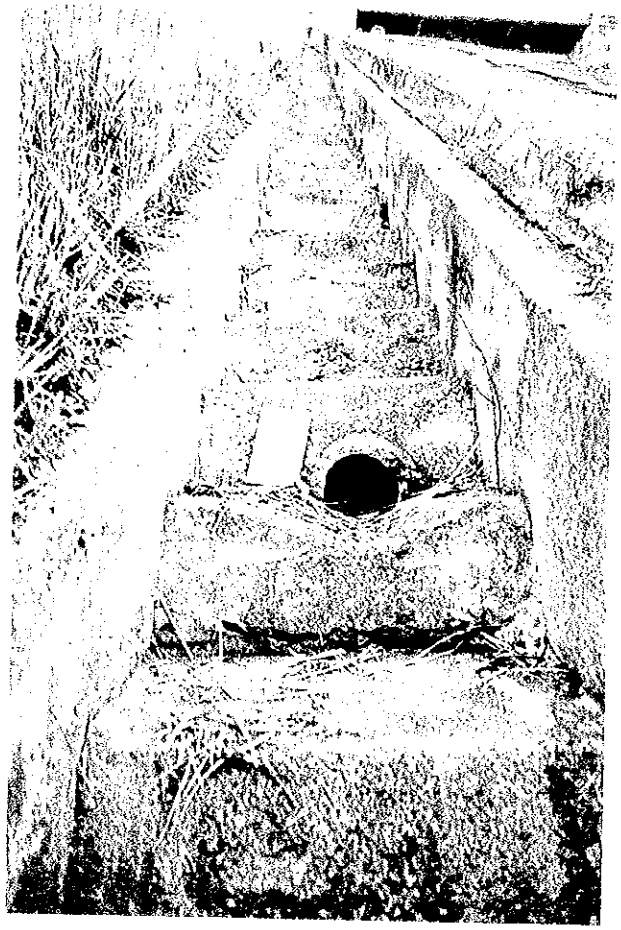


9. About 10m Long Crock and Land Slide which Took Place on Surface of Dounstream Embbankment Slope of Dam near the Spillway Right Wall in 1978

1978年における洪水吐付近ダム下流側の法面上の亀裂（長さ10m）と法面崩壊の発生状況

10. Drain Pipe Installed on Concrete Stair beside the Dounstream Spillway Right Wall

洪水吐の下流側右岸に設置されている排水パイプ

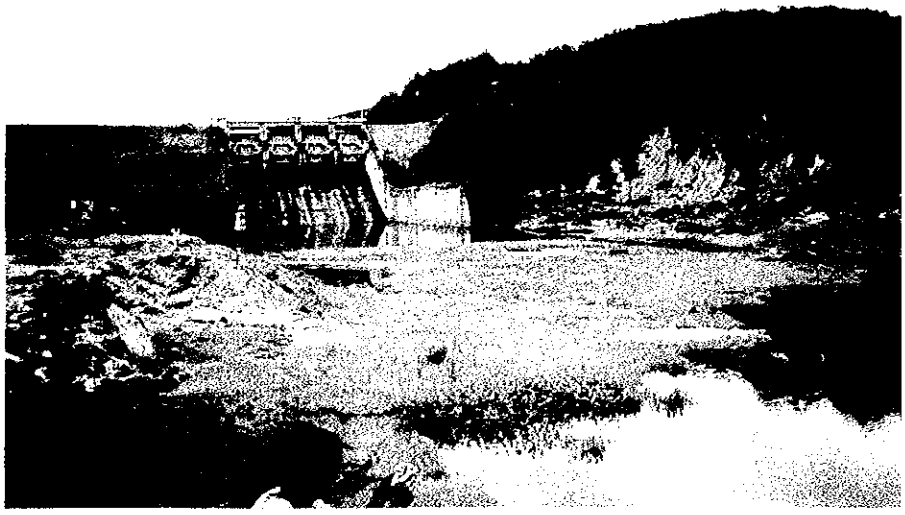


11. Erosion along Left Bank Side of the Reservoir in the Upstream Portion of Spillway

洪水吐に近い貯水池左岸側斜面の浸食

12. View of River Bank Erosion in the Doun Stream Portion of Spillway

洪水吐下流側の河岸浸食状況



13. Land Slide Occuring around Inlet Channel of Intake Structure (1/2)

取水口付近の法面崩壊箇所（1/2）

14. Land Slide Occuring around Inlet Channel of Intake Structure (2/2)

取水口付近の法面崩壊箇所（2/2）

15. Inspection of Foundation of the Penstock Line
(Anchor Block No. 3 - No. 7)

水圧鉄管路の基礎調査
(ｱﾝｶｰﾌﾞﾛｯｸ No. 3 - No.7)

16. Inspection of Anchor Blocks of Penstock Line
(Anchor Block No.8)

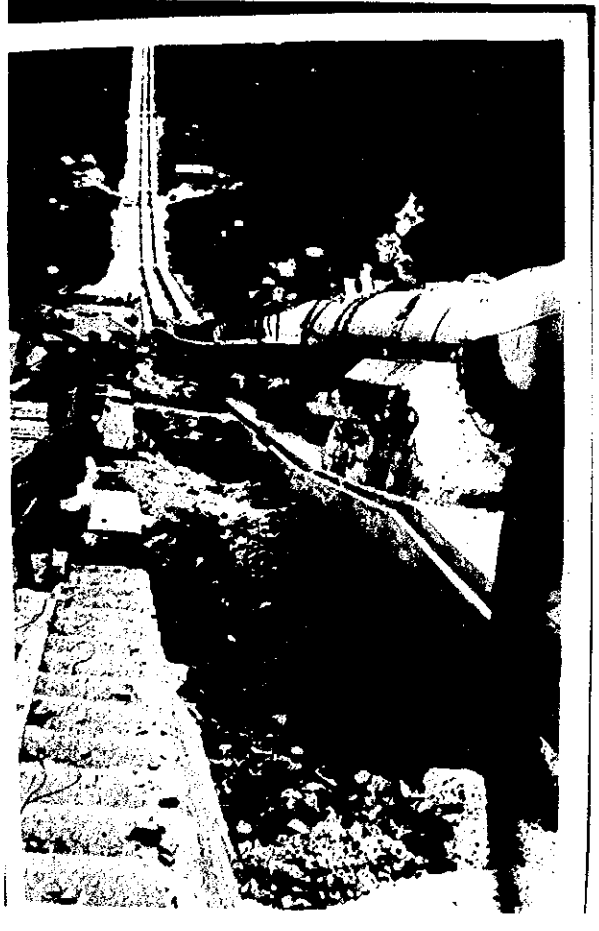
水圧鉄管路のｱﾝｶｰﾌﾞﾛｯｸ調査
(ｱﾝｶｰﾌﾞﾛｯｸ No. 8)

17. Steep Sloped Portion of Penstock Line Destroyed in the Past (1/2)
(It was restored by Da Nhim P/S office in 1976.)

破壊された急勾配部分の水圧鉄管路（1/2）
（その後1976年にダニム発電所により修復された。）

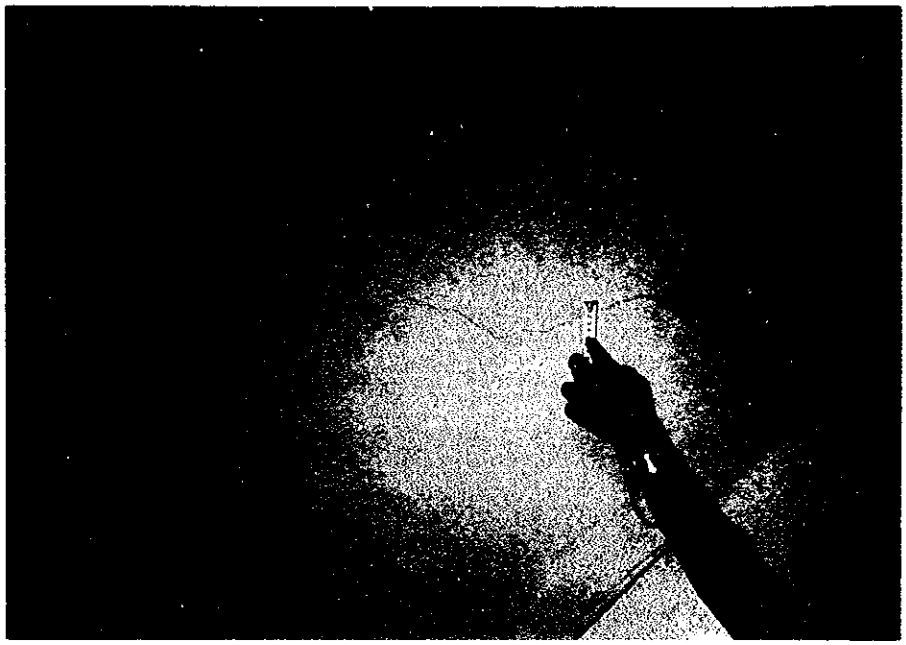
18. Steep Sloped Portion of Penstock Line Destroyed in the Past (2/2)
(It was restored by Da Nhim P/S office in 1976.)

破壊された急勾配部分の水圧鉄管路（2/2）
（その後1976年にダニム発電所により修復された。）



19. Cracks in Concrete Wall of Powerhouse

発電所のコンクリート壁の亀裂



20. Rehabilitation Works for Land Slope on the Left Bank (from the Road Surface to the Reservoir Surface)

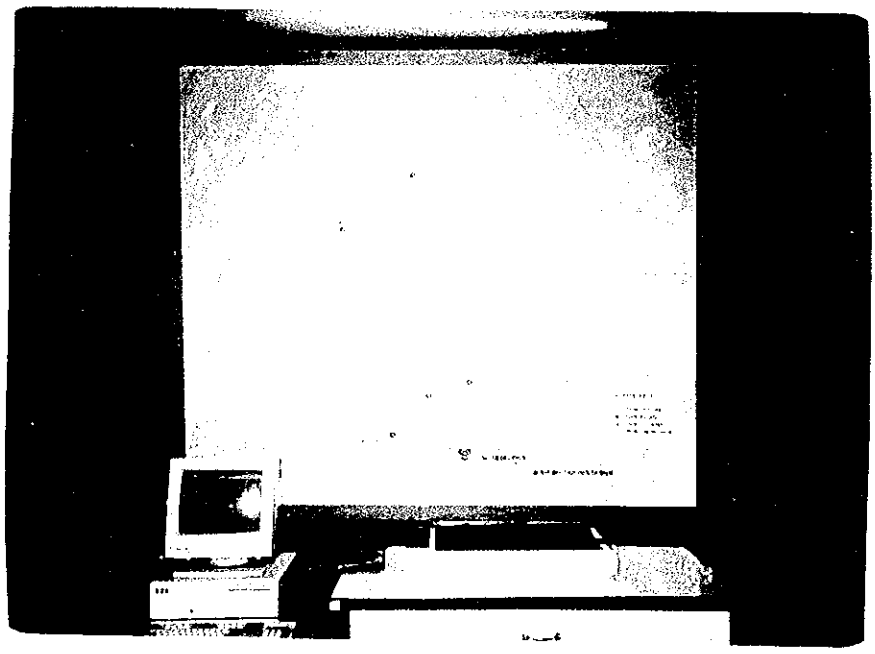
左岸側道路の法面保護工事
(道路から貯水池水面に下る法面)

21. Inspection of White Ants on the Dam Body

ダム提体における白アリ調査

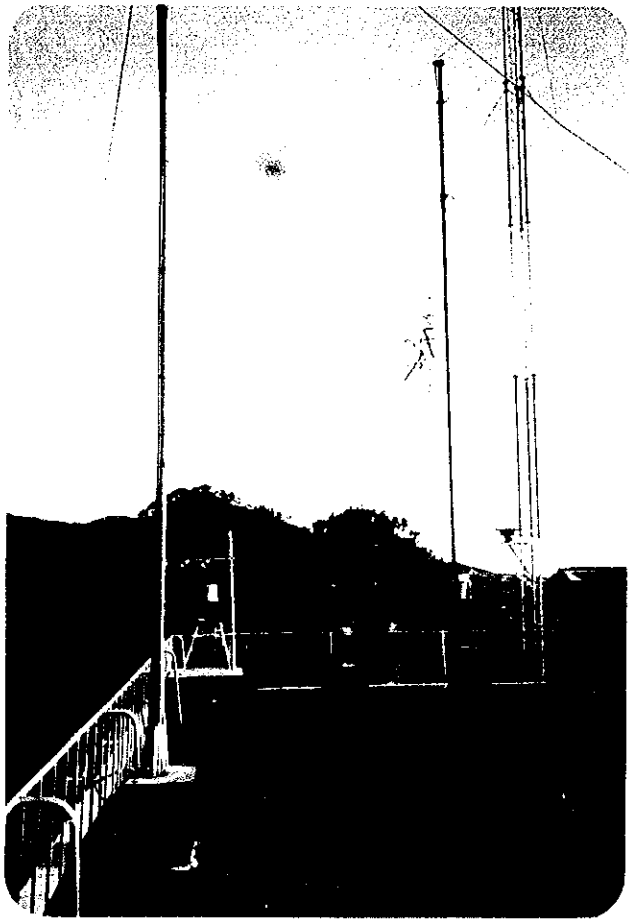
22. Central Station at the Dam Site (1/2)

ダムサイトにある中央観測所（1/2）



23. Central Station at the Dam Site (2/2)

ダムサイトにある中央観測所（2/2）

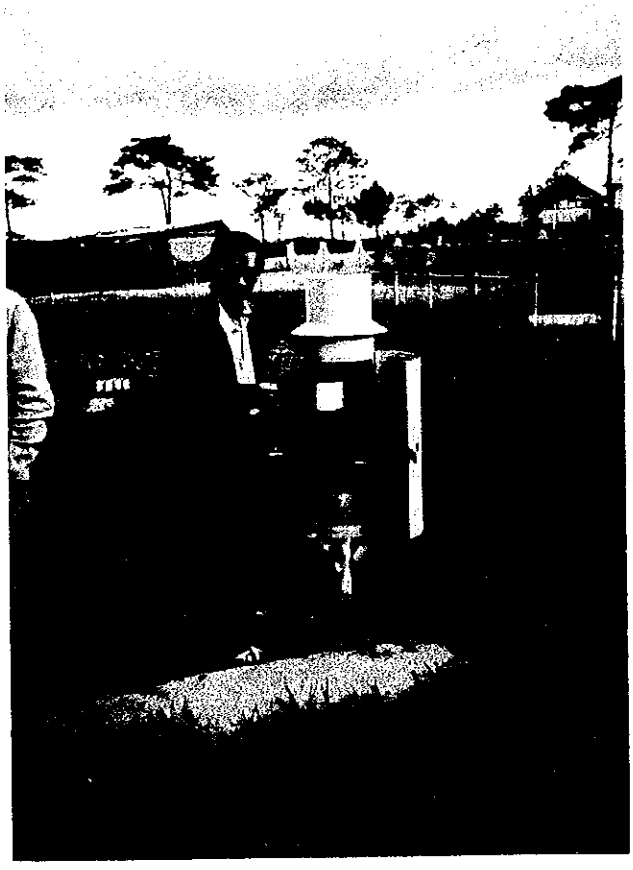


24. Dalat Meteorological Station (1/2)

ダラット　気象観測所（1/2）

25. Dalat Meteorological Station (2/2)

ダラット　気象観測所（2/2）



26. Viewing Upstream of the Left Bank of Reservoir

貯水池左岸側からの上流域の状況

27. Downstream View of the Dam

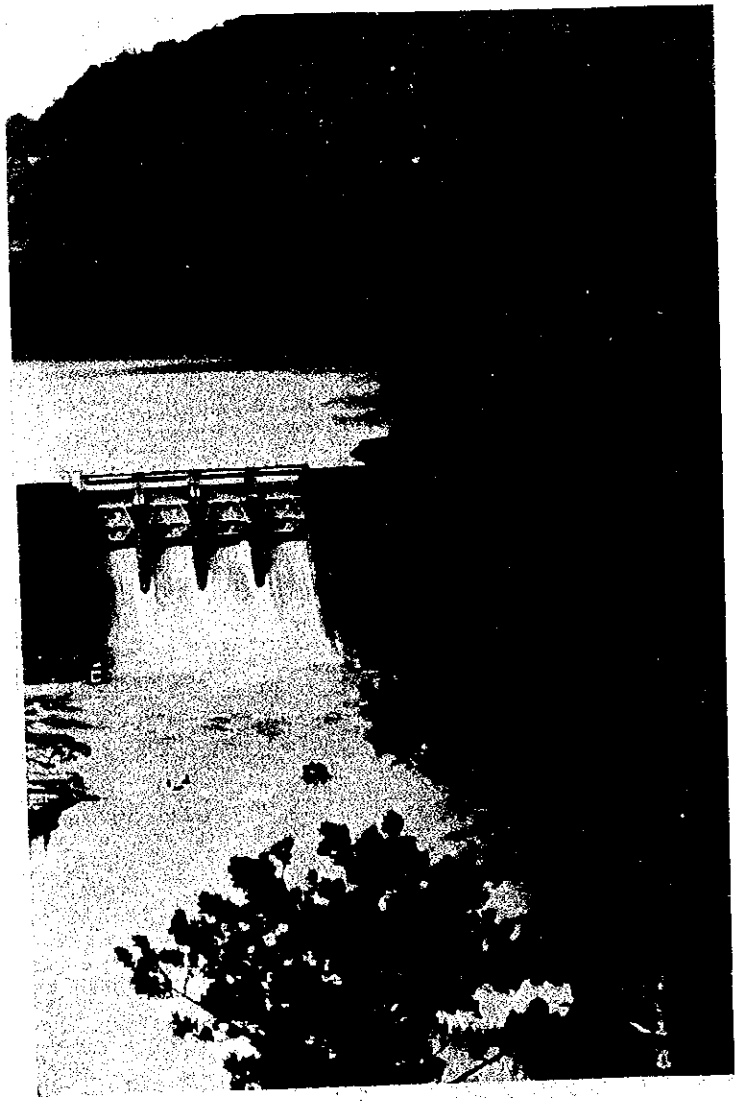
ダム下流域の状況

28. Dou Duoug Bridge in the Downstream of the Dam
(Viewed from Downstream)

ダム下流の Dou Duoug 橋
（下流から見た写真）

29. The 1993 Flood with a Peak Discharge of about 1,600 m3/sec

1993年の洪水時の洪水吐放流（ピーク流入量 1,600 m3/sec）



CHAPTER 5

SUBSTATION FACILITIES

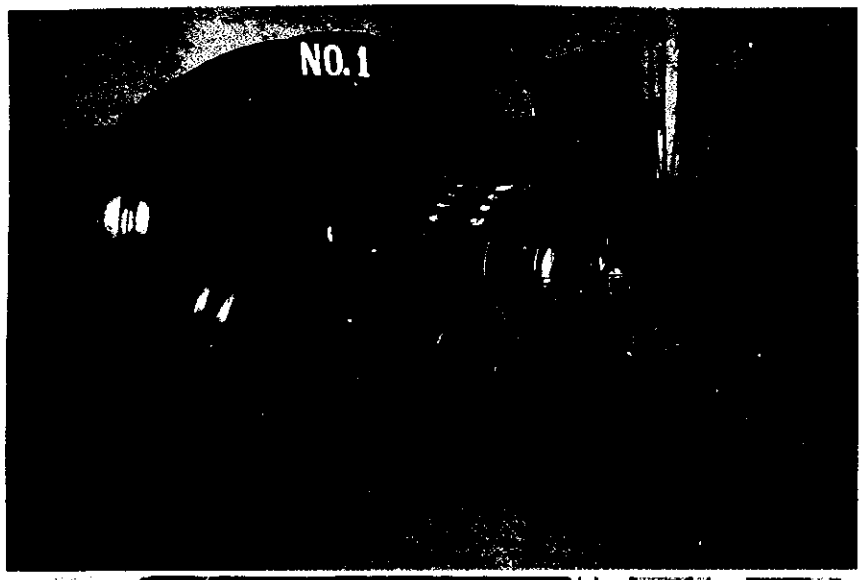
5.1 SAIGON SUBSTATION

Synchronous Condensers 同期調相機

1. General View of Synchronous Condenser

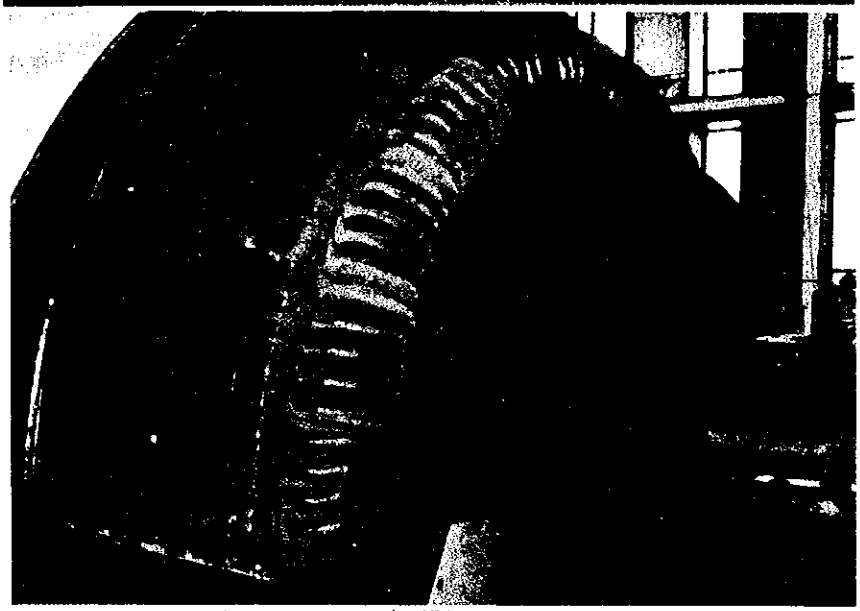
   同期調相機外観

   19,000 kVA (leading)
   11,000 V, 998 A
   750 rpm



2. Synchronous Condenser (Unit No. 2) under Disassembling
   (Viewed from PMG Side)
   Windings were covered with heavy dust.

