

INTRODUCTION

The increasing of the electrical power demands in the Metropolitan area causes the increasing of the electrical substations. The duties of these substations are as follows :

1. To transform the high voltage power into power at suitable level, normally from 69 KV. to 12 KV. or 24 KV. before distributing through transmission lines.

2. To protect the transmission system from damage due to the faults, by using the protective relays and oil Circuit Breakers (OCB) .

All substations are centrally controlled by the load dispatching center as shown in Fig. 1, the present communication mean between the load dispatching center and the substations is via the very high frequency (VHF) radio links.

The substations' operators control all the operation of high voltage equipments in their stations such as closing and tripping of oil circuit breakers, changing of transformer taps, blocking of protective relays etc, according to the information received from the Load dispatching center. Another important duty of the operators is to report the

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kilowatts, kilovars, kilovolts and amperes to the load dispatching center at every hour. The data of load reporting will be used for load prediction.

This old-fashion communication or control system has several disadvantages such as :

1. A lot of time is consumed in communication with the two-way radio system.
2. The system requires a lot of man-hours to operate.

The first disadvantage creates some delay in control system. For example, with ordinary operation, the time taking for load reporting from all substations is about 15 minutes, this accounts for 29 substations at present. According to the MEA. developing project, the numbers of substations will be increased to be 60 by the year 1977, then time will be wasted more than 30 minutes for this operation alone.

The second disadvantage causes a considerable expenses, one for the salaries and another for the good-living of the substation's operators.

This leads to a survey and study of a new control system between the load dispatching center.

substations to replace the VHF system. The study aims at the high efficiency and more economical operation as its goal. The new control system under study will be the telemetering and supervisory control types.

The telemetering is the method of transmitting the measurands and other kinds of information, which are usually converted in the digital forms, from one station to the other. While the supervisory control system is the method of tele-control from the center to the distant station. The advantages of this system are

1. A lot of informations can be transmitted in the same interval of time by using multi-channell transmission.

2. The employment of automatic control system eliminates the problems of man-power and money to spend.

The telemetering and supervisory control system depend on the media available, the pilot wire, power line carrier, VHF, UHF and Microwave, The selection of these media is necessary because of the differences in geographical, economical and operational viewpoints. The concentration of this thesis is put on this selection. The result obtained is the best control medium with the lowest investment.

NS. 809 - 230 KV. (LINE 230KV. FROM NAKORN SAWAN)
 NS. 807 - 230 KV. (LINE 230KV. FROM NAKORN SAWAN)

