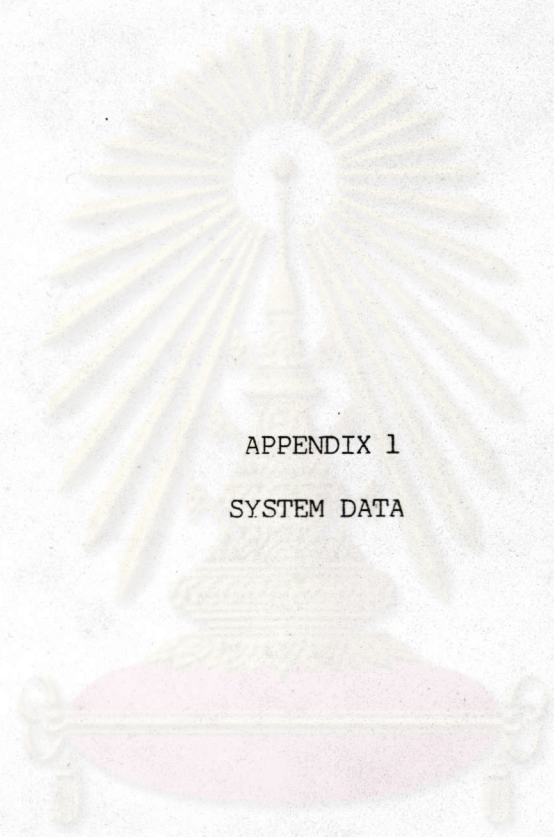


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APPENDIX 1  
SYSTEM DATA

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

## SYSTEM DATA

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CONTROL DATA

EDIT=-1

END

GENERAL

SN=1

END

NODES

1	UB=.40	AREA=1	X=20	Y=150	C=0
2	UB=.40	AREA=1	X=40	Y=115	C=0
3	UB=.40	AREA=1	X=60	Y=150	C=1
4	UB=.40	AREA=1	X=110	Y=135	C=1
5	UB=.40	AREA=1	X=155	Y=150	C=1
6	UB=.40	AREA=1	X=175	Y=135	C=1
7	UB=.40	AREA=1	X=195	Y=110	C=0
8	UB=.40	AREA=1	X=215	Y=135	C=0
9	UB=.40	AREA=1	X=225	Y=110	C=0
10	UB=.40	AREA=1	X=250	Y=135	C=1
11	UB=.40	AREA=1	X=250	Y=40	C=1
12	UB=.40	AREA=1	X=240	Y=80	C=0
13	UB=.40	AREA=1	X=195	Y=55	C=0
14	UB=.40	AREA=1	X=160	Y=65	C=1
15	UB=.40	AREA=1	X=135	Y=25	C=1
16	UB=.40	AREA=1	X=55	Y=55	C=1
17	UB=.40	AREA=1	X=110	Y=95	C=1
18	UB=.40	AREA=1	X=85	Y=120	C=0
19	UB=.40	AREA=1	X=60	Y=95	C=1
20	UB=.40	AREA=1	X=20	Y=55	C=1
21	UB=.40	AREA=2	X=15	Y=70	C=0
22	UB=.40	AREA=2	X=15	Y=120	C=0
23	UB=.40	AREA=2	X=30	Y=35	C=1
24	UB=.40	AREA=2	X=55	Y=60	C=0
25	UB=.40	AREA=2	X=65	Y=140	C=0
26	UB=.40	AREA=2	X=75	Y=90	C=0
27	UB=.40	AREA=2	X=100	Y=55	C=1
28	UB=.40	AREA=2	X=115	Y=80	C=0
29	UB=.40	AREA=2	X=115	Y=150	C=0
30	UB=.40	AREA=2	X=140	Y=35	C=1
31	UB=.40	AREA=2	X=130	Y=95	C=1
33	UB=.40	AREA=2	X=140	Y=145	C=1
34	UB=.40	AREA=2	X=185	Y=125	C=1
35	UB=.40	AREA=2	X=200	Y=155	C=1
36	UB=.40	AREA=2	X=175	Y=80	C=0
37	UB=.40	AREA=2	X=200	Y=105	C=1
38	UB=.40	AREA=2	X=215	Y=130	C=0
39	UB=.40	AREA=2	X=235	Y=150	C=0
40	UB=.40	AREA=2	X=220	Y=65	C=1
41	UB=.40	AREA=3	X=230	Y=125	C=1
42	UB=.40	AREA=3	X=215	Y=90	C=0
43	UB=.40	AREA=3	X=190	Y=60	C=0