   同期調相機（２号機）の分解状況
   （PGM 側）
   内部は塵埃の付着量が多い。



3. Synchronous Condenser (Unit No. 1) under Inspection

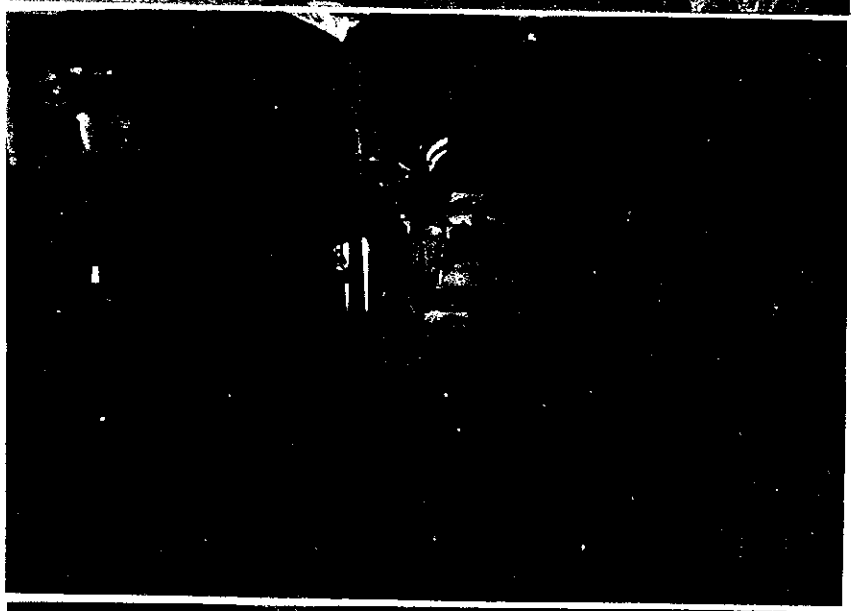
   同期調相機（１号機）の検査風景

4. Fretting Corrosion on the Main Shaft at the PMG Side of Unit No. 1

1号機のPMG側で主軸と回転子スパイダーのかん合部に現れたフレッティングコロージョン

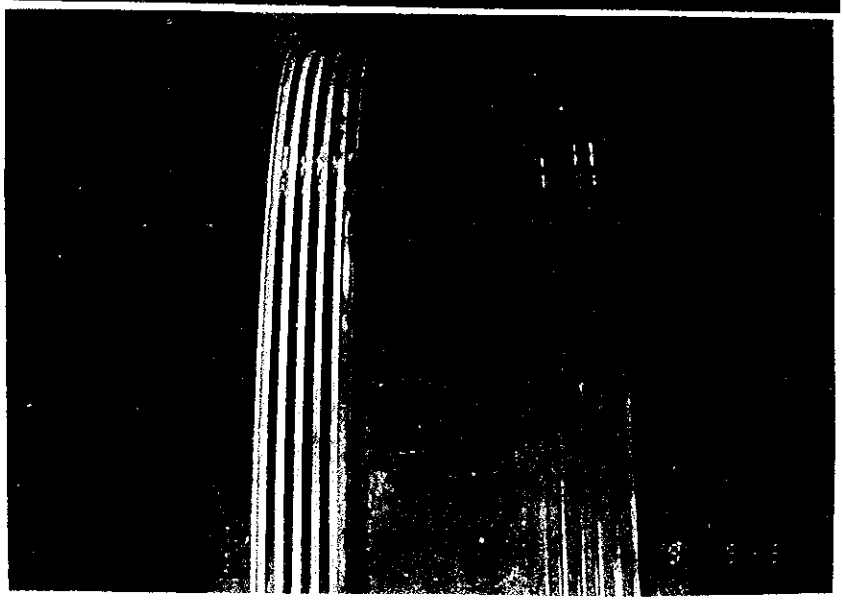
5. Damage on Support Insulator of Brush Holder for Unit No. 1

1号機のブラシホルダー支持棒の絶縁筒の溶断状況



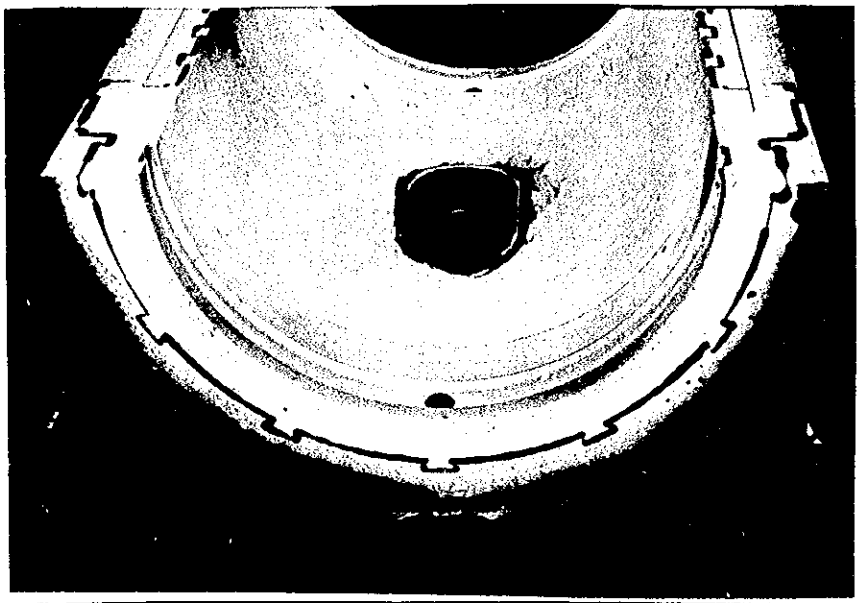
6. Worn-out Conditions of Slip Rings for Unit No. 1

1号機のスリップリングの磨耗状況



7. Split-off Conditions of Babbit Metal Lining for Bearing Metal for Unit No.1

軸受メタルの剥離状況（1号機）

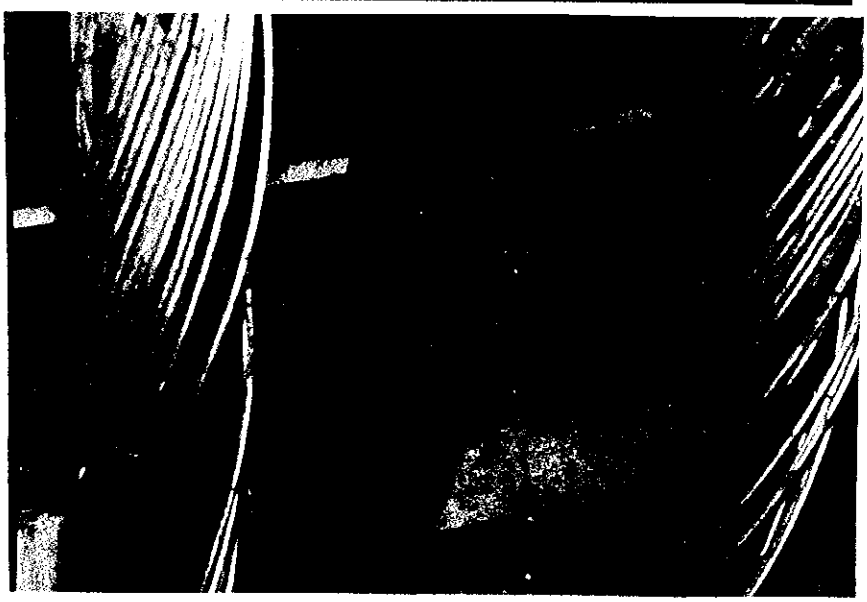


8. Line Side Terminal Conductors Covered with Heavy Dust (Unit No. 2)

ライン側引き出し導体の塵埃付着状況（2号機）

9. Deformation of 11 kV Power Cable

11 kV 電力ケーブルの変形

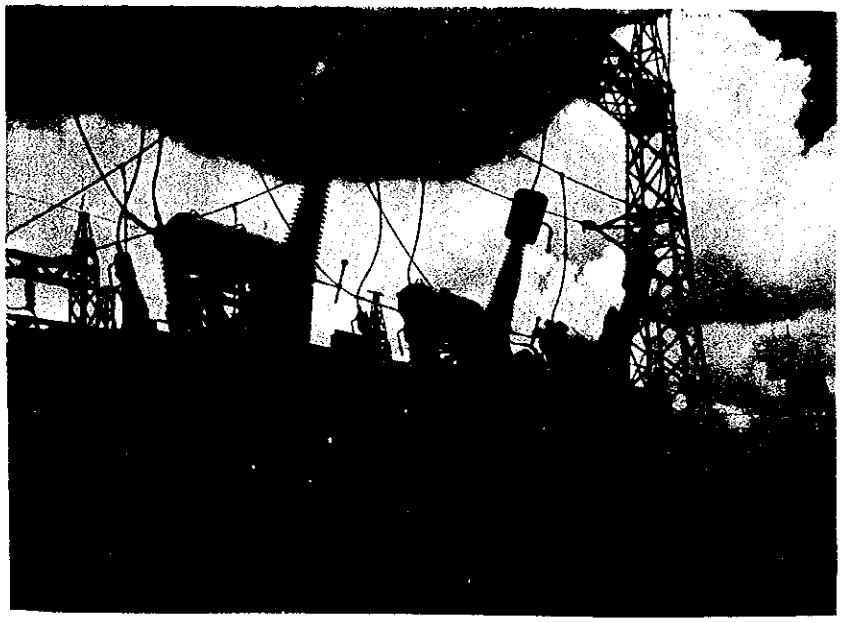


Main Transformers　　主要変圧器

1. General View of Main Transformer "2T"

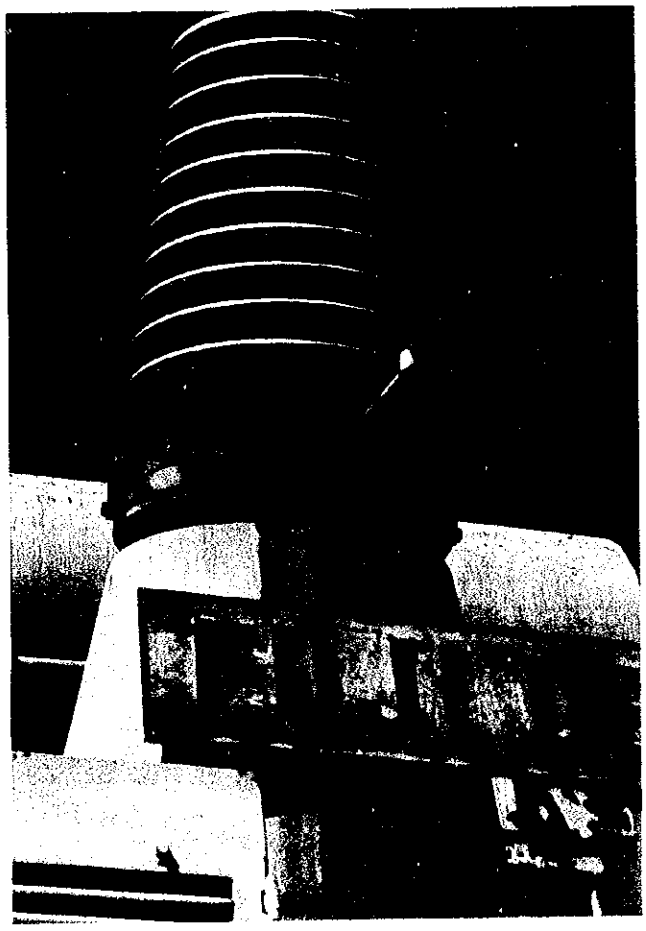
   主要変圧器 "2T" の外観

   Single-phase x 3
   26/28/13 MVA x 3
   $\frac{230}{\sqrt{3}} / \frac{66}{\sqrt{3}} / 11$ kV
   OFAF



2. Oil Leakage from 230 kV Line Bushing
   (Main Transformer "2T")

   230 kV ブッシングの漏油状況
   （主要変圧器 "2T"）

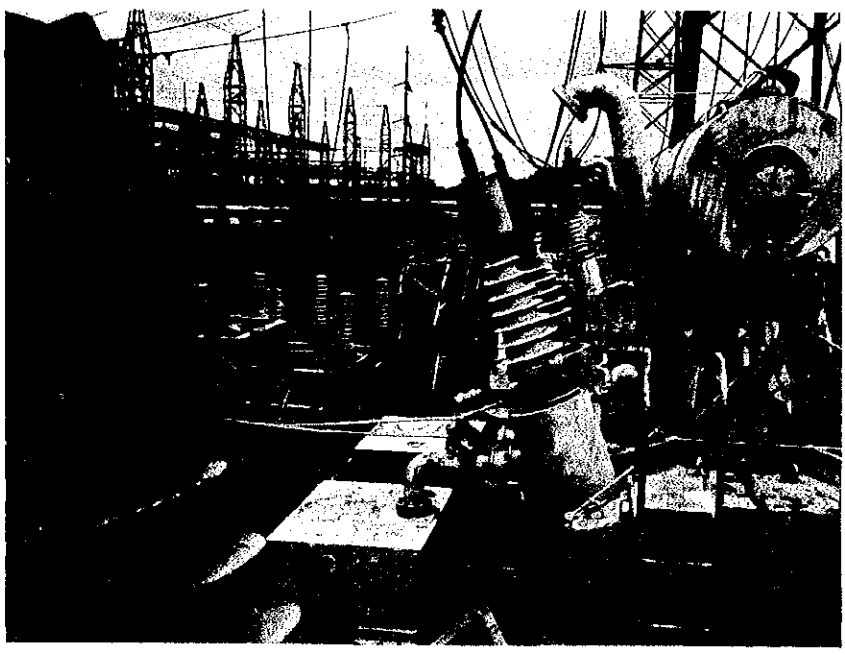


3. Oil Leakage from 230 kV Neutral Bushing
(Main Transformer "2T")

230 kV 中性点ブッシングの漏油状況
（主要変圧器 "2T"）

4. Oil Leakage from 66 kV Bushing
(Main Transformer "1T")

66 kV ブッシングからの漏油状況
（主要変圧器 "1T"）

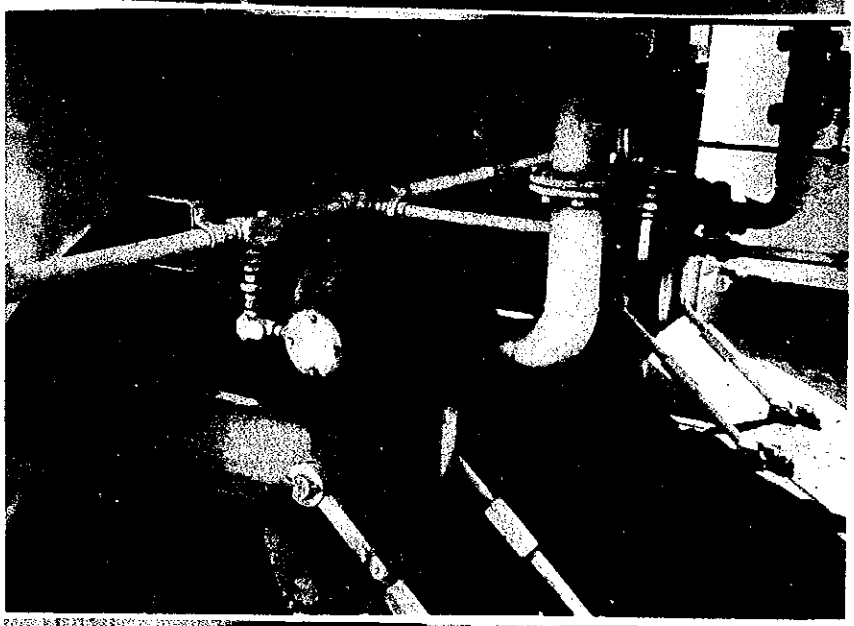


5. Oil Leakage from 11 kV Bushing
(Main Transformer "1T")

11 kV ブッシングからの漏油状況
（主要変圧器 "1T"）

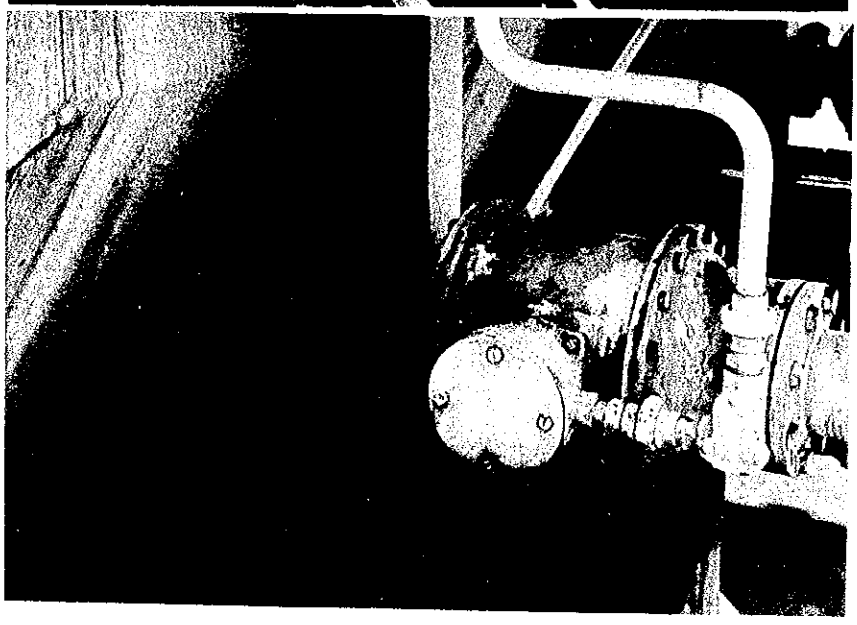
6. Oil Leakage from Oil Pump
(Main Transformer "2T")

送油ポンプからの漏油状況
（主要変圧器 "2T"）



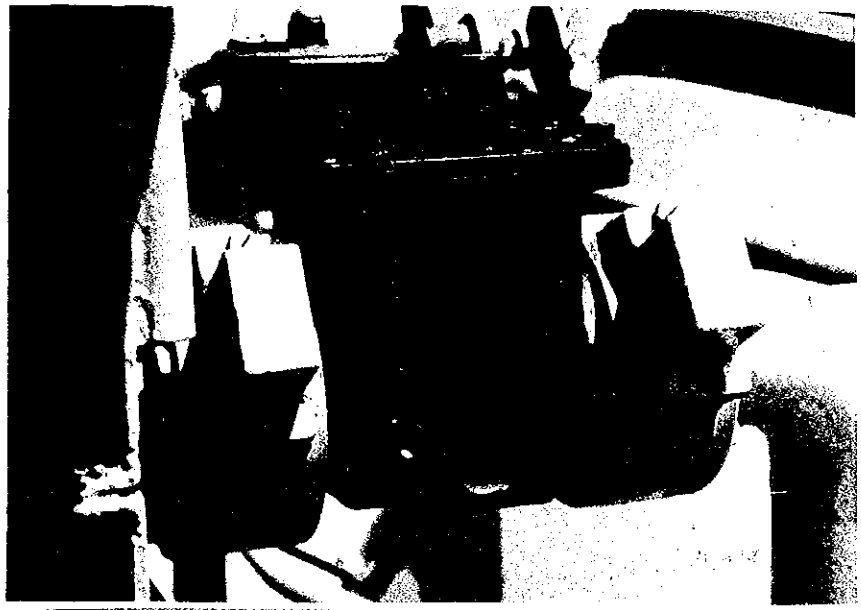
7. Oil Leakage from Radiator Valve
(Main Transformer "1T")