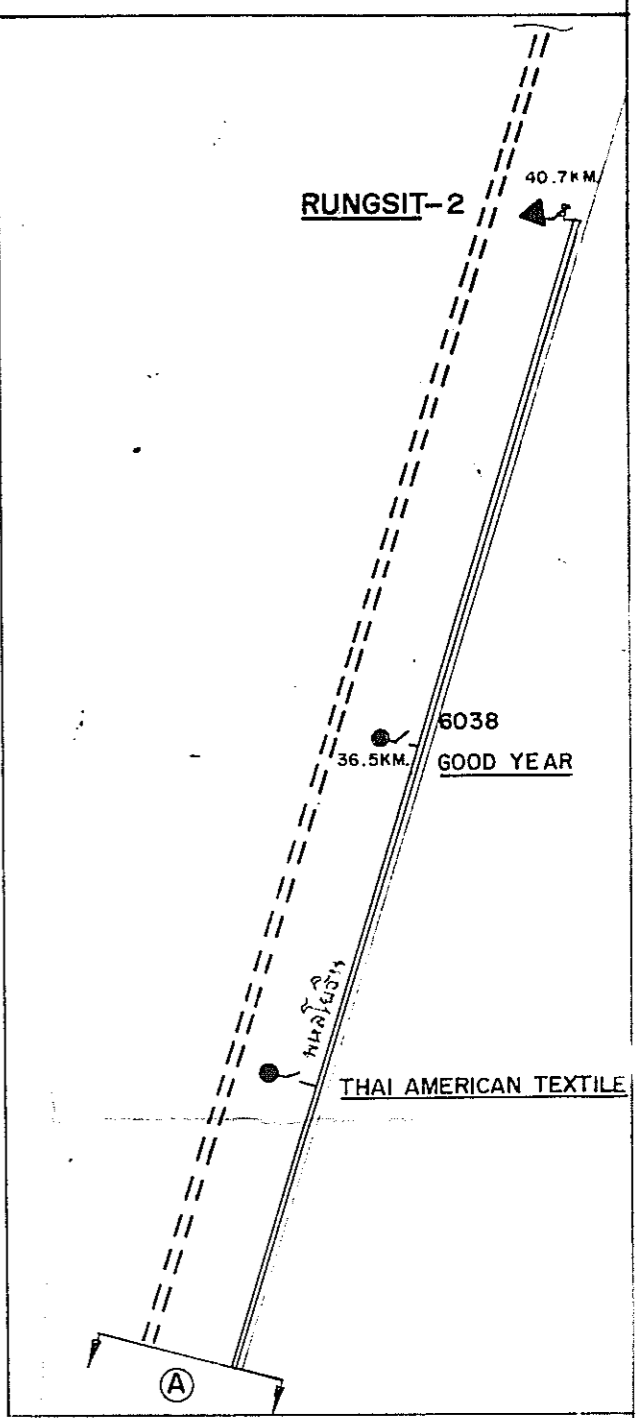
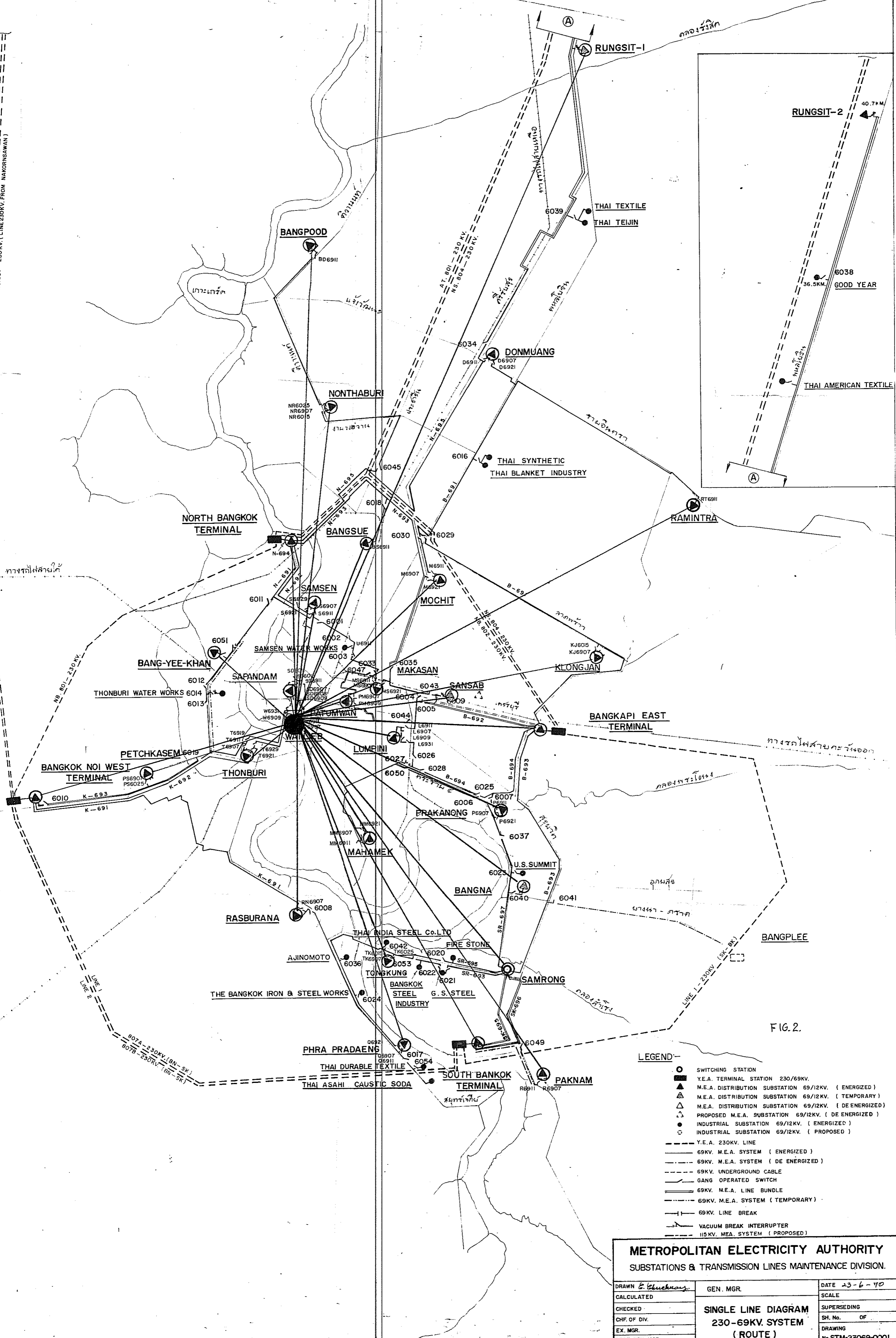