44	UB=.40	AREA=3	X=210	Y=155	C=1
45	UB=.40	AREA=3	X=165	Y=130	C=0
46	UB=.40	AREA=3	X=135	Y=130	C=0
47	UB=.40	AREA=3	X=110	Y=125	C=1
48	UB=.40	AREA=3	X=85	Y=150	C=0
49	UB=.40	AREA=3	X=90	Y=95	C=1
50	UB=.40	AREA=3	X=115	Y=80	C=0
51	UB=.40	AREA=3	X=115	Y=50	C=0
52	UB=.40	AREA=3	X=160	Y=45	C=1
54	UB=.40	AREA=3	X=55	Y=150	C=0
55	UB=.40	AREA=3	X=10	Y=115	C=1
56	UB=.40	AREA=3	X=25	Y=90	C=0
57	UB=.40	AREA=3	X=10	Y=65	C=1
58	UB=.40	AREA=3	X=10	Y=45	C=1
59	UB=.40	AREA=3	X=45	Y=60	C=0
60	UB=.40	AREA=3	X=10	Y=15	C=1
61	UB=.40	AREA=4	X=150	Y=15	C=1
62	UB=.40	AREA=4	X=130	Y=35	C=1
63	UB=.40	AREA=4	X=130	Y=55	C=1
64	UB=.40	AREA=4	X=160	Y=85	C=1
65	UB=.40	AREA=4	X=180	Y=65	C=1
66	UB=.40	AREA=4	X=150	Y=55	C=1
67	UB=.40	AREA=4	X=180	Y=35	C=1
68	UB=.40	AREA=4	X=130	Y=115	C=1
69	UB=.40	AREA=4	X=150	Y=125	C=1
70	UB=.40	AREA=4	X=170	Y=145	C=1
71	UB=.40	AREA=4	X=170	Y=115	C=1
72	UB=.40	AREA=4	X=230	Y=145	C=1
73	UB=.40	AREA=4	X=200	Y=145	C=1
74	UB=.40	AREA=4	X=80	Y=45	C=1
75	UB=.40	AREA=4	X=20	Y=65	C=1
76	UB=.40	AREA=4	X=20	Y=125	C=1
77	UB=.40	AREA=4	X=20	Y=35	C=1
78	UB=.40	AREA=4	X=55	Y=70	C=0
79	UB=.40	AREA=4	X=90	Y=85	C=1
80	UB=.40	AREA=4	X=90	Y=115	C=1
81	UB=.40	AREA=4	X=60	Y=135	C=1
82	UB=.40	AREA=4	X=40	Y=145	C=1
83	UB=.40	AREA=4	X=90	Y=145	C=1
84	UB=.40	AREA=4	X=130	Y=155	C=1
85	UB=.40	AREA=1	X=115	Y=65	C=1
86	UB=.40	AREA=3	X=165	Y=100	C=0
87	UB=.40	AREA=3	X=130	Y=105	C=1
88	UB=.40	AREA=3	X=60	Y=45	C=1
89	UB=.40	AREA=3	X=35	Y=130	C=0
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11515	UB=.40	AREA=4	X=55	Y=20	C=0
11525	UB=.40	AREA=2	X=220	Y=65	C=1
12508	UB=.40	AREA=1	X=85	Y=175	C=0
12510	UB=.40	AREA=3	X=90	Y=125	C=1
12511	UB=.40	AREA=1	X=180	Y=30	C=1
12512	UB=.40	AREA=3	X=60	Y=115	C=1
12525	UB=.40	AREA=3	X=140	Y=65	C=1