放熱器弁からの漏油状況
（主要変圧器 "1T"）



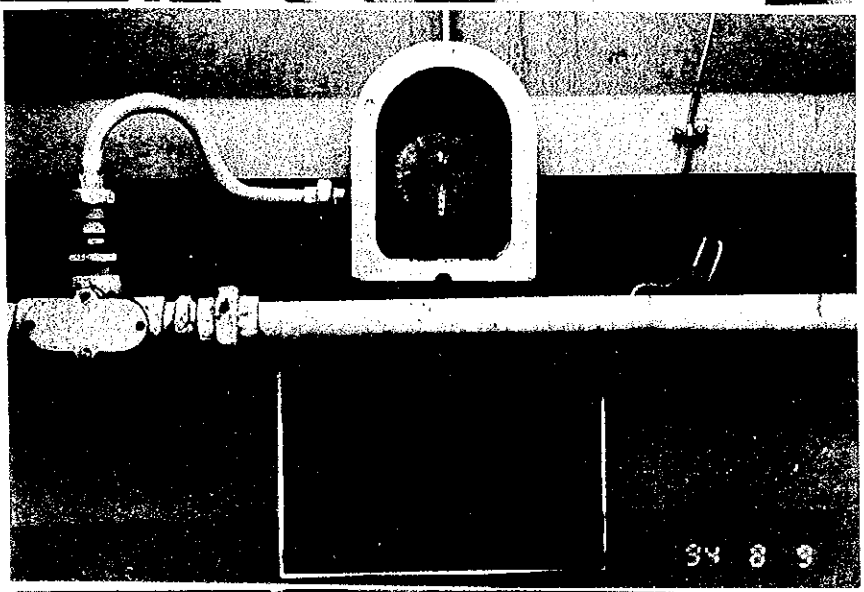
8. Buchholts Relay on Main Transformer

ブッフホルツ継電器の外観



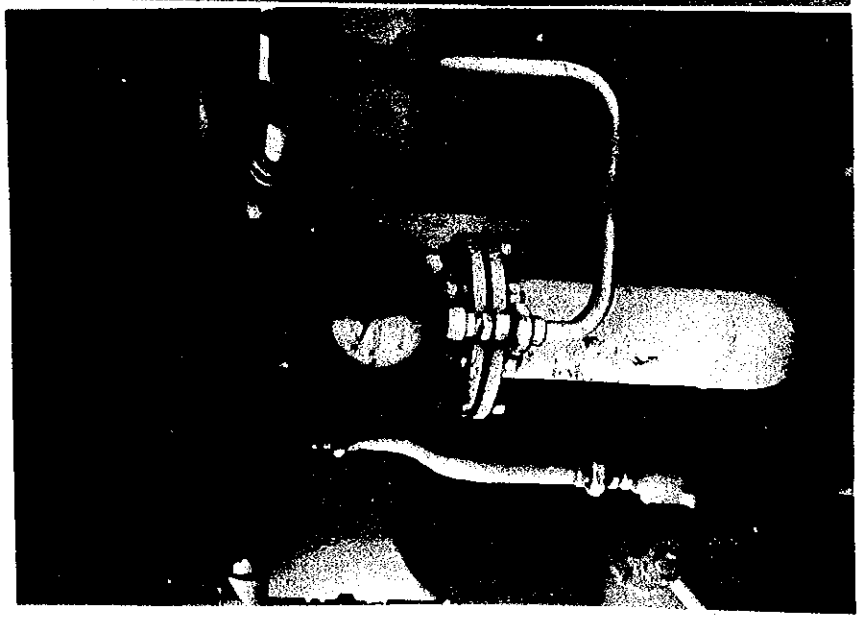
9. Dial Thermometer on Main Transformer

ダイアル温度計の外観



10. Oil Flow Relay on Main Transformer

油流指示器の外観

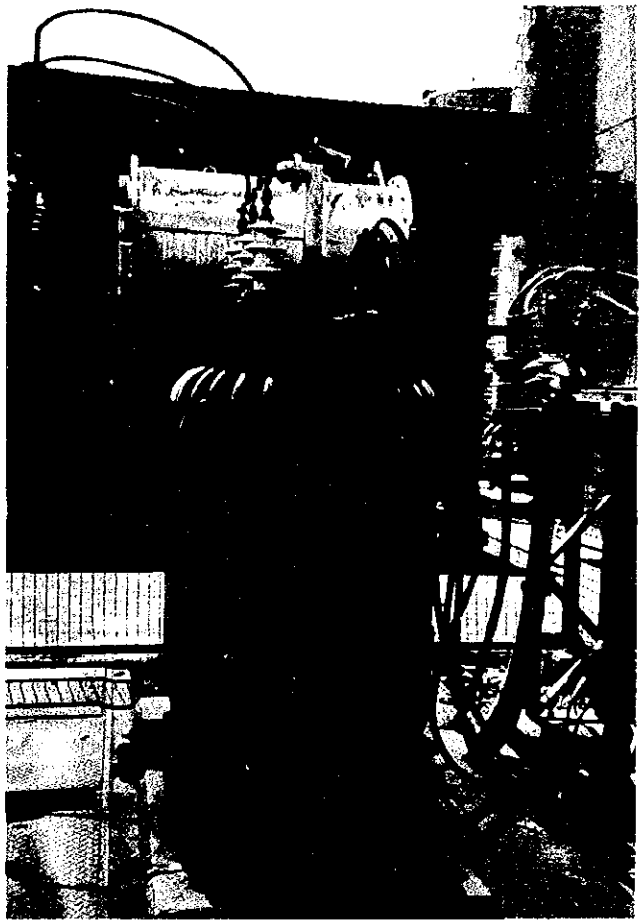


House-service Transformer 所内変圧器

1. General View of House-service Transformer "5T"

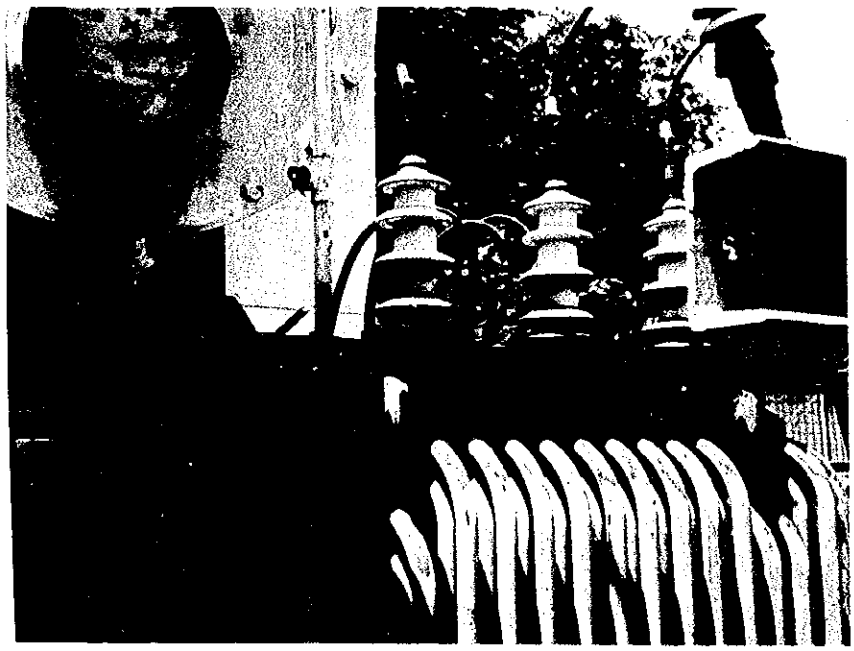
   所内変圧器 "5T" の外観

   Three-phase
   300 kVA
   11/0.38 kV
   ONAN, Dyn 11



2. Oil Leakage from Top Cover of Tank (House-service Transformer "5T")

   タンク上ぶたからの漏油状況
   (所内変圧器 "5T")



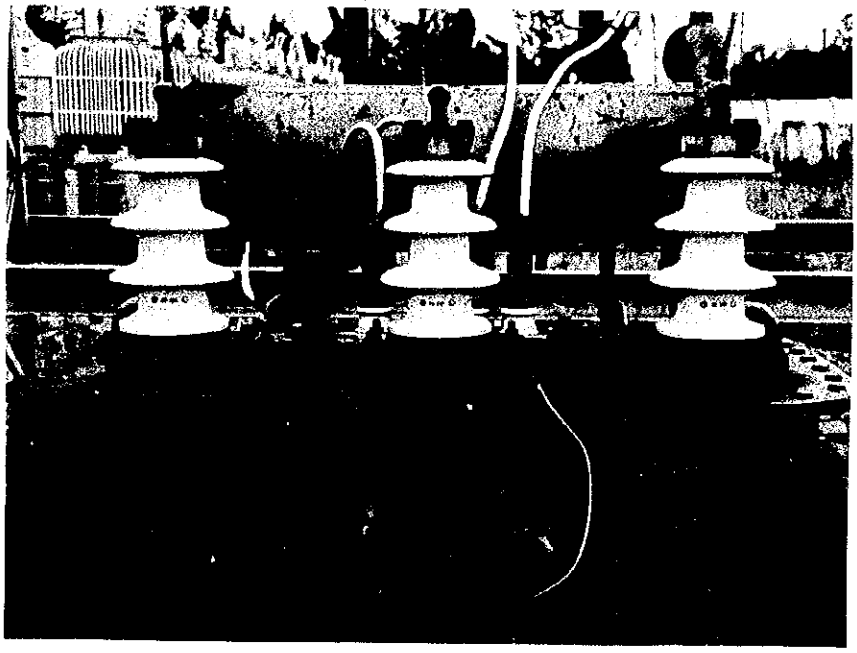
3. General View of House-service Transformer "7T"

所内変圧器 "7T" の外観

Three-phase
300 kVA
15/0.38 kV
ONAN, Dyn II

4. Oil Leakage and Rust on the Upper Part of Transformer (House-service Transformer "5T")

変圧器上部の漏油および発錆状況（所内変圧器 "5T"）

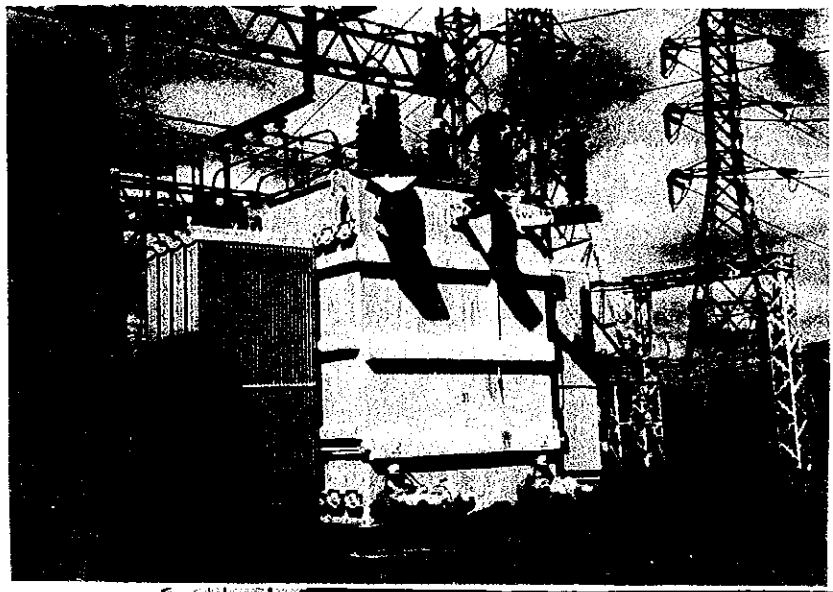


66kV Transformers　　66kV変圧器

1. General View of 66 kV Transformer "3T"

   66 kV 変圧器 "3T" の外観

   Three-Phase
   12/16/20 MVA
   66/15 kV
   ONAF
   Dyn 1

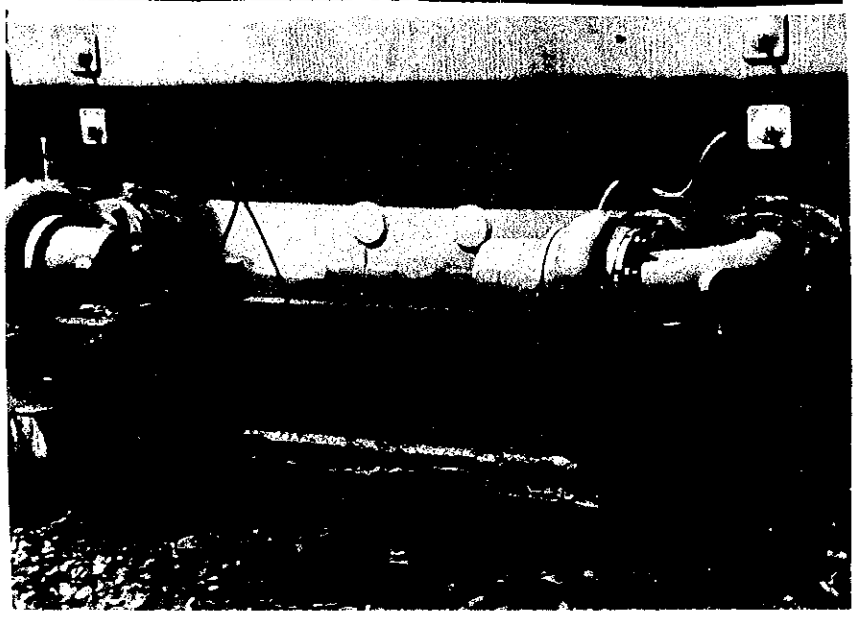


2. Oil Leakage from On-load Tap-changer
   (66 kV Transformer "3T")

   負荷時タップ切替器からの漏油状況
   （66 kV 変圧器 "3T"）

3. Oil Leakage from Oil Pumps
   (66 kV Transformer "4T")

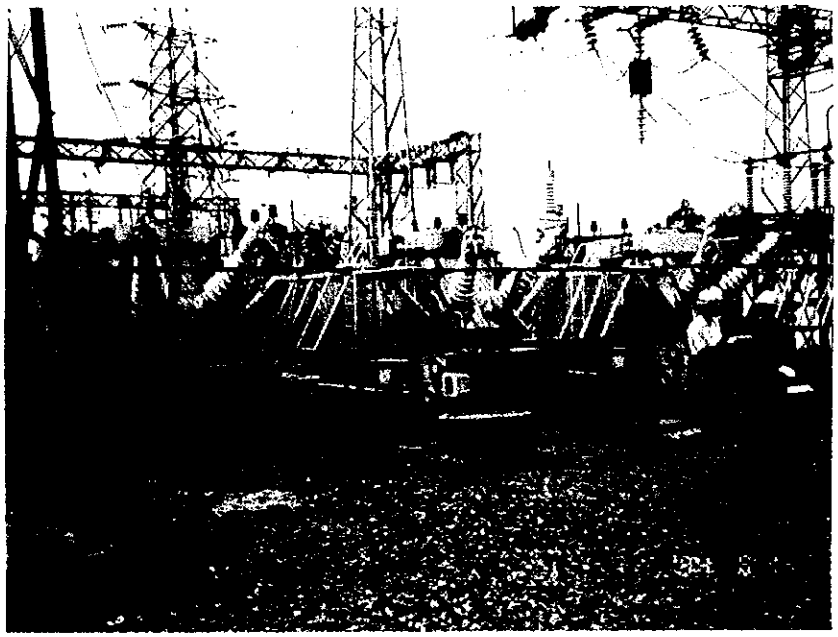
   送油ポンプからの漏油状況
   （66 kV 変圧器 "4T"）



4. General View of 66 kV Transformer "9T"

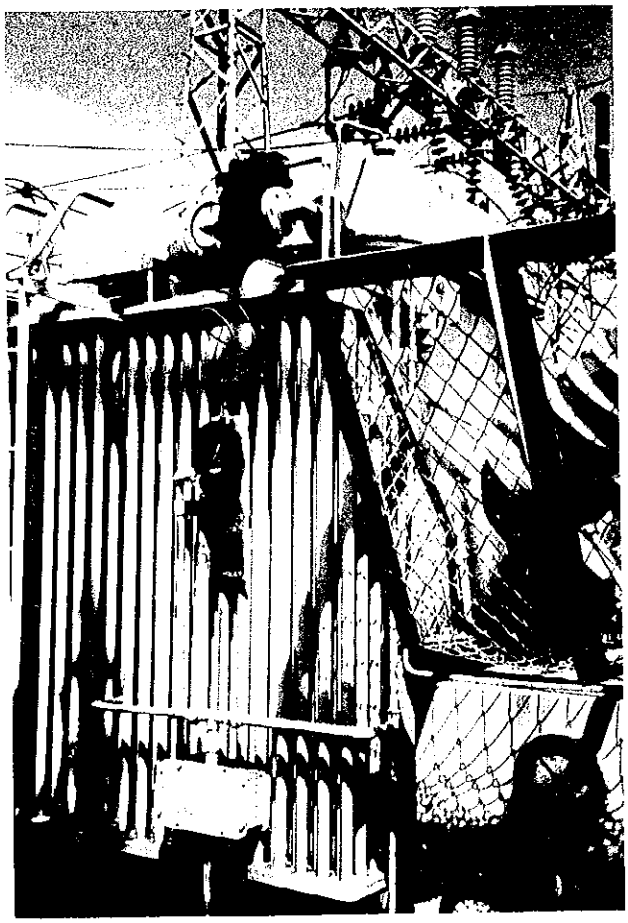
66 kV 変圧器 "9T" の外観

Single-phase x 3
2 MVA x 3
66/15 kV
ONAN



5. Oil Leakage from the Upper Part (66 kV Transformer "9T")

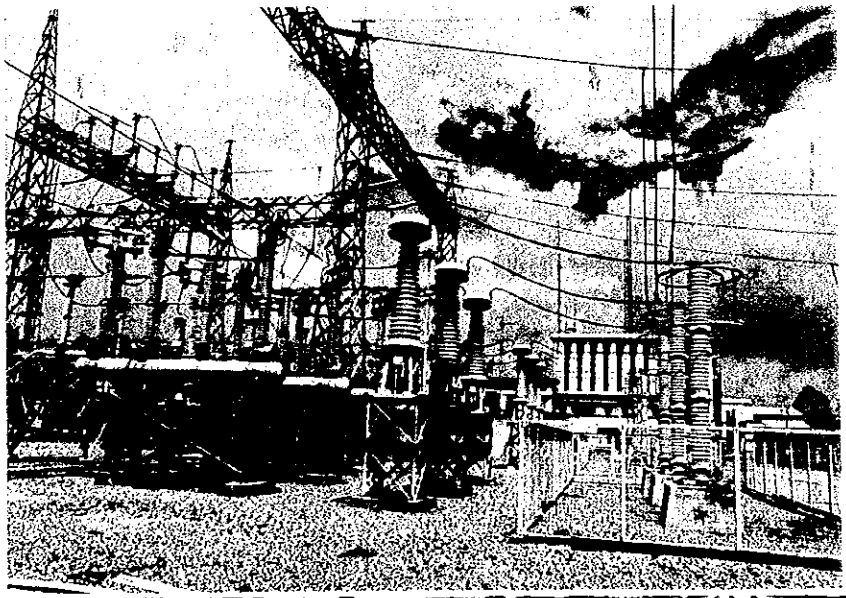
変圧器上部からの漏油状況
（66 kV 変圧器 "9T"）



Switchgear　　開閉機器

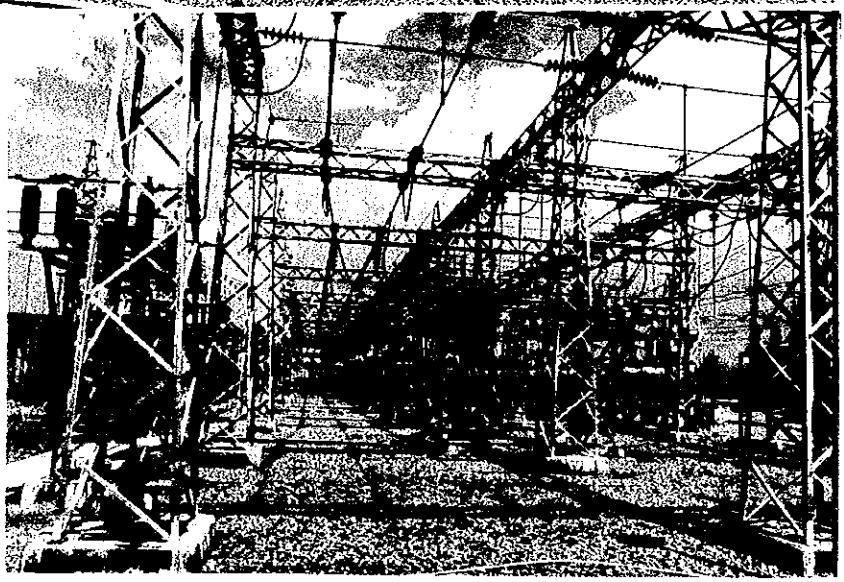
1. General View of 230 kV Switchyard

   230 kV 開閉所概観



2. General View of 66 kV Switchyard

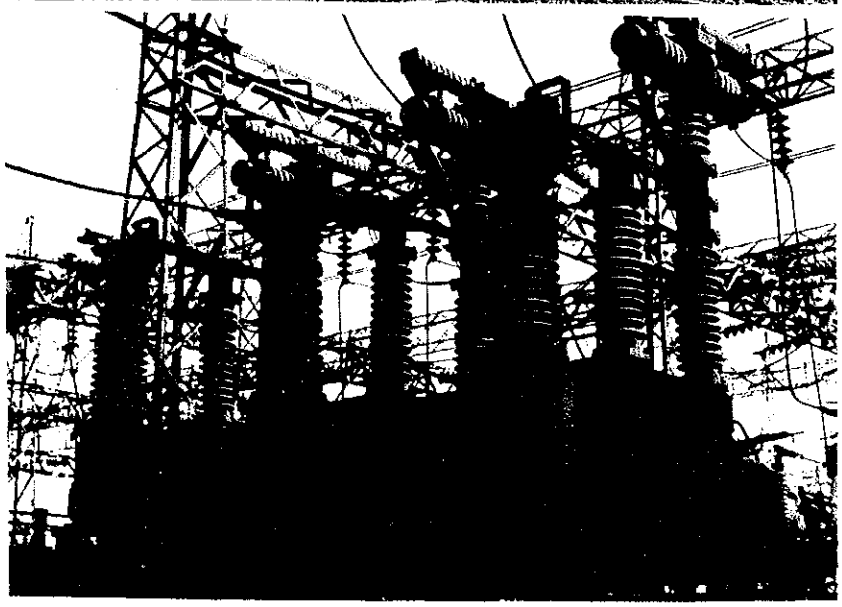
   66 kV 開閉所概観



3. General View of 66 kV Air-blast Type Circuit Breaker and Current Transformer Unit

   Oil leakage was observed on each current transformer.