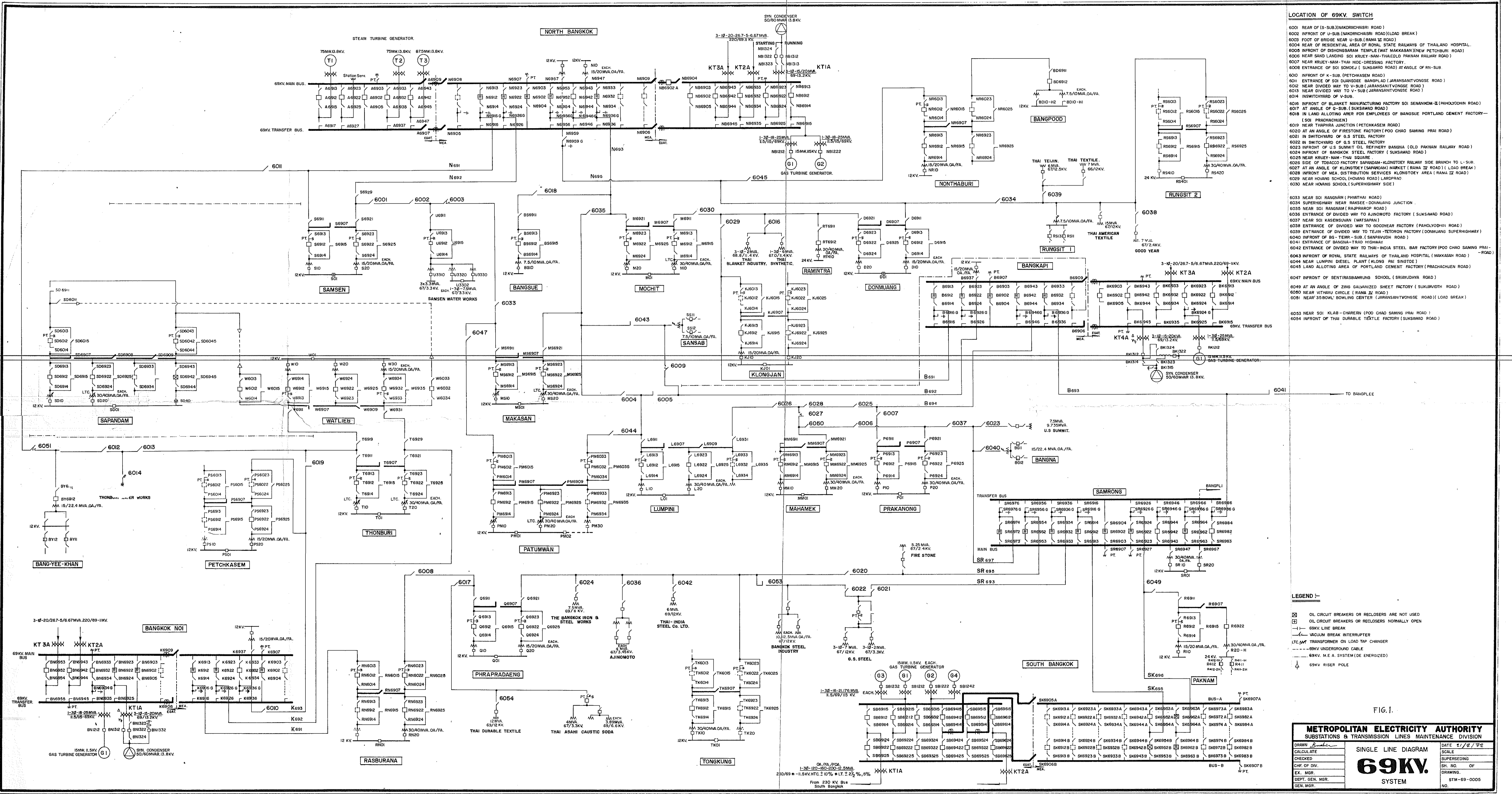
FIG. 2.