13507	UB=.40	AREA=1	X=150	Y=100	C=1
42507	UB=.40	AREA=2	X=150	Y=65	C=1
42508	UB=.40	AREA=4	X=60	Y=105	C=1
42509	UB=.40	AREA=4	X=105	Y=20	C=0
15511	UB=.40	AREA=2	X=210	Y=115	C=1
15512	UB=.40	AREA=1	X=40	Y=175	C=0
15514	UB=.40	AREA=3	X=190	Y=30	C=0
15519	UB=.40	AREA=2	X=150	Y=115	C=1
15521	UB=.40	AREA=4	X=120	Y=135	C=1
21504	UB=.40	AREA=3	X=145	Y=150	C=0
42506	UB=.40	AREA=1	X=240	Y=175	C=0
21509	UB=.40	AREA=2	X=205	Y=40	C=0
21512	UB=.40	AREA=4	X=120	Y=95	C=1
21515	UB=.40	AREA=2	X=95	Y=120	C=0
21528	UB=.40	AREA=2	X=45	Y=100	C=0
22508	UB=.40	AREA=3	X=200	Y=125	C=1
22517	UB=.40	AREA=1	X=20	Y=85	C=1
22519	UB=.40	AREA=1	X=55	Y=30	C=1
22530	UB=.40	AREA=3	X=60	Y=90	C=1
23512	UB=.40	AREA=3	X=175	Y=150	C=0
23514	UB=.40	AREA=3	X=85	Y=30	C=0
23518	UB=.40	AREA=1	X=135	Y=175	C=0
23519	UB=.40	AREA=1	X=195	Y=170	C=0
24506	UB=.40	AREA=2	X=75	Y=30	C=0
24511	UB=.40	AREA=4	X=20	Y=95	C=1
24512	UB=.40	AREA=3	X=140	Y=20	C=0
24520	UB=.40	AREA=3	X=115	Y=150	C=0
24522	UB=.40	AREA=2	X=165	Y=150	C=0
42524	UB=.40	AREA=3	X=45	Y=30	C=0
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SD11	UB=12.00				
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SD11S2	UB=12.00				
SD11S3	UB=12.00				
SD11S4	UB=12.00				
SD12	UB=12.00				
SD12S1	UB=12.00				
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SD12S7	UB=12.00				
SD12S8	UB=12.00				
SD13	UB=12.00				
SD13S1	UB=12.00				
SD13S2	UB=12.00				
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 SD15S4 UB=12.00  
 SD15S5 UB=12.00  
 SD15S6 UB=12.00

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 SD21S2 UB=12.00  
 SD21S3 UB=12.00  
 SD21S4 UB=12.00  
 SD21S5 UB=12.00  
 SD21S6 UB=12.00  
 SD21S7 UB=12.00  
 SD21S8 UB=12.00

SD22 UB=12.00  
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 SD22S2 UB=12.00  
 SD22S3 UB=12.00  
 SD22S4 UB=12.00  
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 SD23S3 UB=12.00  
 SD23S4 UB=12.00  
 SD23S5 UB=12.00

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 SD24S4 UB=12.00  
 SD24S5 UB=12.00  
 SD24S6 UB=12.00  
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 SD24S8 UB=12.00  
 SD24S9 UB=12.00  
 SD24S10 UB=12.00

END

LINES

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2	3	TYPE=1	R=0.187	X=0.232	L=0.057
3	12508	TYPE=1	R=0.187	X=0.232	L=0.013
12508	4	TYPE=1	R=0.187	X=0.232	L=0.017
4	23518	TYPE=1	R=0.093	X=0.116	L=0.018
23518	5	TYPE=1	R=0.187	X=0.232	L=0.058
5	13507	TYPE=1	R=0.187	X=0.232	L=0.076
13507	6	TYPE=1	R=0.093	X=0.116	L=0.038
6	7	TYPE=1	R=0.093	X=0.116	L=0.029
7	23519	TYPE=1	R=0.093	X=0.116	L=0.010
7	8	TYPE=1	R=0.093	X=0.116	L=0.066
7	14	TYPE=1	R=0.093	X=0.116	L=0.018
8	42506	TYPE=1	R=0.093	X=0.116	L=0.016
8	13	TYPE=1	R=0.093	X=0.116	L=0.018