   66 kV 空気遮断器変流器ユニット外観
   各相変流器で漏油が観測された。

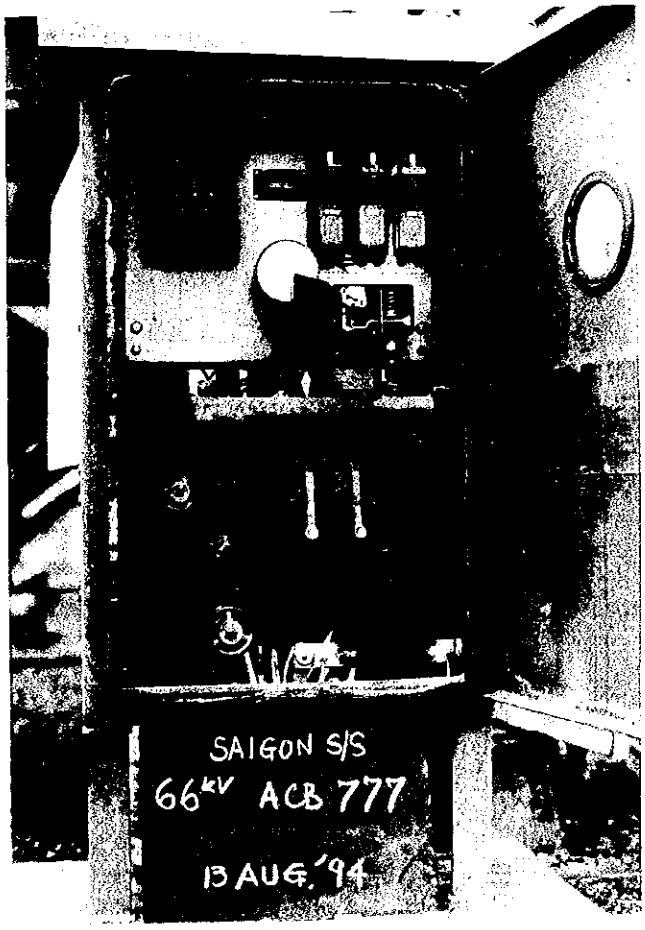


4. Oil Leakage from Dash-pot Part of 66 kV Air-blast Type Circuit Breaker

66 kV 空気遮断器のダッシュポット部からの漏油状況

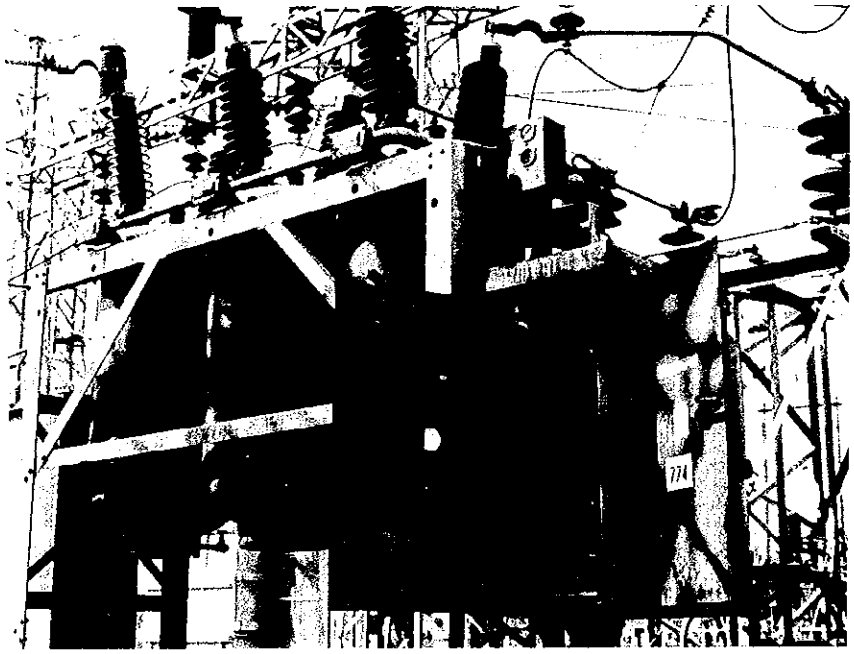
5. Corrosion of Local Control Box for 66 kV Air-blast Type Circuit Breaker

66 kV 空気遮断器現場制御箱の腐食状況



6. General View of 66 kV Oil Circuit Breaker

66 kV 油遮断器外観

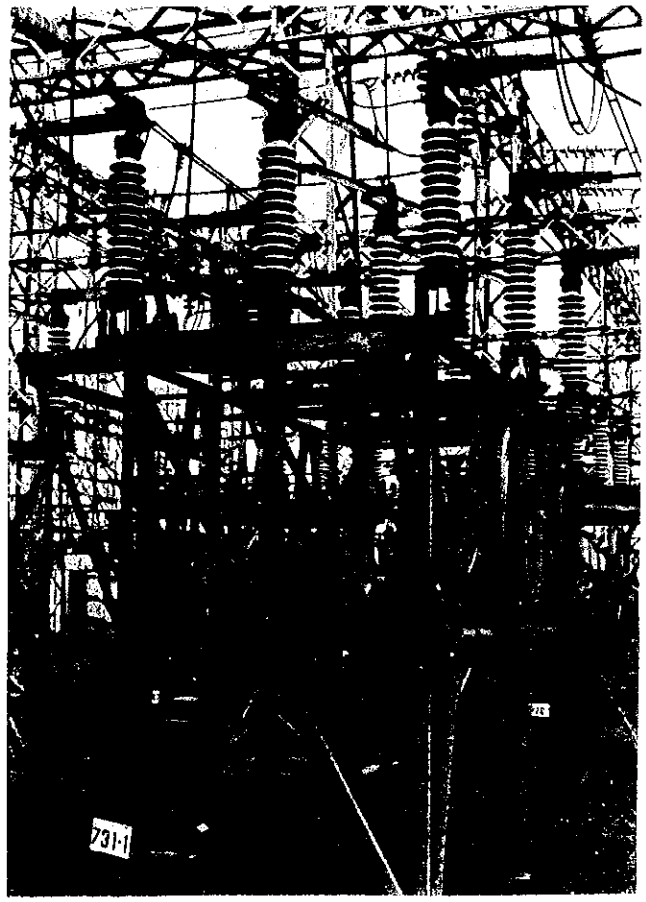


7. Interior of Local Control Box for 66 kV Oil Circuit Breaker

66 kV 油遮断器の現場制御箱の内部状況

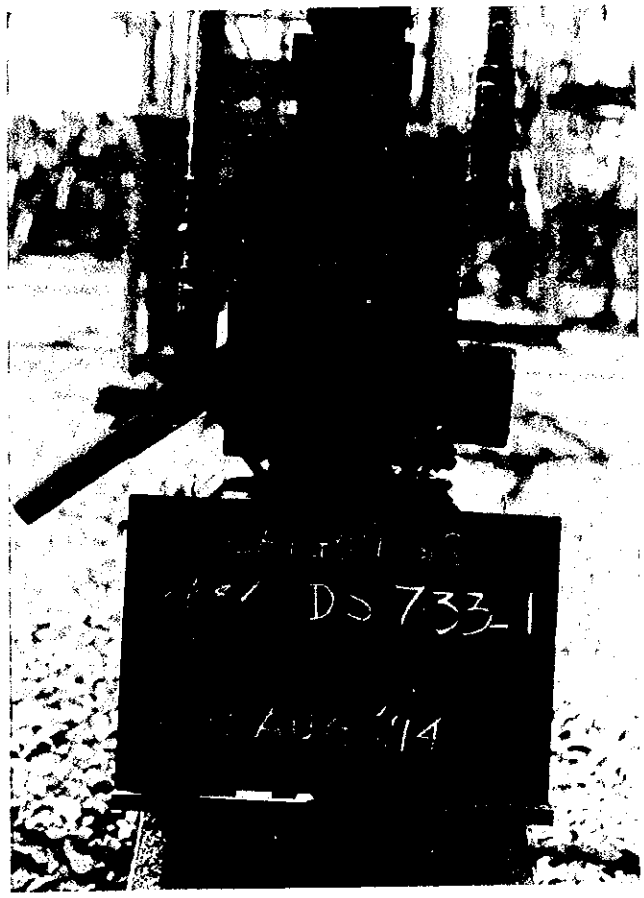
8. General View of 66 kV Disconnecting Switch

66 kV 断路器外観



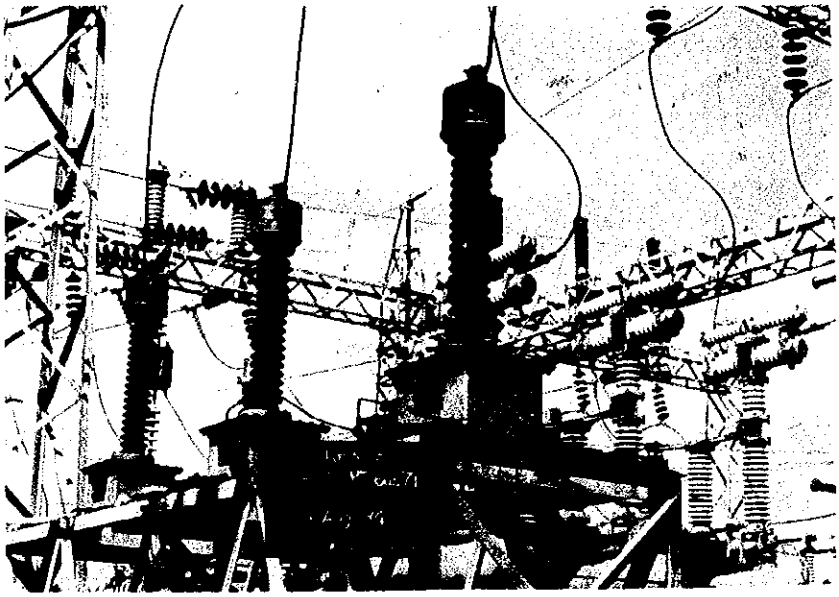
9. Corrosion of Local Control Box for 66 kV Disconnecting Switch

66 kV 断路器の現場制御箱の腐食状況



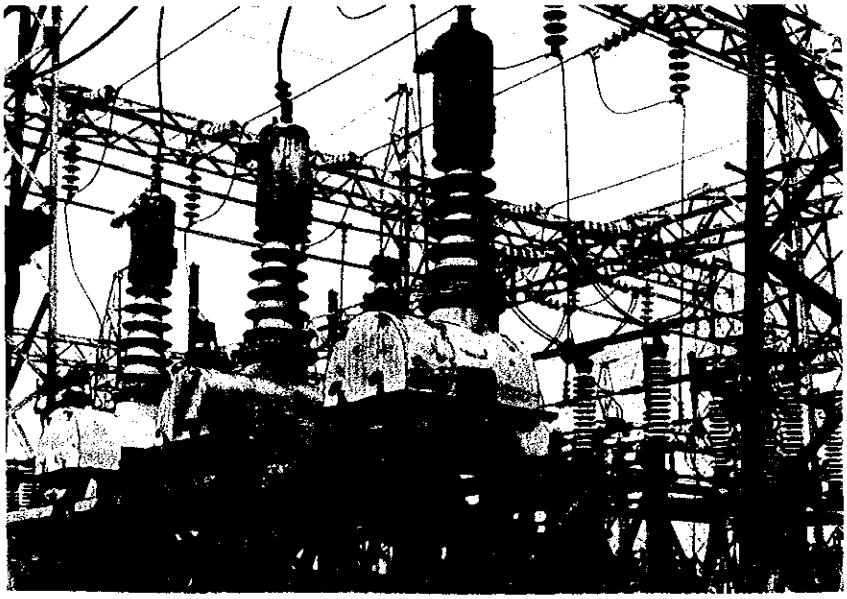
10. 66 kV capacitance voltage transformer, which was temporarily borrowed from another substation, for 66 kV bus No. 1.

66 kV No. 1 母線用計器用変圧器他の変電所から一時的に借用していた。



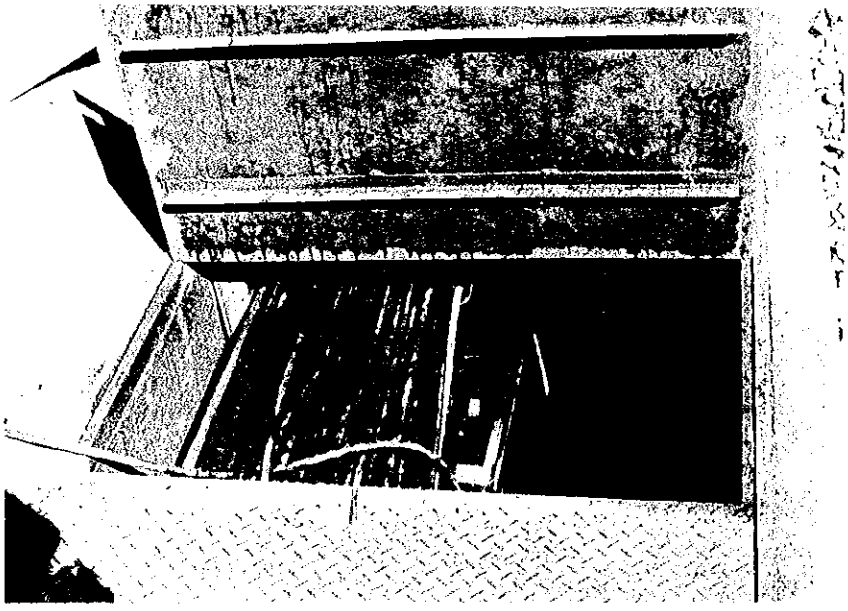
11. 66 kV Capacitance Voltage Transformer for 66 kV bus No. 2

66 kV No. 2 母線用計器用変圧器



12. Inside of Cable Trench for Control Cables in 66 kV Switchyard

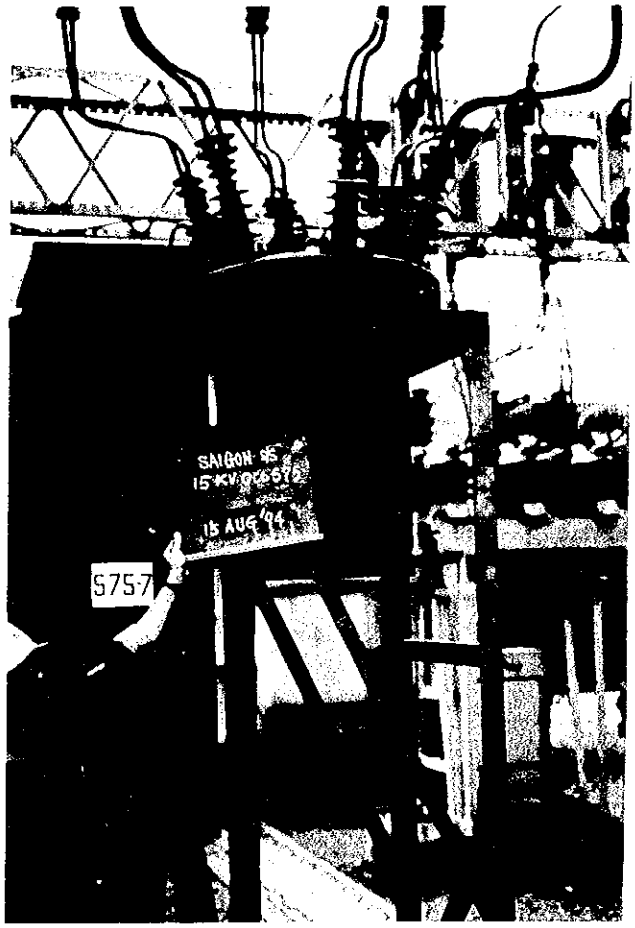
66 kV 開閉所内の制御ケーブル用ケーブルダクトの内部



5-16

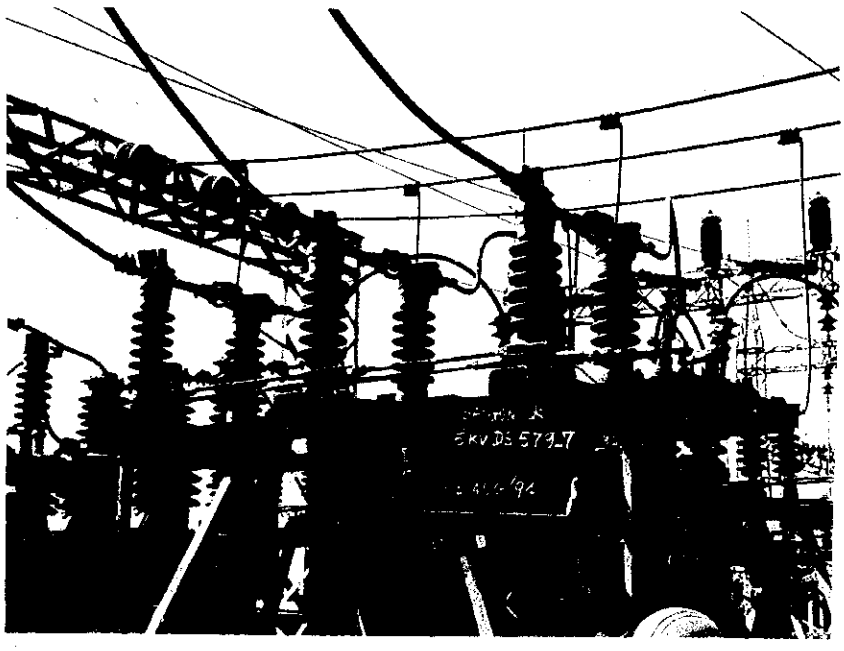
13. 15 kV Oil Circuit Breaker
Oil leakage was observed on the oil tank.

15 kV 油遮断器
油タンクに漏油が観測された



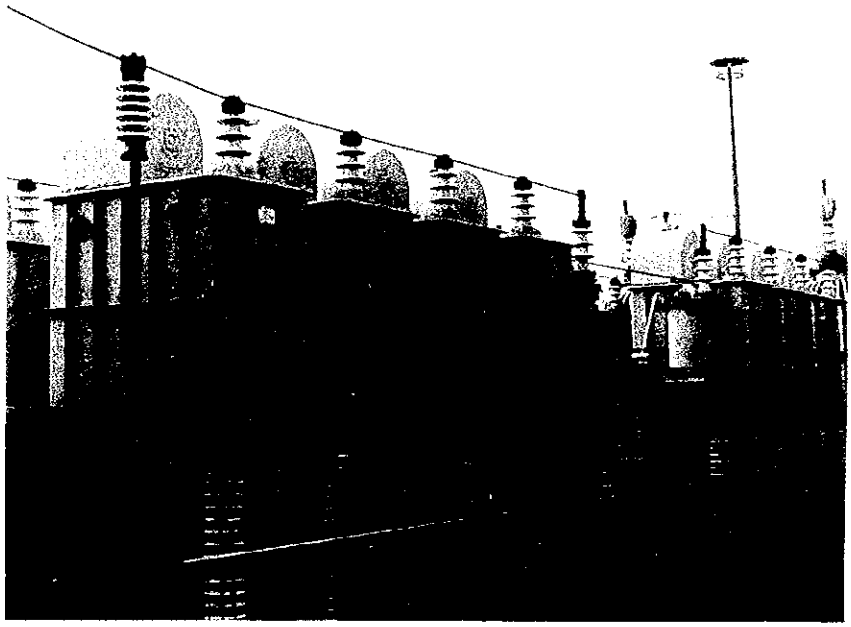
14. 15 kV Disconnecting Switch
Heavy rust was observed on all metaric parts.