- LEGEND**
- SWITCHING STATION
 - Y.E.A. TERMINAL STATION 230/69KV.
 - ▲ M.E.A. DISTRIBUTION SUBSTATION 69/12KV. (ENERGIZED)
 - △ M.E.A. DISTRIBUTION SUBSTATION 69/12KV. (TEMPORARY)
 - ◻ M.E.A. DISTRIBUTION SUBSTATION 69/12KV. (DE ENERGIZED)
 - ◊ PROPOSED M.E.A. SUBSTATION 69/12KV. (DE ENERGIZED)
 - INDUSTRIAL SUBSTATION 69/12KV. (ENERGIZED)
 - INDUSTRIAL SUBSTATION 69/12KV. (PROPOSED)
 - Y.E.A. 230KV. LINE
 - 69KV. M.E.A. SYSTEM (ENERGIZED)
 - 69KV. M.E.A. SYSTEM (DE ENERGIZED)
 - 69KV. UNDERGROUND CABLE
 - GANG OPERATED SWITCH
 - 69KV. M.E.A. LINE BUNDLE
 - 69KV. M.E.A. SYSTEM (TEMPORARY)
 - 69KV. LINE BREAK
 - VACUUM BREAK INTERRUPTER
 - 115 KV. ME.A. SYSTEM (PROPOSED)

METROPOLITAN ELECTRICITY AUTHORITY
 SUBSTATIONS & TRANSMISSION LINES MAINTENANCE DIVISION.

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DEPT. GEN. MGR.		No. STM-23069-0001

SINGLE LINE DIAGRAM
230-69KV. SYSTEM
(ROUTE)