9	42506	TYPE=1	R=0.187	X=0.232	L=0.008
42506	10	TYPE=1	R=0.187	X=0.232	L=0.026
10	11	TYPE=1	R=0.187	X=0.232	L=0.023
11	12511	TYPE=1	R=0.093	X=0.116	L=0.022
11	13	TYPE=1	R=0.187	X=0.232	L=0.057
11	12	TYPE=1	R=0.187	X=0.232	L=0.022
12	9	TYPE=1	R=0.187	X=0.232	L=0.033
12	13	TYPE=1	R=0.187	X=0.232	L=0.035
13	14	TYPE=1	R=0.187	X=0.232	L=0.064
14	15	TYPE=1	R=0.093	X=0.116	L=0.036
15	85	TYPE=1	R=0.093	X=0.116	L=0.026
85	13507	TYPE=1	R=0.093	X=0.116	L=0.018
22519	85	TYPE=1	R=0.093	X=0.116	L=0.016
85	16	TYPE=1	R=0.187	X=0.116	L=0.053
16	17	TYPE=1	R=0.187	X=0.232	L=0.123
17	4	TYPE=1	R=0.187	X=0.232	L=0.014
17	18	TYPE=1	R=0.187	X=0.232	L=0.017
18	12508	TYPE=1	R=0.187	X=0.232	L=0.014
18	19	TYPE=1	R=0.187	X=0.232	L=0.063
19	22517	TYPE=1	R=0.187	X=0.232	L=0.043
15512	2	TYPE=1	R=0.187	X=0.232	L=0.029
22517	1	TYPE=1	R=0.187	X=0.232	L=0.017
22517	20	TYPE=1	R=0.187	X=0.232	L=0.140
20	21	TYPE=1	R=0.187	X=0.232	L=0.024
21	22	TYPE=1	R=0.187	X=0.232	L=0.045
22	15512	TYPE=1	R=0.187	X=0.232	L=0.045
21	23	TYPE=1	R=0.187	X=0.232	L=0.082
23	24	TYPE=1	R=0.093	X=0.116	L=0.015
24	21528	TYPE=1	R=0.093	X=0.116	L=0.017
24	24506	TYPE=1	R=0.093	X=0.116	L=0.016
21528	25	TYPE=1	R=0.187	X=0.232	L=0.068
25	18	TYPE=1	R=0.187	X=0.232	L=0.036
24506	26	TYPE=1	R=0.187	X=0.232	L=0.033
26	17	TYPE=1	R=0.187	X=0.232	L=0.076
24506	27	TYPE=1	R=0.093	X=0.116	L=0.081
27	11510	TYPE=1	R=0.093	X=0.116	L=0.085
11510	28	TYPE=1	R=0.187	X=0.232	L=0.038
28	21515	TYPE=1	R=0.187	X=0.232	L=0.054
21515	29	TYPE=1	R=0.187	X=0.232	L=0.033
29	22519	TYPE=1	R=0.187	X=0.232	L=0.019
11510	30	TYPE=1	R=0.093	X=0.116	L=0.039
30	42507	TYPE=1	R=0.093	X=0.116	L=0.033
42507	31	TYPE=1	R=0.093	X=0.116	L=0.0355
31	15519	TYPE=1	R=0.093	X=0.116	L=0.0315
15519	33	TYPE=1	R=0.187	X=0.232	L=0.242
33	21515	TYPE=1	R=0.187	X=0.232	L=0.0675
15519	24522	TYPE=1	R=0.187	X=0.232	L=0.054
24522	14	TYPE=1	R=0.093	X=0.116	L=0.016
24522	34	TYPE=1	R=0.093	X=0.116	L=0.028
34	35	TYPE=1	R=0.187	X=0.232	L=0.059
35	38	TYPE=1	R=0.187	X=0.232	L=0.058
15519	36	TYPE=1	R=0.187	X=0.232	L=0.057
36	37	TYPE=1	R=0.187	X=0.232	L=0.043
37	38	TYPE=1	R=0.187	X=0.232	L=0.010
38	12	TYPE=1	R=0.187	X=0.232	L=0.036
38	39	TYPE=1	R=0.187	X=0.232	L=0.016
37	40	TYPE=1	R=0.187	X=0.232	L=0.029
39	11	TYPE=1	R=0.187	X=0.232	L=0.034
40	12511	TYPE=1	R=0.187	X=0.232	L=0.050
40	21509	TYPE=1	R=0.093	X=0.116	L=0.027