15 kV 断路器
全ての金属部が発錆していた



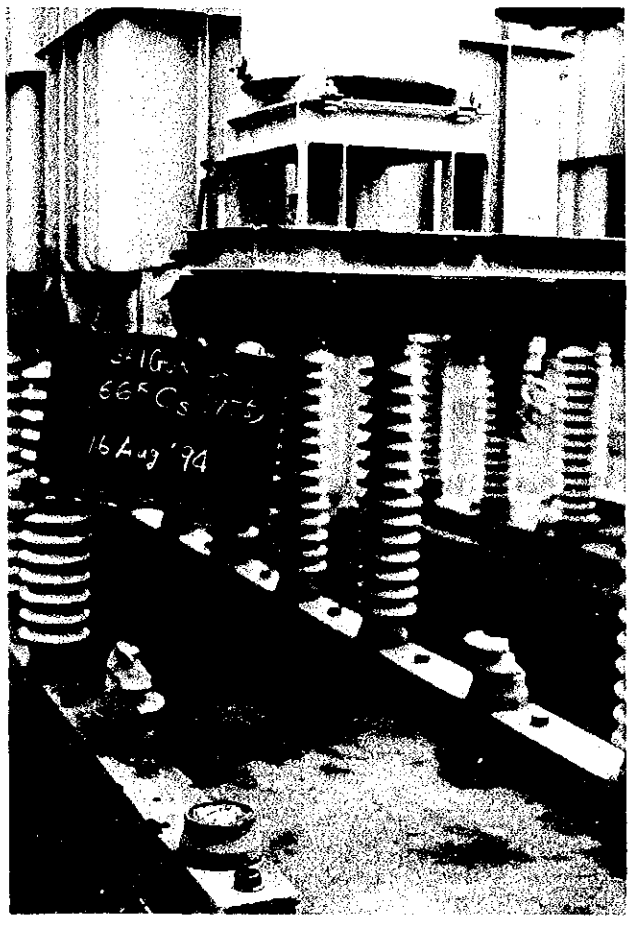
15. General View of 66 kV Static Condenser Bank

66 kV スタティックコンデンサ外観



16. Damage on 66 kV Static Condenser Bank

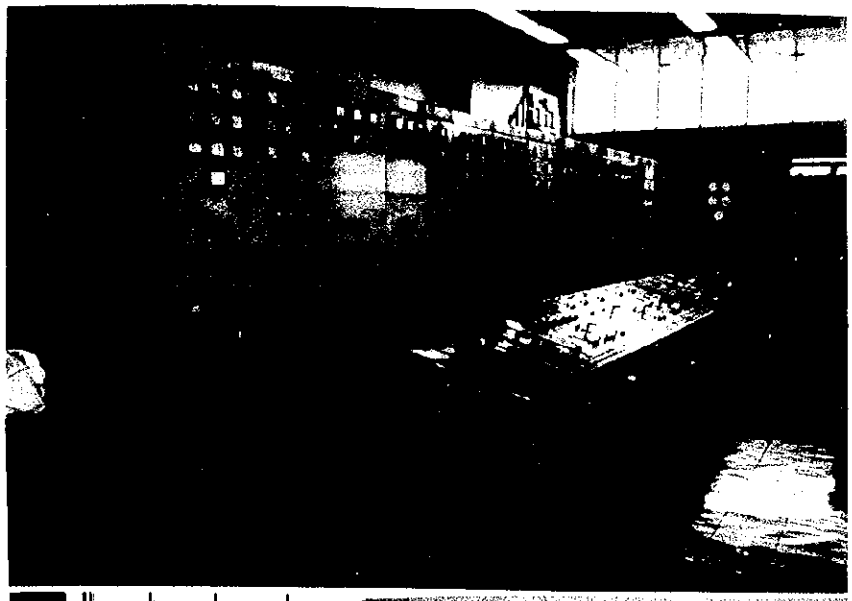
66 kV スタティックコンデンサの破損状況



Control & Relay Board　　配電盤、保護継電器盤

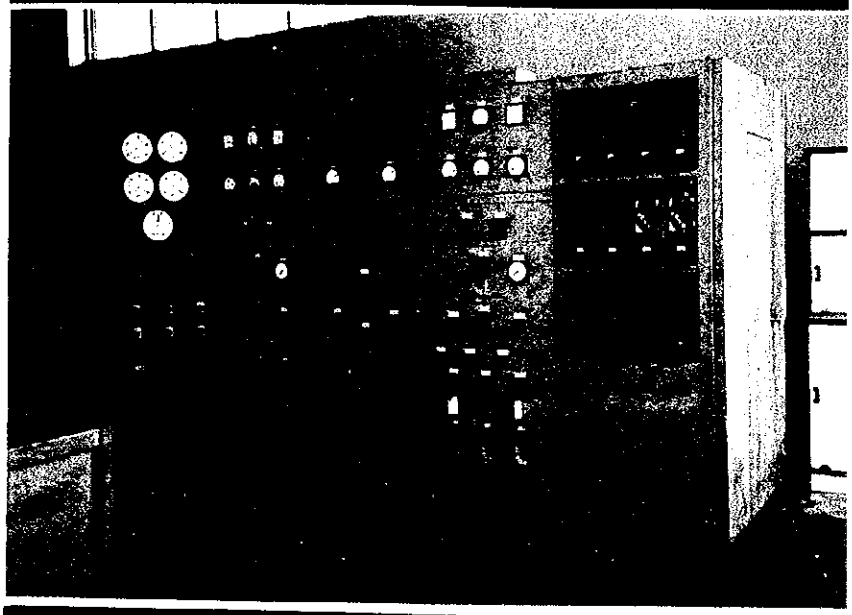
1. General View of Main Control Board

   主配電盤の外観



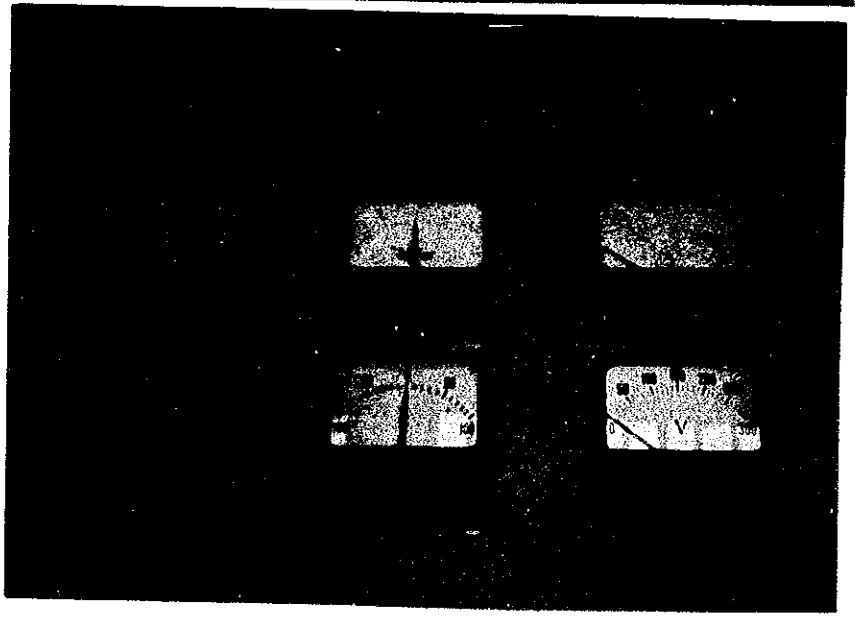
2. Control and Relay Board for Thu Duc P/S (Gas Turbine) Circuits

   Thu Duc 発電所（ガスタービン）接続回路の配電盤・保護継電器盤



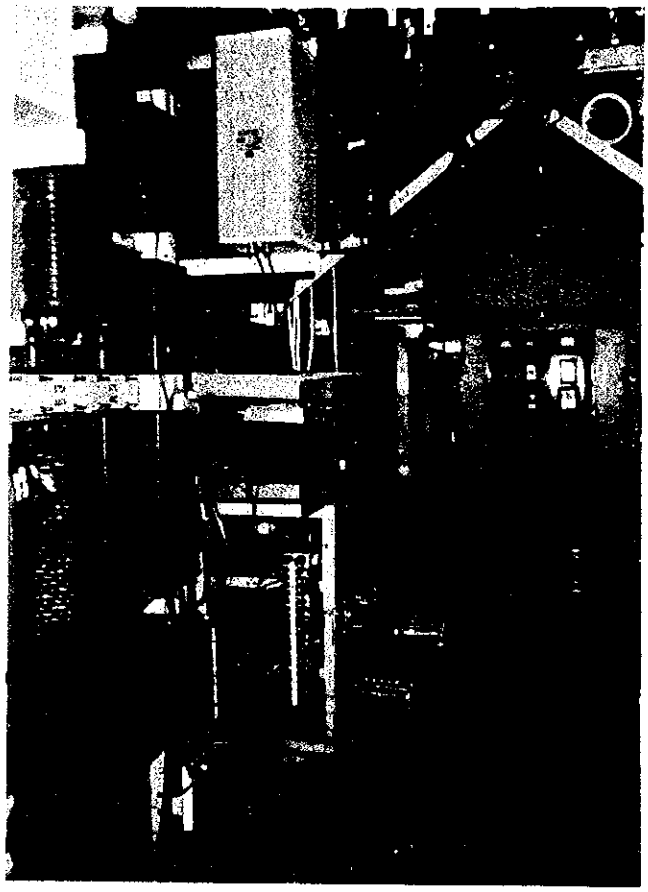
3. Measuring Instruments or Main Control Board
   Scale of some instruments were revised by using papers with hand writing.

   主配電盤上の指示電気計器
   計器の中には紙を使ってスケールを変更しているものがあった



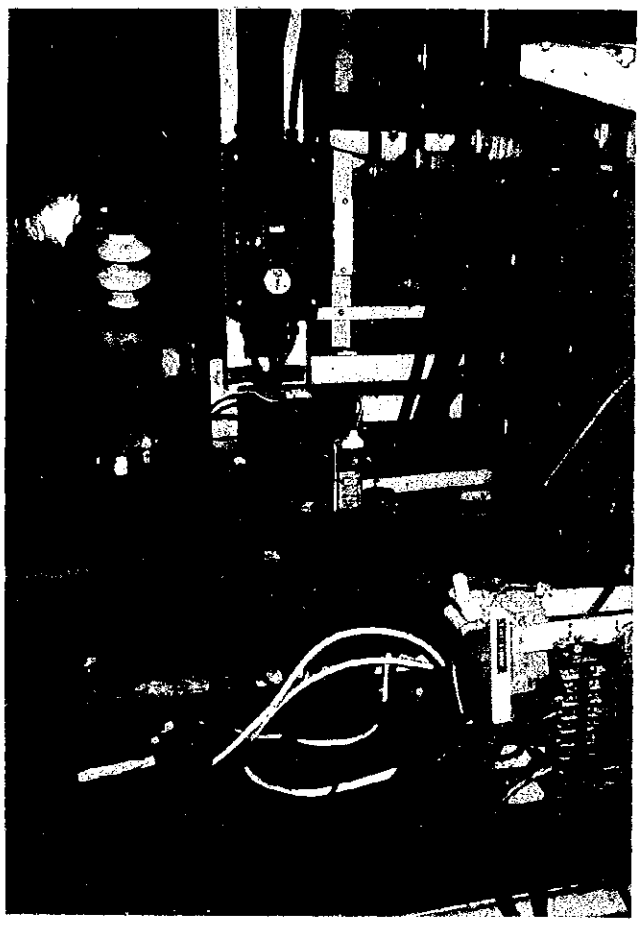
4. Interior of Main Control and Relay Board
Some protective relay were additionally installed at the inside.

主配電盤、保護継電器盤の内部状況
数種の保護継電器が盤内に追加設置されていた



5. Interior of AC and DC Distribution Board

所内交流・直流電源盤の内部

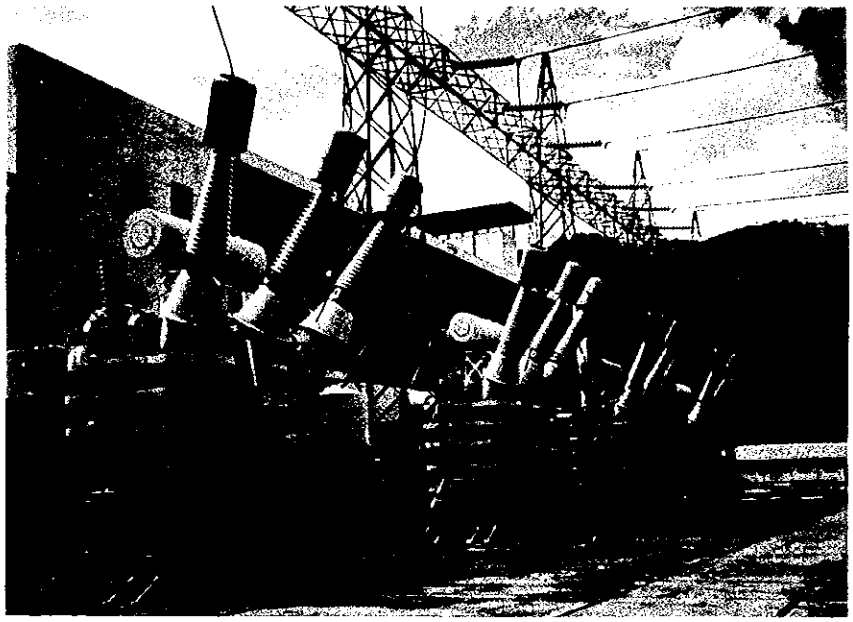


5.2 DA NHIM POWER STATION

Transformers　　変圧器

1. General View of Main Transformers

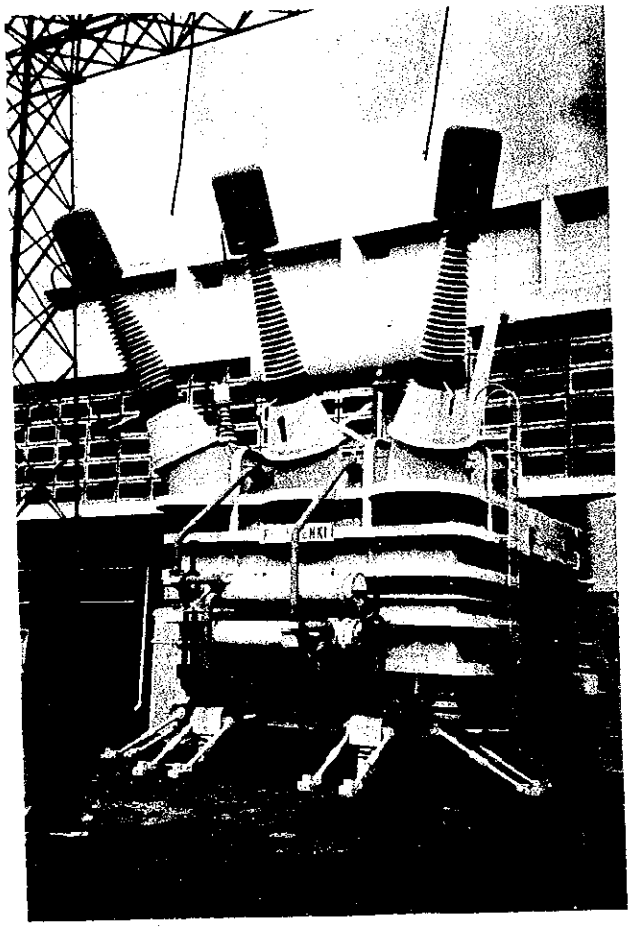
主要変圧器の外観



2. Main Transformer "2T"

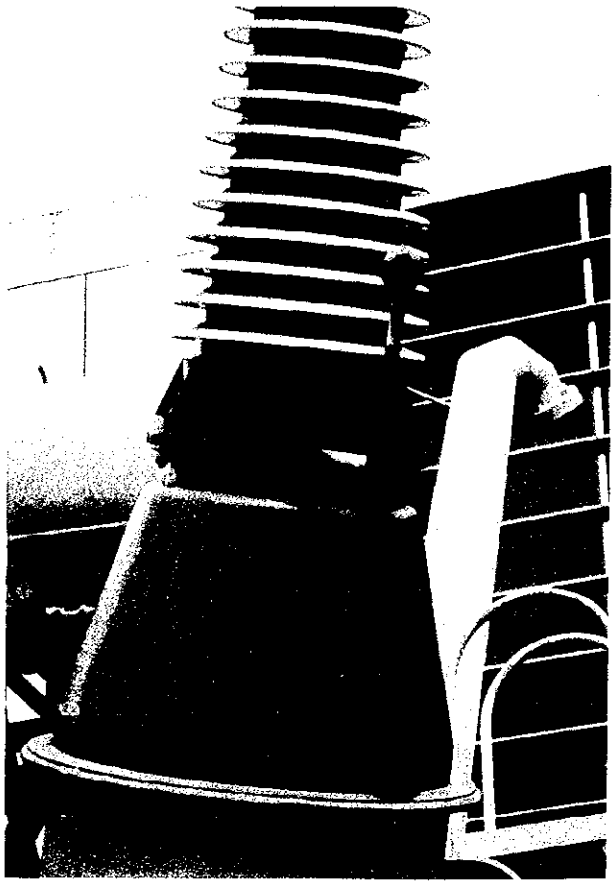
主要変圧器 "2T" の外観

Three-phase
45 MVA
13.2/230 kV
OFWF



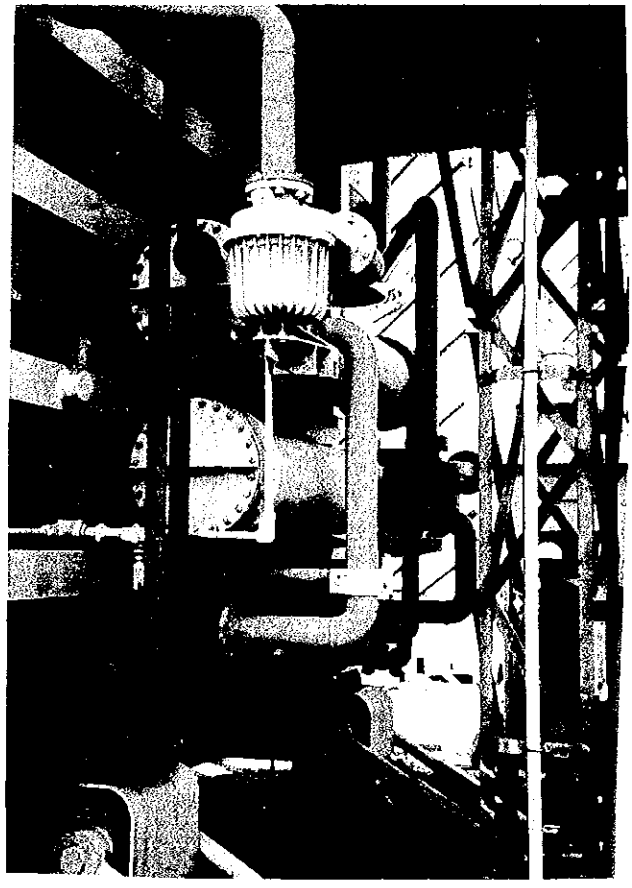
3. Oil Leakage from 230 kV Line Bushing for Main Transformer "2T"

主要変圧器 "2T" の230 kV ブッシングの漏油状況



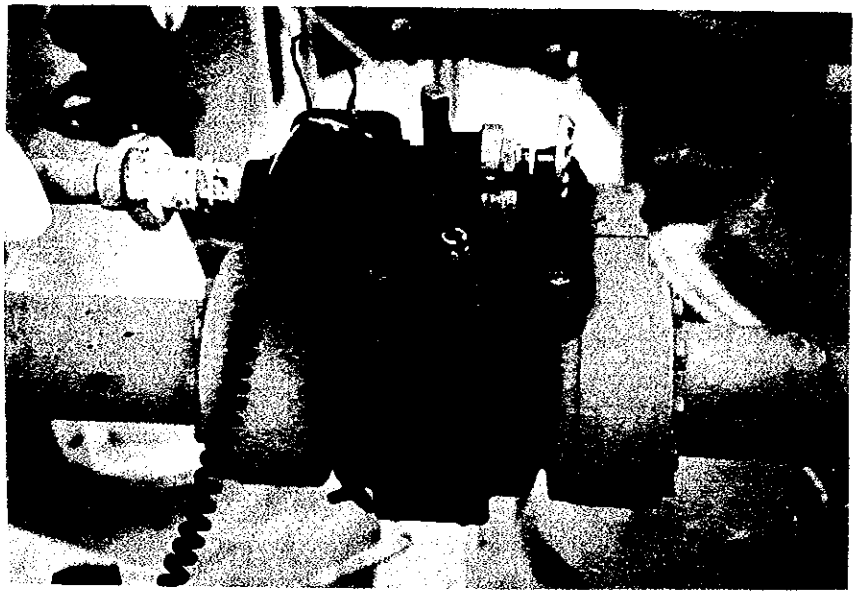
4. Oil Leakage from Oil Pump for Main Transformer "4T"

主要変圧器 "4T" 漏油状況



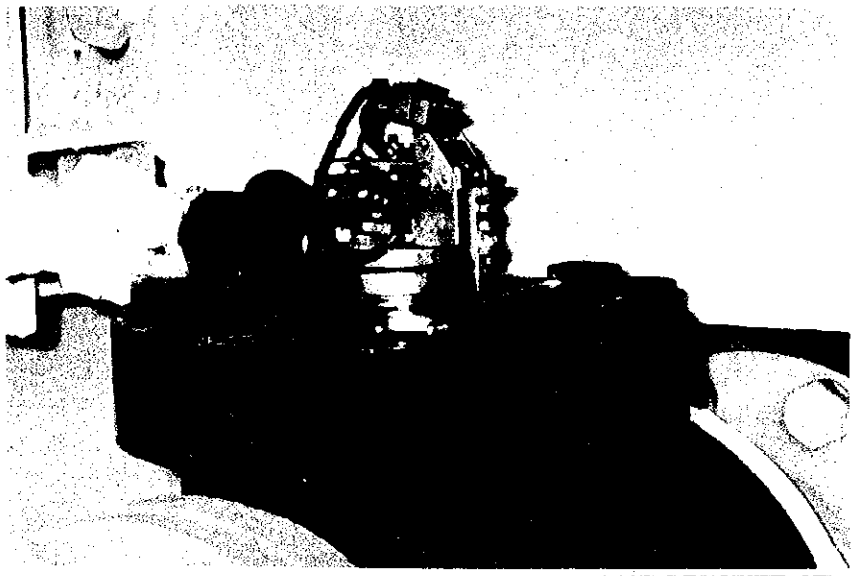
5. Buchholts Relay on Main Transformer "3T"