- LOCATION OF 69KV. SWITCH**
- 6001 REAR OF (S-SUB) (NAKORNCHAIROAD)
 - 6002 INFRONT OF U-SUB (NAKORNCHAIROAD) (LOAD BREAK)
 - 6003 FOOT OF BRIDGE NEAR U-SUB (RAMA II ROAD)
 - 6004 REAR OF RESIDENTIAL AREA OF ROYAL STATE RAILWAYS OF THAILAND HOSPITAL.
 - 6005 INFRONT OF DSHONGSIRAM TEMPLE (WAT MAKASAN) (NEW PETCHBURI ROAD)
 - 6006 NEAR SAND LANDING SOI KRUEY-NAM-THAI (OLD PAKNAM RAILWAY ROAD)
 - 6007 NEAR KRUEY-NAM-THAI HOE-DRESSING FACTORY.
 - 6008 ENTRANCE OF SOI SOMDEJ (SUNGSAWAD ROAD) AT ANGLE OF RN-SUB
 - 6009 INFRONT OF K-SUB (PETCHKASEM ROAD)
 - 6010 ENTRANCE OF SOI DUANGDEE BANGPLAD (JARANSANTIVONGSE ROAD)
 - 6011 NEAR DIVIDED WAY TO V-SUB (JARANSANTIVONGSE ROAD)
 - 6012 NEAR DIVIDED WAY TO V-SUB (JARANSANTIVONGSE ROAD)
 - 6013 NEAR DIVIDED WAY TO V-SUB (JARANSANTIVONGSE ROAD)
 - 6014 INSWITCHYARD OF V-SUB.
 - 6015 INFRONT OF BLANKET MANUFACTURING FACTORY SOI SENANOM-2 (PAHOLOPHIN ROAD)
 - 6016 AT AN ANGLE OF O-SUB (SUKSAWAD ROAD)
 - 6017 IN LAND ALLOCATING AREA FOR EMPLOYEES OF BANGSUE PORTLAND CEMENT FACTORY (SOI PRACHACHUEN)
 - 6018 NEAR THAPHA JUNCTION (PETCHKASEM ROAD)
 - 6019 AT AN ANGLE OF FRESTONE FACTORY (POO CHAO SAMING PRAI ROAD)
 - 6020 IN SWITCHYARD OF G.S STEEL FACTORY
 - 6021 IN SWITCHYARD OF G.S STEEL FACTORY
 - 6022 IN SWITCHYARD OF G.S STEEL FACTORY
 - 6023 INFRONT OF U.S SUMMIT OIL REFINERY BANGKAPI (OLD PAKNAM RAILWAY ROAD)
 - 6024 INFRONT OF BANGKOK STEEL FACTORY (SUKSAWAD ROAD)
 - 6025 NEAR KRUEY-NAM-THAI SQUARE
 - 6026 SIDE OF TOBACCO FACTORY SAMPANOM-KLONGTOEY RAILWAY SIDE BRANCH TO L-SUB
 - 6027 AT AN ANGLE OF KLONGTOEY (SAMPANOM) MARKET (RAMA II ROAD) (LOAD BREAK)
 - 6028 INFRONT OF MEA. DISTRIBUTION SERVICES KLONGTOEY AREA (RAMA II ROAD)
 - 6029 NEAR HOVANG SCHOOL (HOVANG ROAD) LARDPRAO
 - 6030 NEAR HOVANG SCHOOL (SUPERHIGHWAY SIDE)
 - 6031 NEAR SOI RANGHAM (PHYATHAI ROAD)
 - 6032 SUPERHIGHWAY NEAR RAKSEE-DONMUANG JUNCTION
 - 6033 NEAR SOI RANGHAM (RAJAPRAROP ROAD)
 - 6034 ENTRANCE OF DIVIDED WAY TO AJINOMOTO FACTORY (SUKSAWAD ROAD)
 - 6035 NEAR SOI WASEM-SURAN (WATSURAN)
 - 6036 ENTRANCE OF DIVIDED WAY TO GOODYEAR FACTORY (PAHOLOPHIN ROAD)
 - 6037 ENTRANCE OF DIVIDED WAY TO GOODYEAR FACTORY (PAHOLOPHIN ROAD)
 - 6038 ENTRANCE OF DIVIDED WAY TO TEJIN-TETONOR FACTORY (DONMUANG SUPERHIGHWAY)
 - 6039 INFRONT OF U.S SUMMIT OIL REFINERY BANGKAPI (OLD PAKNAM RAILWAY ROAD)
 - 6040 INFRONT OF BANGKOK STEEL FACTORY (SUKSAWAD ROAD)
 - 6041 ENTRANCE OF BANGKOK-TRID HIGHWAY
 - 6042 ENTRANCE OF DIVIDED WAY TO THAI-INDIA STEEL BAR FACTORY (POO CHAO SAMING PRAI-ROAD)
 - 6043 INFRONT OF ROYAL STATE RAILWAYS OF THAILAND HOSPITAL (MAKASAN ROAD)
 - 6044 NEAR LUMPINI DIESEL PLANT (KLONG PAI SINGTOE)
 - 6045 LAND ALLOCATING AREA OF PORTLAND CEMENT FACTORY (PRACHACHUEN ROAD)
 - 6046 INFRONT OF SENTIRASBAMRANG SCHOOL (SRIYUDHIN ROAD)
 - 6047 AT AN ANGLE OF ZING GALUMNANG SHEET FACTORY (SUKSAWAD ROAD)
 - 6048 NEAR WITAYU CIRCLE (RAMA II ROAD)
 - 6049 NEAR 35/BOWL BOWLING CENTER (JARANSANTIVONGSE ROAD) (LOAD BREAK)
 - 6050 NEAR SOI KLAB-CHARERN (POO CHAO SAMING PRAI ROAD)
 - 6051 INFRONT OF THAI DURABLE TEXTILE FACTORY (SUKSAWAD ROAD)

- LEGEND**
- ☒ OIL CIRCUIT BREAKERS OR REclosERS ARE NOT USED
 - ☐ OIL CIRCUIT BREAKERS OR REclosERS NORMALLY OPEN
 - |— VACUUM BREAK INTERRUPTER
 - LTC TRANSFORMER ON LOAD TAP CHANGER
 - 69KV UNDERGROUND CABLE
 - 69KV. M.E.A. SYSTEM (DE ENERGIZED)
 - ▲ 69KV RISER POLE

FIG. 1.

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69KV. SYSTEM