主要変圧器 "3T" 用ブックホルツ継電器



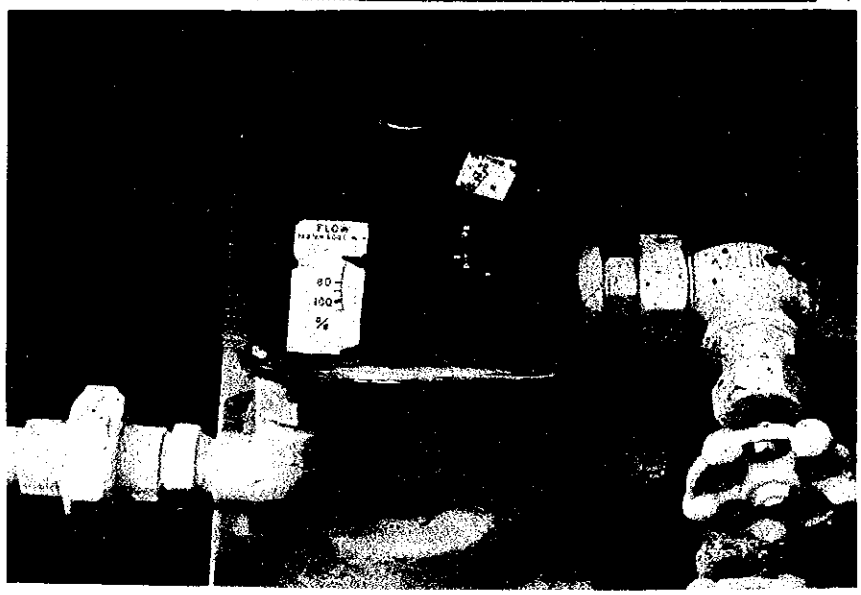
6. Oil Flow Relay on Main Transformer "3T"

主要変圧器 "3T" 用油流継電器



7. Water Flow Relay on Main Transformer "2T"

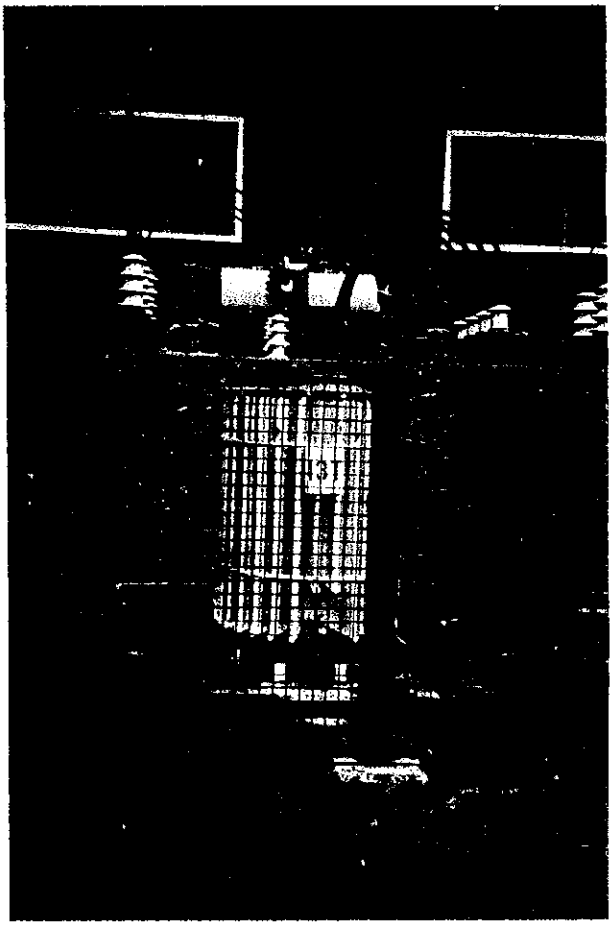
主要変圧器 "2T" 用水流指示器



8. General View of House-service Transformer "13T"

所内変圧器 "13T" の外観

Three-phase
500 kVA
13.2/0.38 kV
ONAN



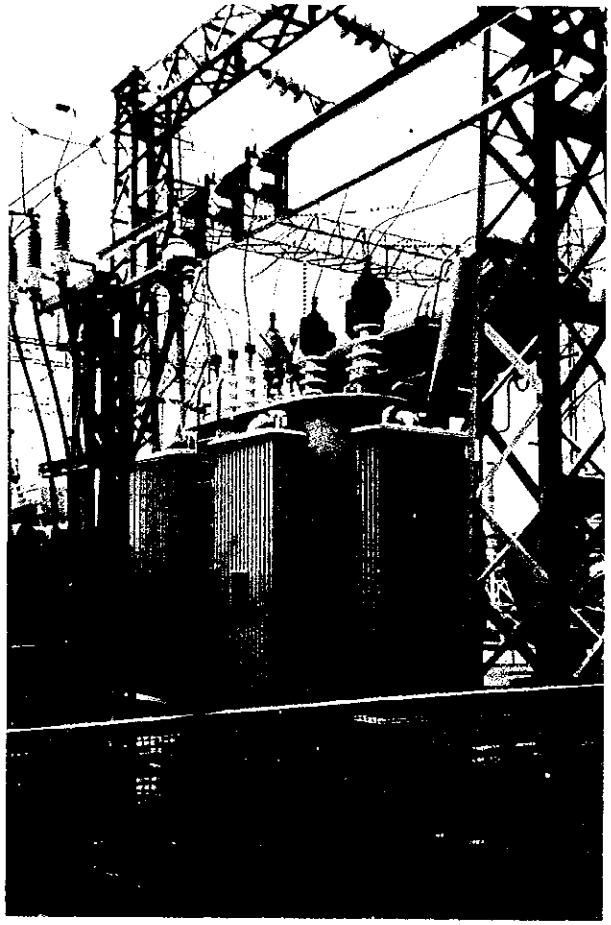
9. Oil Leakage from Bushing and Top Cover for House-service Transformer "11T"

所内変圧器 "11T" のブッシングおよび上ぶたからの漏油状況

10. General View of 66 kV Transformer "6T"

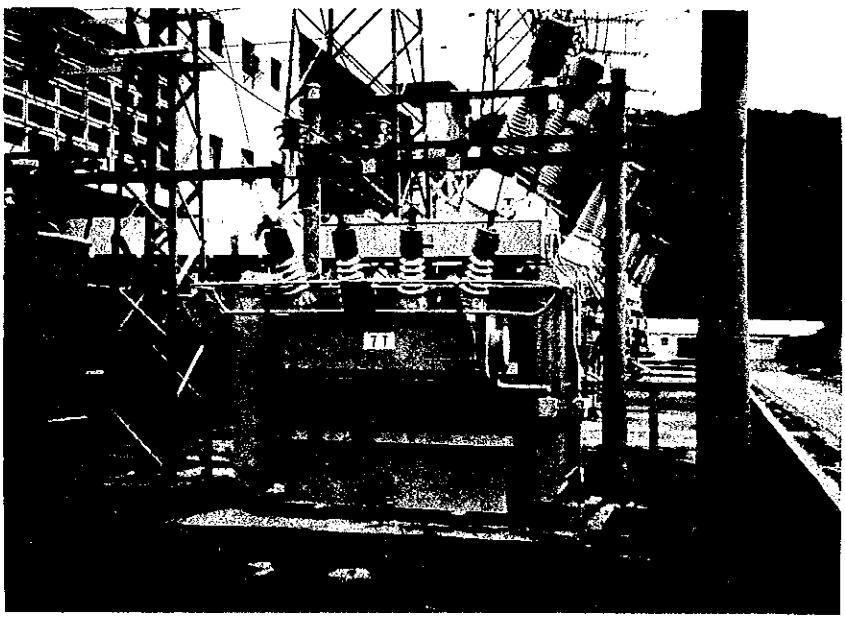
66 kV 変圧器 "6T" の外観

Three-phase, Three-winding
3/2/1 MVA
13.2/31.5/6.6 kV



11. General View of 66 kV Transformer "7T"

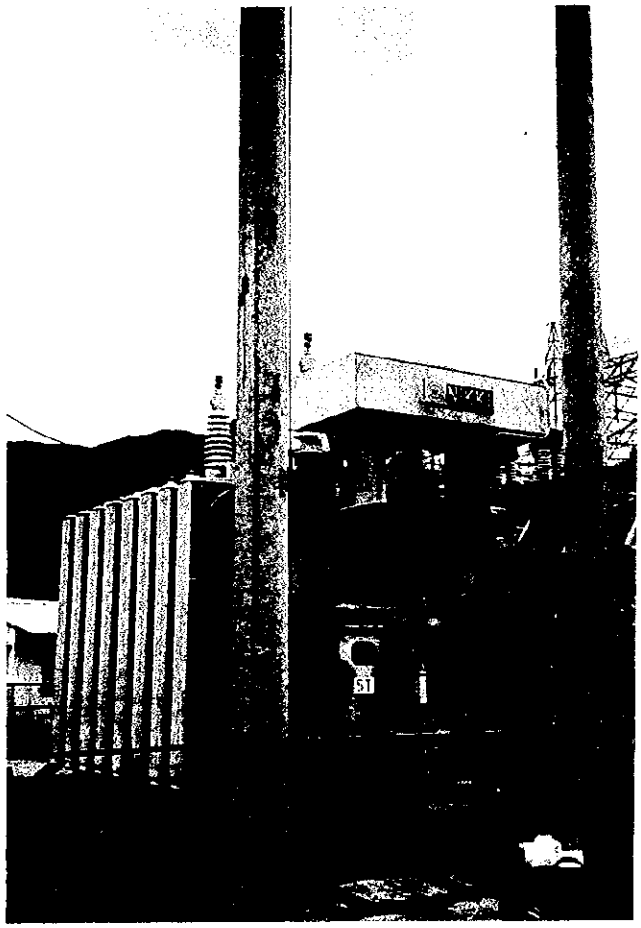
66 kV 変圧器 "7T" の外観



12. General View of 66 kV Transformer "5T"

66 kV 変圧器 "5T" の外観

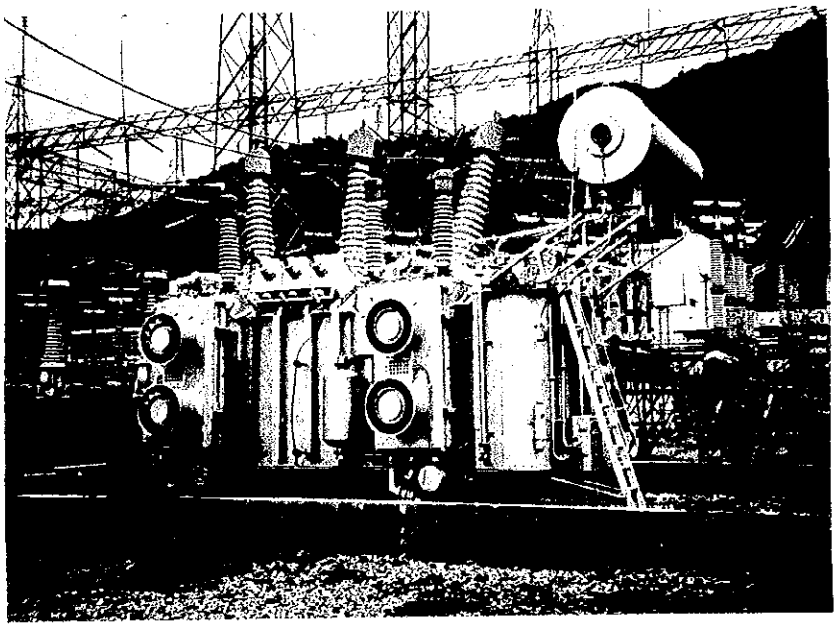
Three-phase
22.5/17 MVA
13.2/66 kV
ONAF/ONAN



13. General View of 110 kV Transformer "9T"

110 kV 変圧器 "9T" の外観

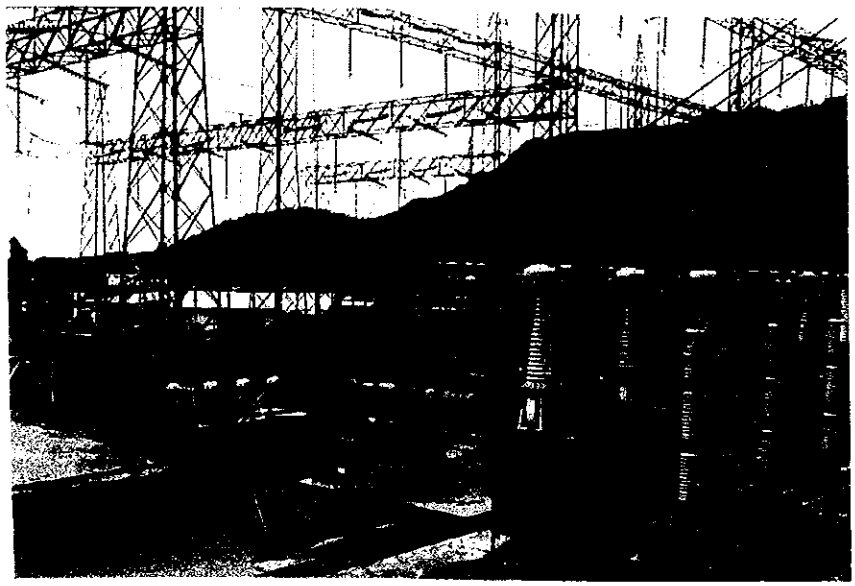
Three-phase
Auto-transformer with OLTC
63 MVA
230/121 kV
OFAF



Switchgear　　開閉機器

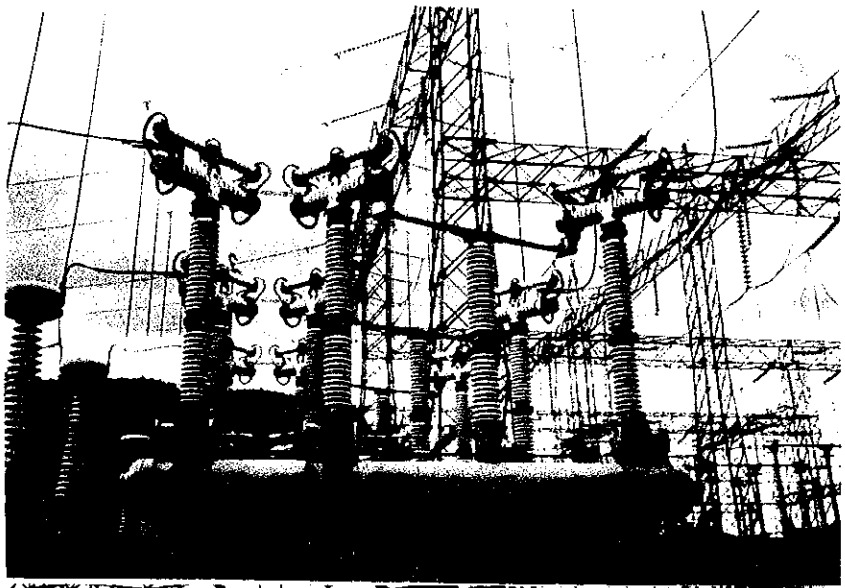
1. General View of 230 kV Switchyard

   230 kV 開閉所の既観



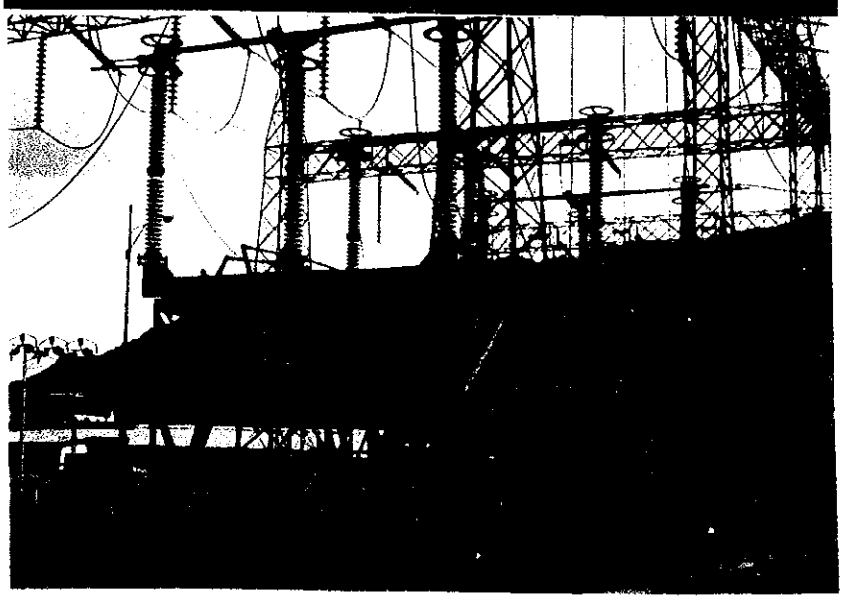
2. 230 kV Air-blast Type Circuit Breaker

   230 kV 空気遮断器



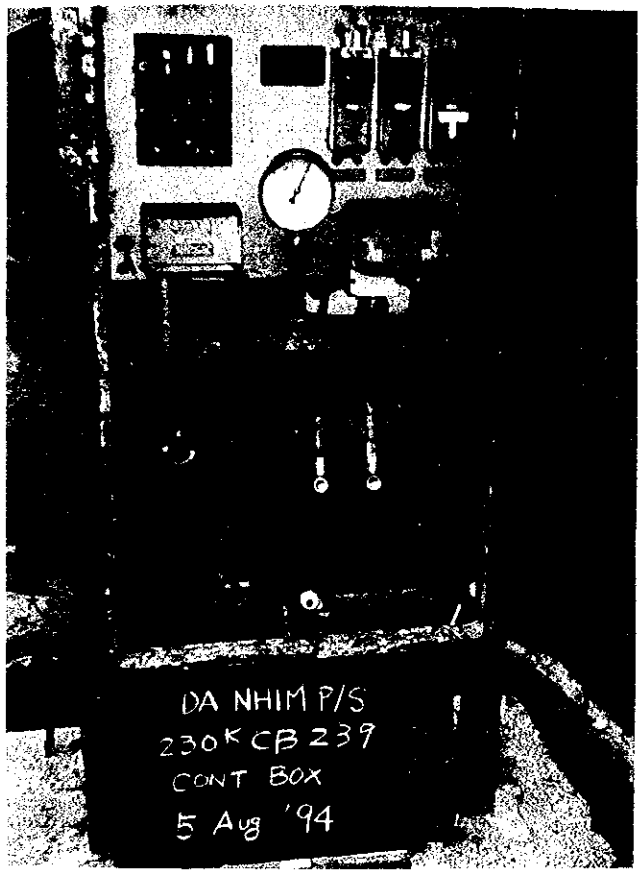
3. 230 kV Disconnecting Switch

   230 kV 断路器



4. Corrosion of Local Control Box for 230 kV Air-blast Circuit Breaker

230 kV 空気遮断器の現場制御箱の腐食状況

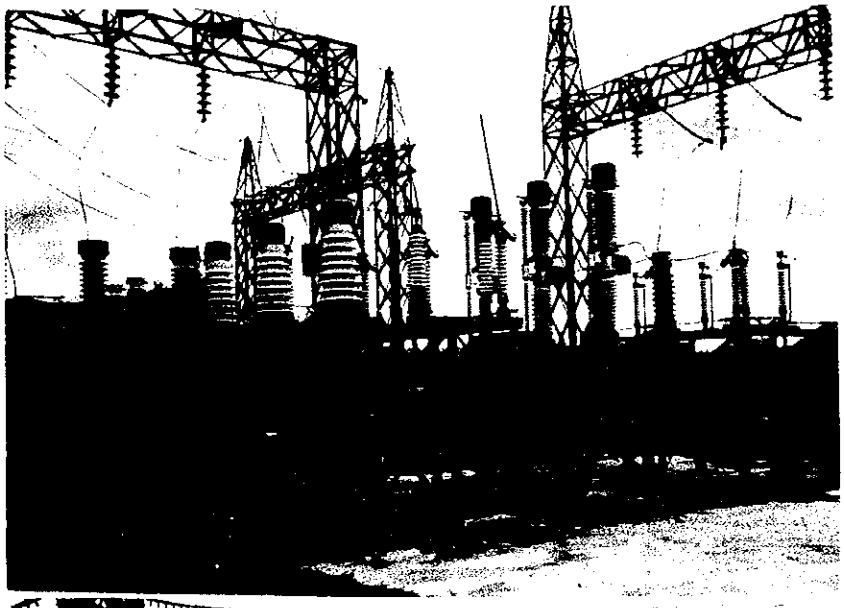


5. Corrosion of Local Control Box for 230 kV Disconnecting Switch

230 kV 断路器の現場制御箱の腐食状況

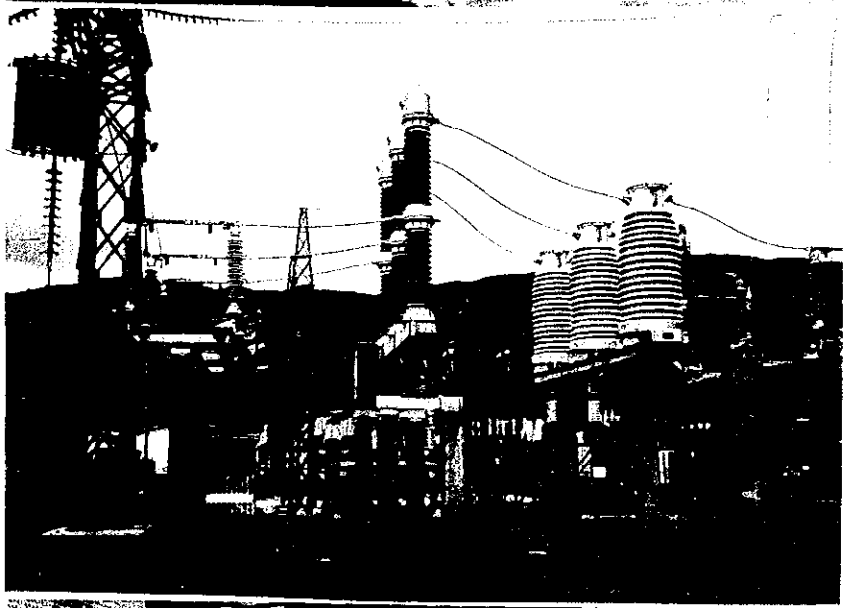
6. General View of 66 kV Switchyard

66 kV 開閉所の概観



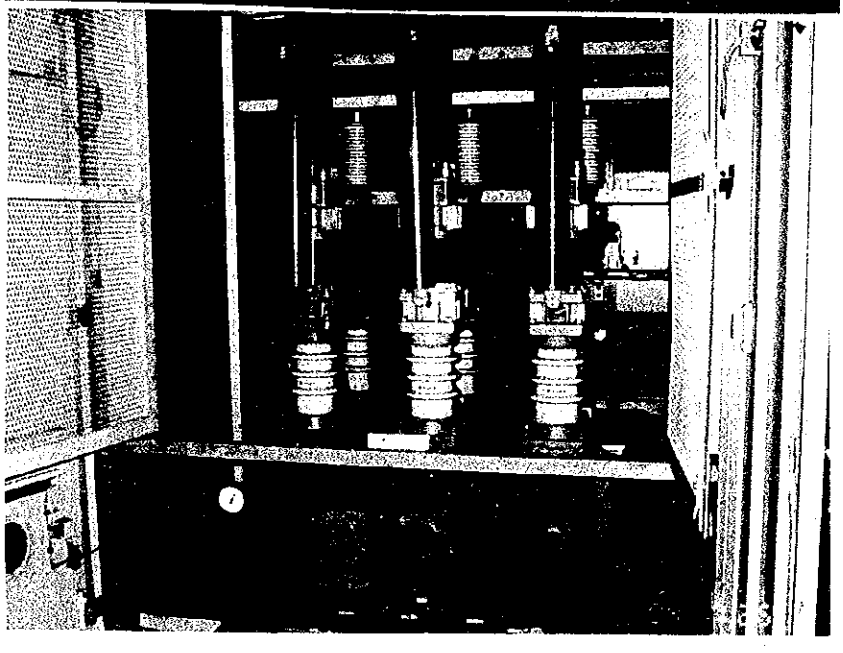
7. General View of 110 kV Switchyard

110 kV 開閉所の概観



8. 13.2 kV Indoor Air-blast Type Air-circuit Breaker

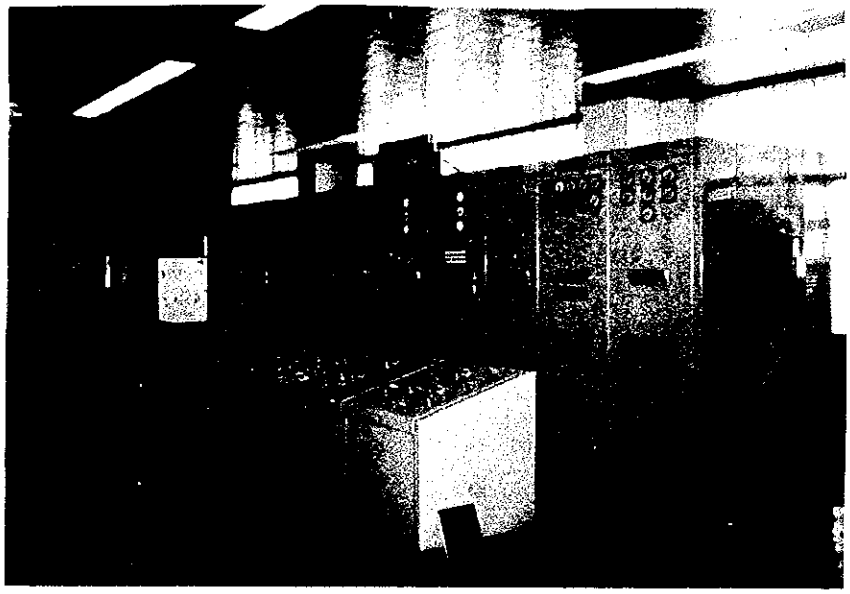
13.2 kV 屋内形空気遮断器



Control & Relay Board　　配電盤、保護継電器盤

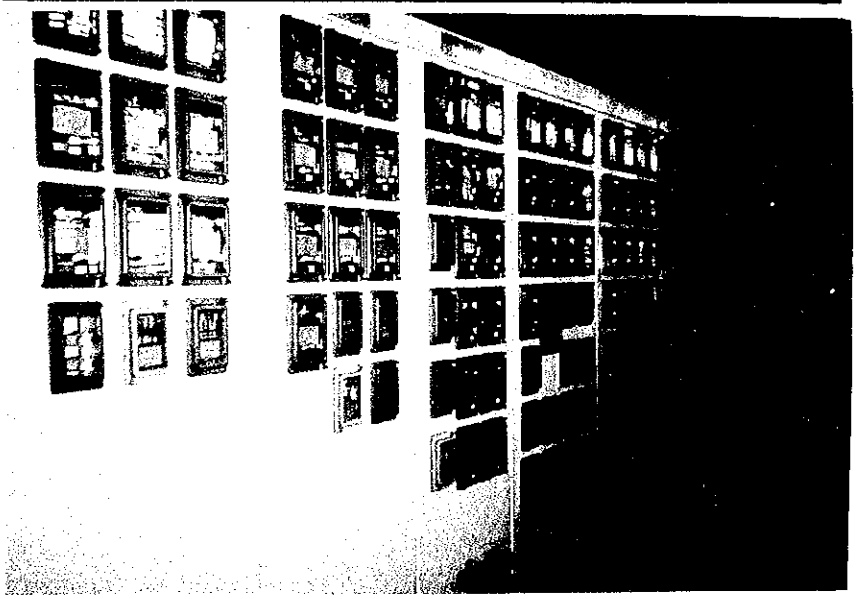
1. General View of Main Control Board

主配電盤の外観



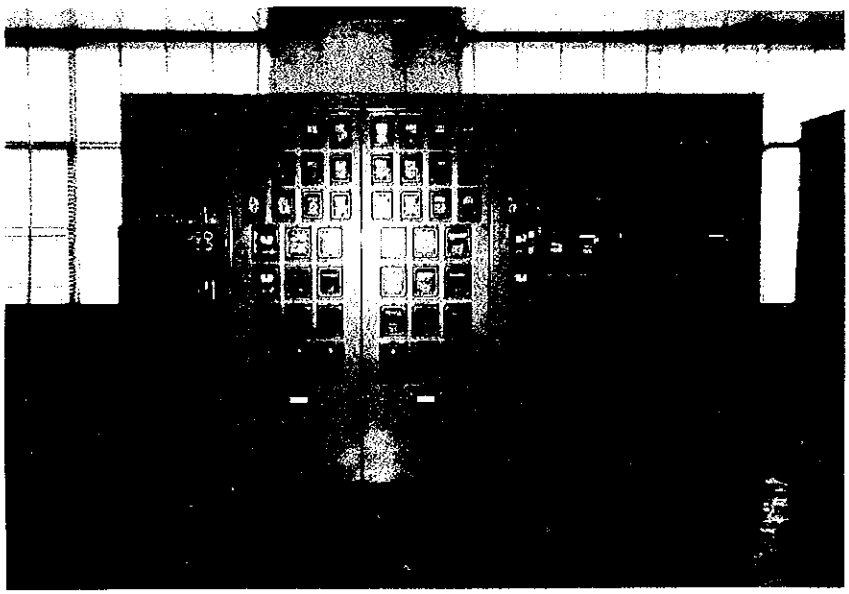
2. Protective Relay Board

保護継電器盤



3. Unit Automatic Control Board for Generating Equipment

水車発電機用自動制御盤

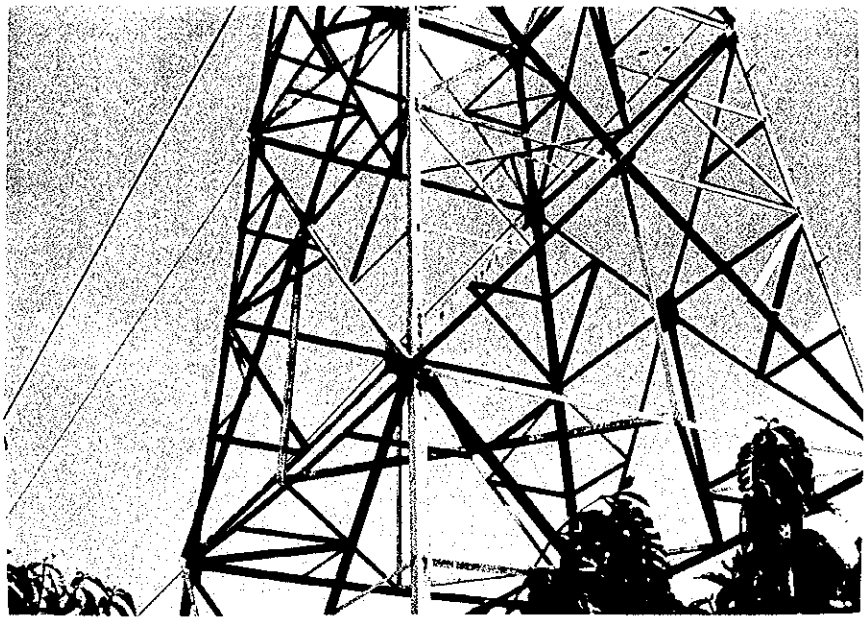


CHAPTER 6

TRANSMISSION LINE FACILITIES

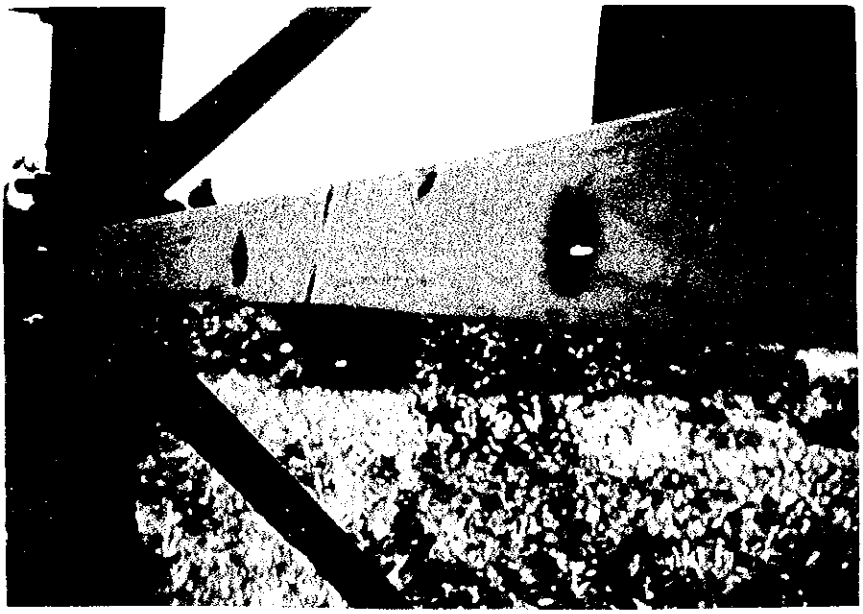
1. 230kV Transmission Line Tower
(Use of Non-galvanized Steel for Tentative Repair)

230kV 送電線鉄塔
(非亜鉛メッキ部材による仮補修)



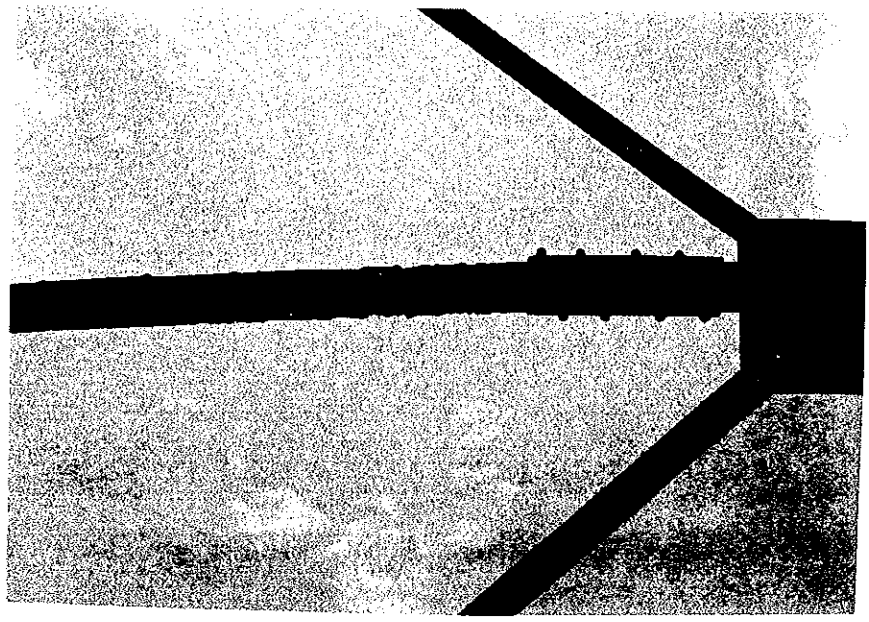
2. 230 kV Tower
Steel Member Bored by Bullets

230kV 鉄塔の被弾部材



3. 230kV Tower
Rusted Steel Member

230kV 鉄塔の腐食部材

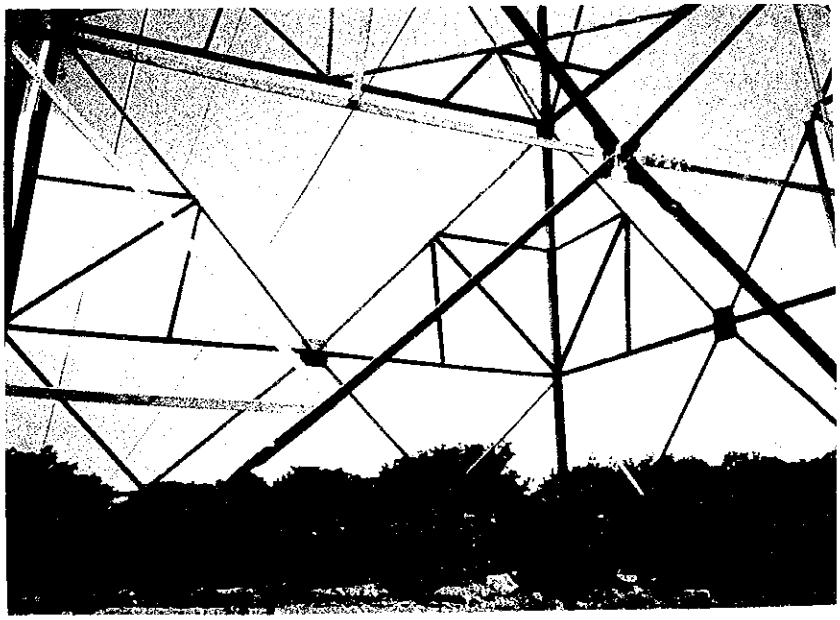


4. 230kV Tower Repaired by Non-galvanized and Smaller Size Steel

230kV 鉄塔
非亜鉛メッキ・原サイズより小型の材料による仮補修

5. 230kV Tower Tentatively Repaired by Non-galvanized Steel with Damaged Member by Bullets

230kV 鉄塔
被弾部材及び非亜鉛メッキ材料による仮補修



6. 230kV Line Conductor Breakage of Individual Wires

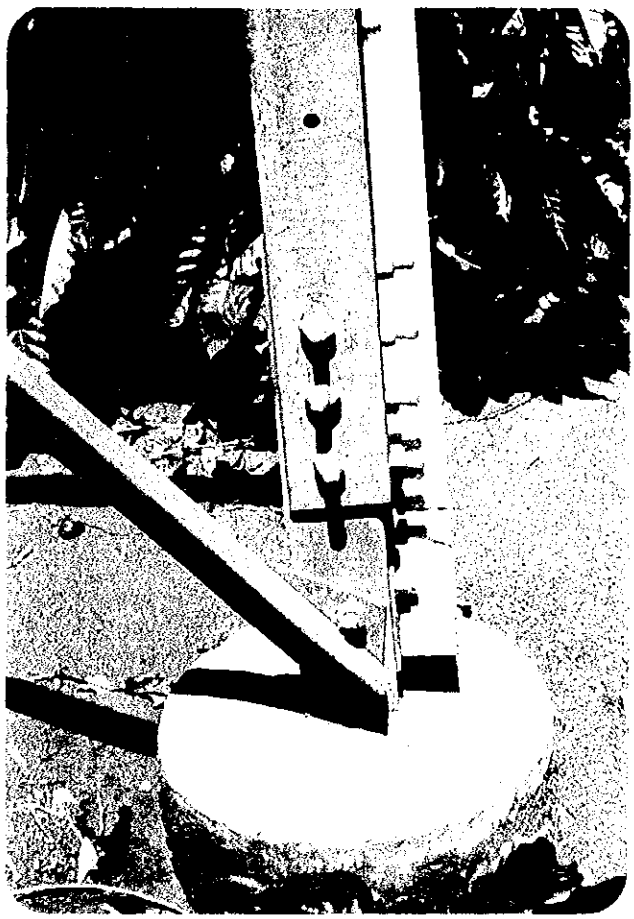
230kV 送電線
素線の破断したまま使用している電線

7. 230kV Tower Leg Tentatively Repaire

230kV 鉄塔
主脚材の仮補修

8. 230kV Tower Tentatively Repaired by Non-galvanized Steel

230kV 鉄塔
非亜鉛メッキ材による部材補修

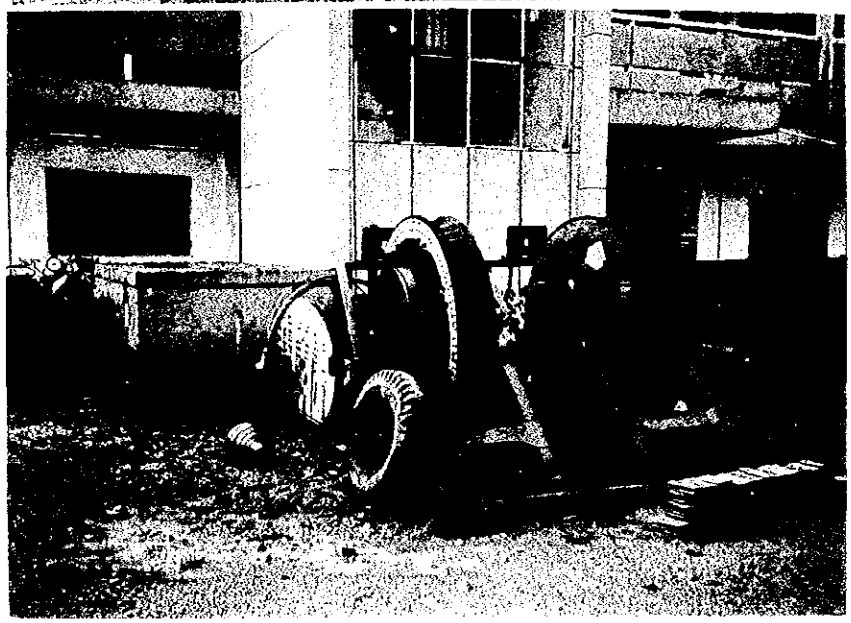


9. Insulators for Transmission Line
Rusted Pin

送電線用碍子
腐食によりピン部磨耗

10. Tool
Conductor Tensioner Damaged

送電線用工具
破損した延線車

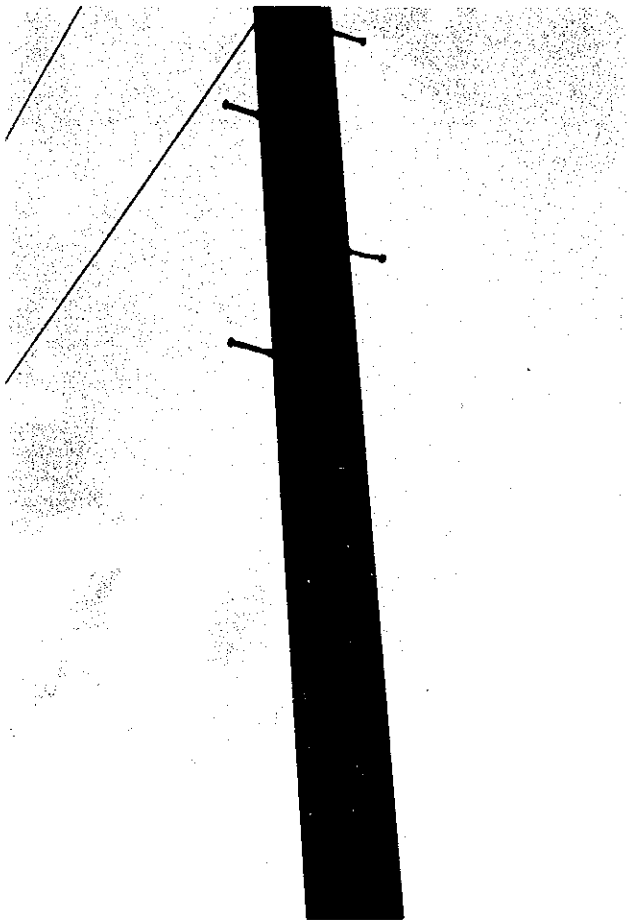


11. 66kV Thap Cham - Phan Ri Section
Conductor Joint

66kV Thap Cham - Phan Ri 区間
電線仮接続

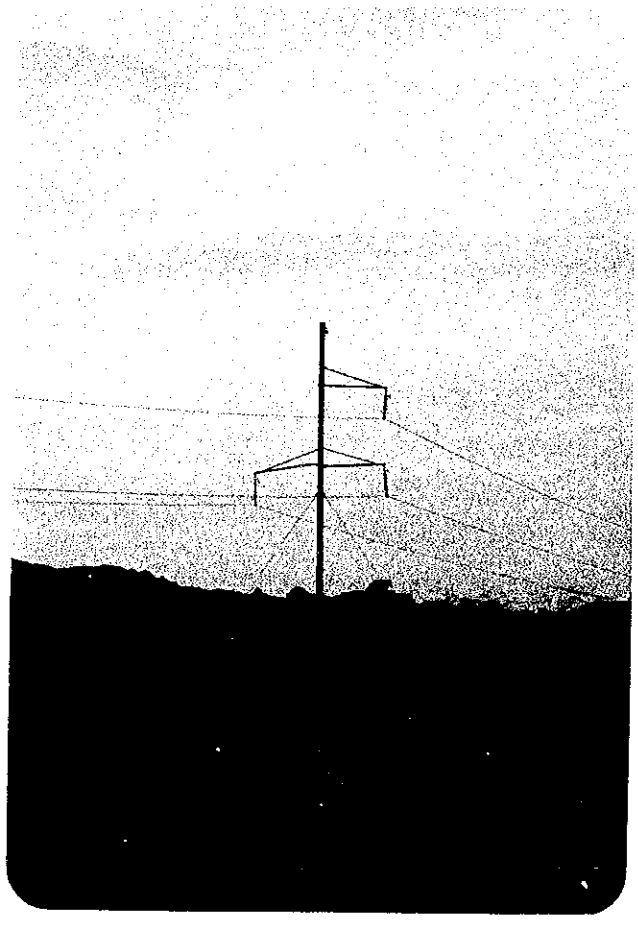
12. 66kV Da Nhim - Thap Cham Section
Steel Tubular Pole Bored by Bullet

66kV Da Nhim - Thap Cham 区間
被弾し穿孔されている鋼管柱



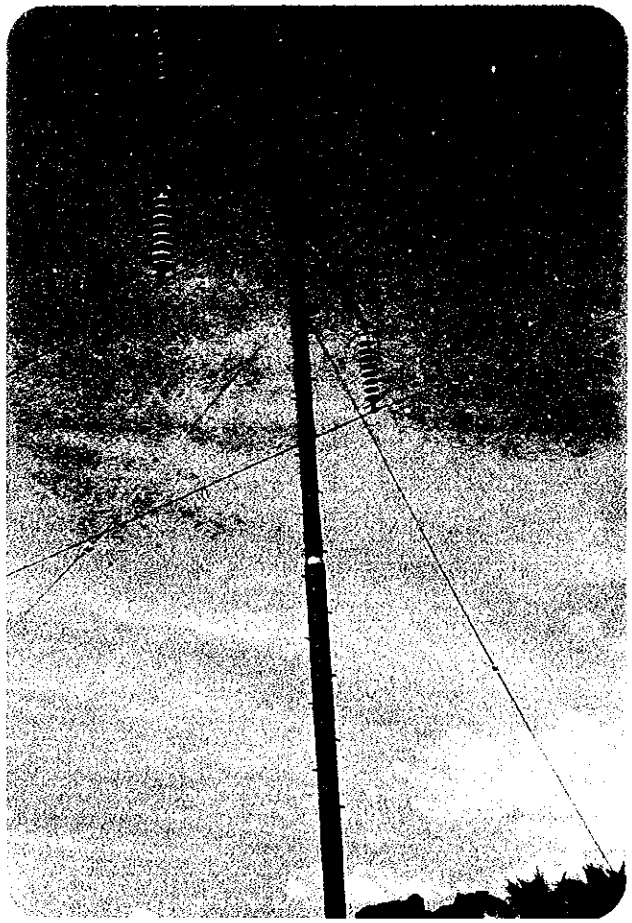
13. 66 kV Da Nhim - Thap Cham Section
Deformed Crossarms for Conductor
(1/2)

66kV Da Nhim - Thap Cham 区間
変形した電線腕金（1/2）



14. 66 kV Da Nhim - Thap Cham Section
Deformed Crossarms for Conductor
(2/2)

66kV Da Nhim - Thap Cham 区間
変形した電線腕金（2/2）

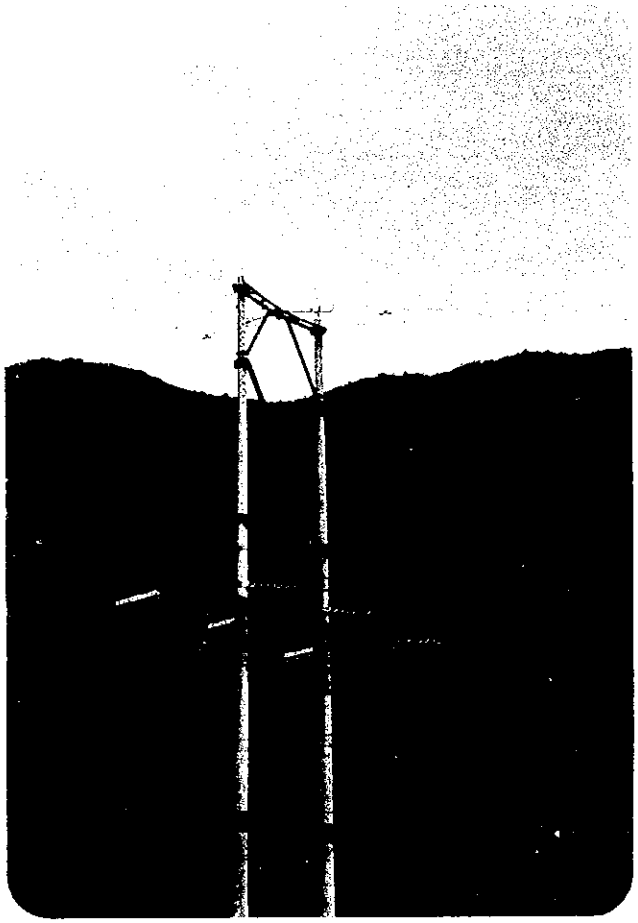


15. 66 kV Da Nhim - Thap Cham Section
Tentative Repair of Steel Tubular Pole
Bored by Bullets

66kV Da Nhim - Thap Cham 区間
被弾した鋼管柱の臨時補強

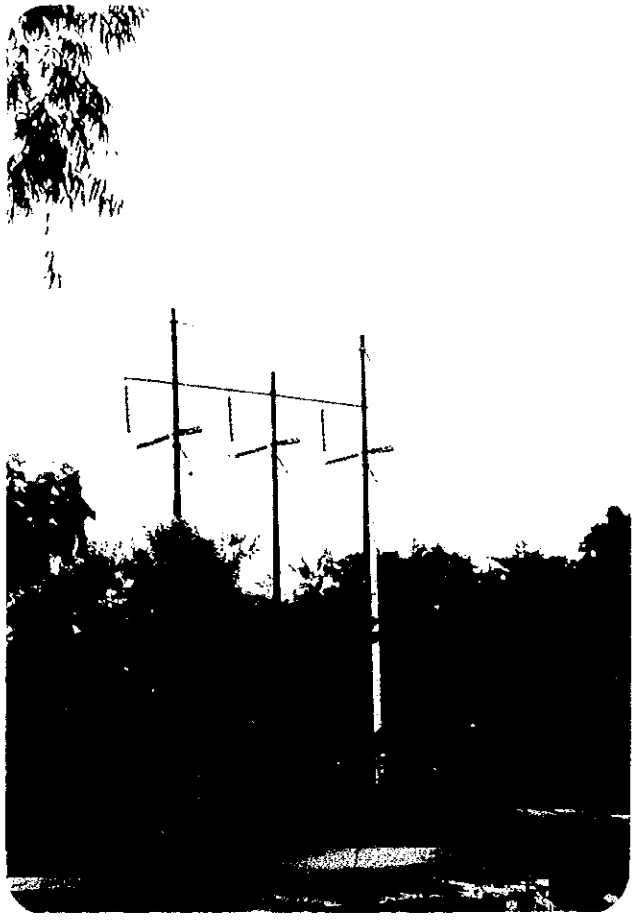
16. 66 kV Thap Cham - Phan Ri Section
Rusted Steel Parts on Concrete Pole

66 kV Thap Cham - Phan Ri 区間
コンクリート柱の錆びた鋼材



17. 66kV Cam Ranh - Dien Khanh Section
Rottened Wooden Pole Reinforced by a Concrete Pole

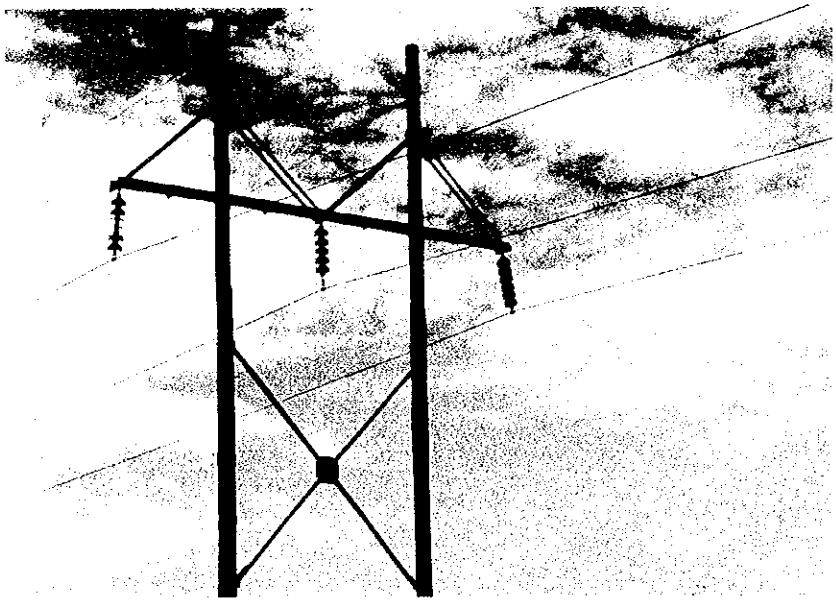
66kV Cam Ranh - Dien Khanh 区間
コンクリート柱により補強されている腐食した木柱



6-7

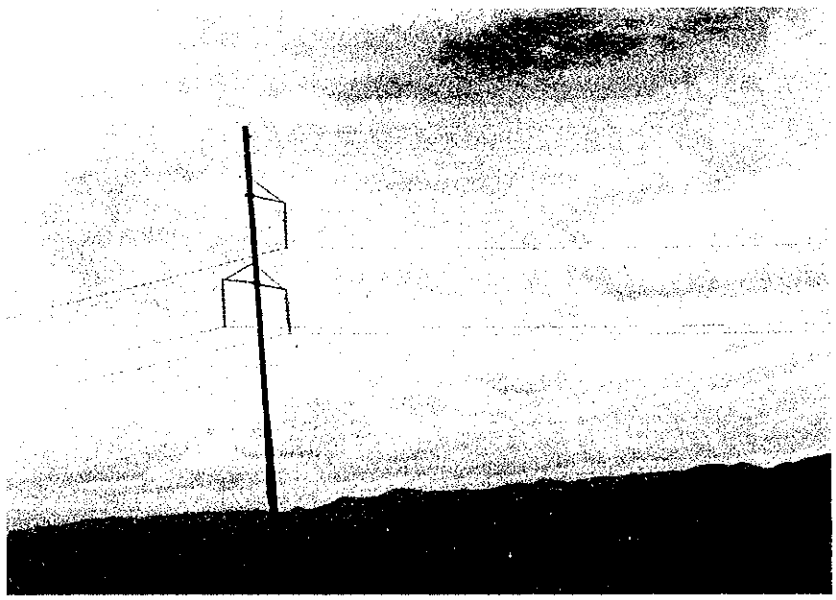
18. 66kV Cam Ranh - Dien Khanh Section
Broken Insulator Sets

66kV Cam Ranh - Dien Khanh 区間
碍子破損のまま運転している送電線



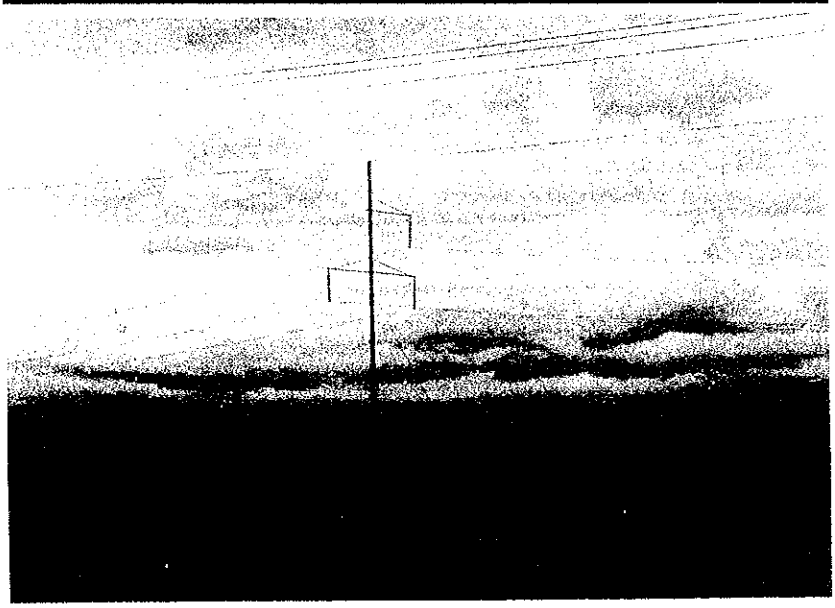
19. 66kV Thap Cham - Cam Ranh Section
Steel Tubular Pole without Staywires (Missing)

66kV Thap Cham - Cam Ranh 区間
支線の全く紛失した鋼管柱



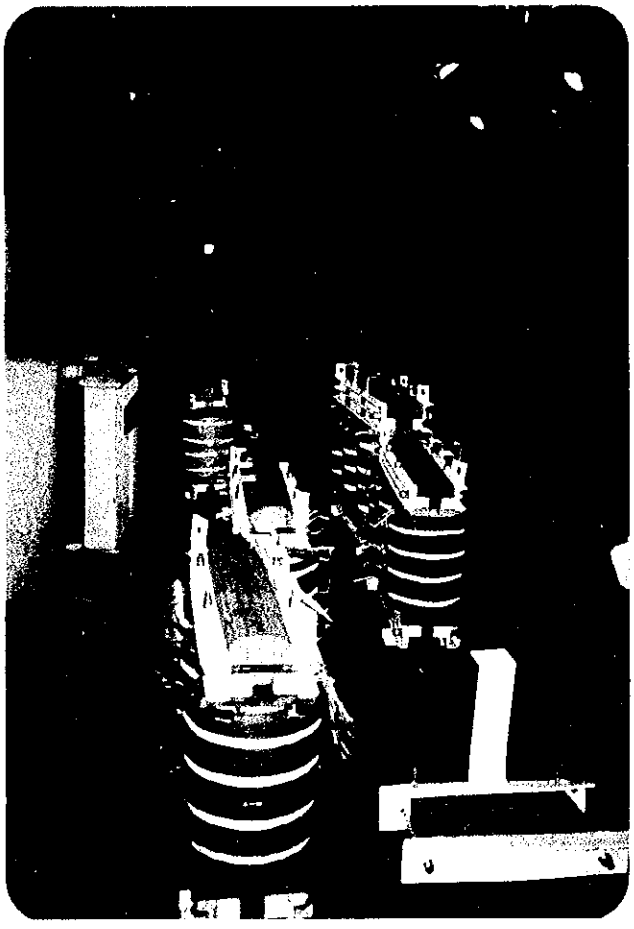
20. 66kV Thap Cham - Cam Ranh Section
Steel Tubular Pole with only One Staywire (One Staywire Missing)

66kV Thap Cham - Cam Ranh 区間
片側支線のみ有する鋼管柱
（1本紛失）



21. PC-2 Transformer Factory

PC-2 変圧器工場

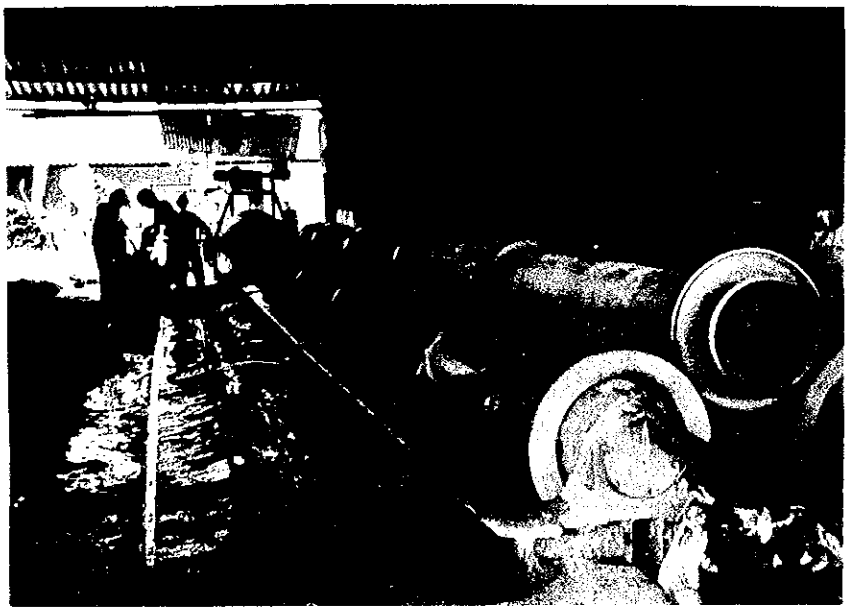


22. Line Fittings Produced by PC-2 Factory

PC-2 工場製造による配電用金具

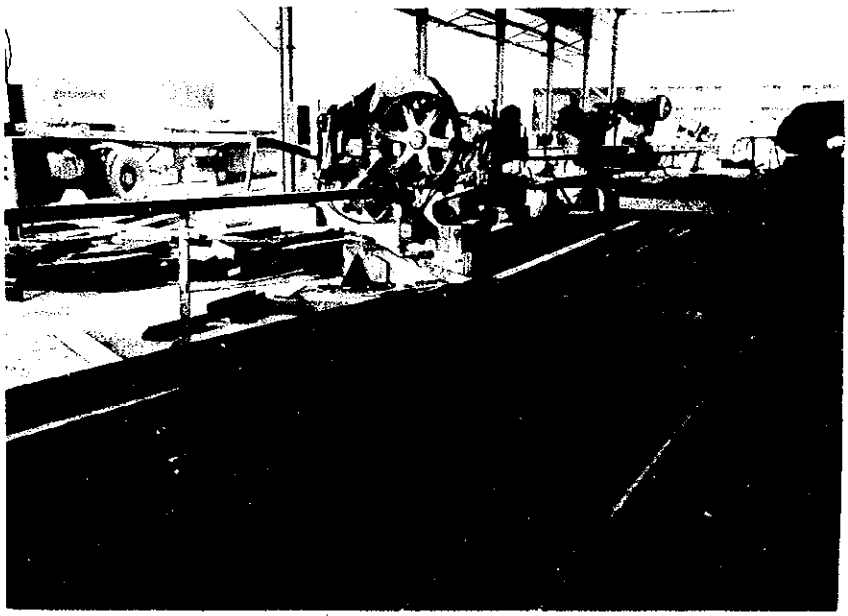
23. Concrete Pole Factory of PCC-2

PCC-2 のコンクリート柱工場



24. Tower Factory of PCC-2

PCC-2 の鉄塔製造工場



25. Tower Materials Produced by PCC-2 Factory

PCC-2 製造の鉄塔部材