40	15514	TYPE=1	R=0.187	X=0.232	L=0.019
39	41	TYPE=1	R=0.187	X=0.232	L=0.038
41	22508	TYPE=1	R=0.187	X=0.232	L=0.036
22508	42	TYPE=1	R=0.187	X=0.232	L=0.058
42	43	TYPE=1	R=0.187	X=0.232	L=0.016
43	15514	TYPE=1	R=0.187	X=0.232	L=0.104
22508	23512	TYPE=1	R=0.093	X=0.116	L=0.015
23512	44	TYPE=1	R=0.093	X=0.116	L=0.0305
44	42507	TYPE=1	R=0.093	X=0.116	L=0.0565
23512	21504	TYPE=1	R=0.187	X=0.232	L=0.074
22508	45	TYPE=1	R=0.187	X=0.232	L=0.074
45	21504	TYPE=1	R=0.093	X=0.116	L=0.016
21504	24520	TYPE=1	R=0.093	X=0.116	L=0.055
45	86	TYPE=1	R=0.093	X=0.116	L=0.0389
86	46	TYPE=1	R=0.093	X=0.116	L=0.0191
46	24520	TYPE=1	R=0.093	X=0.116	L=0.015
46	47	TYPE=1	R=0.187	X=0.232	L=0.0515
24520	48	TYPE=1	R=0.093	X=0.116	L=0.042
47	12510	TYPE=1	R=0.187	X=0.232	L=0.016
12510	49	TYPE=1	R=0.187	X=0.232	L=0.034
49	50	TYPE=1	R=0.187	X=0.232	L=0.059
50	51	TYPE=1	R=0.187	X=0.232	L=0.009
50	12525	TYPE=1	R=0.187	X=0.232	L=0.0715
51	12525	TYPE=1	R=0.187	X=0.232	L=0.0655
12525	52	TYPE=1	R=0.187	X=0.232	L=0.0375
12510	87	TYPE=1	R=0.187	X=0.232	L=0.072
87	12525	TYPE=1	R=0.187	X=0.232	L=0.100
52	24512	TYPE=1	R=0.187	X=0.232	L=0.050
51	23514	TYPE=1	R=0.187	X=0.232	L=0.0455
23514	88	TYPE=1	R=0.187	X=0.232	L=0.0277
88	22530	TYPE=1	R=0.187	X=0.232	L=0.0535
23514	49	TYPE=1	R=0.187	X=0.232	L=0.040
22530	12512	TYPE=1	R=0.187	X=0.232	L=0.0435
49	12512	TYPE=1	R=0.093	X=0.116	L=0.016
12512	54	TYPE=1	R=0.093	X=0.116	L=0.017
54	48	TYPE=1	R=0.093	X=0.116	L=0.086
54	89	TYPE=1	R=0.093	X=0.116	L=0.0128
89	55	TYPE=1	R=0.093	X=0.116	L=0.0256
55	56	TYPE=1	R=0.093	X=0.116	L=0.008
56	57	TYPE=1	R=0.187	X=0.232	L=0.079
56	59	TYPE=1	R=0.187	X=0.232	L=0.065
57	58	TYPE=1	R=0.187	X=0.232	L=0.005
58	42524	TYPE=1	R=0.187	X=0.232	L=0.050
59	42524	TYPE=1	R=0.187	X=0.232	L=0.050
59	42509	TYPE=1	R=0.187	X=0.232	L=0.140
42509	60	TYPE=1	R=0.187	X=0.232	L=0.119
60	42524	TYPE=1	R=0.187	X=0.232	L=0.190
58	61	TYPE=1	R=0.187	X=0.232	L=0.049
61	62	TYPE=1	R=0.187	X=0.232	L=0.048
62	63	TYPE=1	R=0.187	X=0.232	L=0.035
63	21512	TYPE=1	R=0.187	X=0.232	L=0.041
21512	64	TYPE=1	R=0.187	X=0.232	L=0.056
21512	66	TYPE=1	R=0.187	X=0.232	L=0.090
21512	68	TYPE=1	R=0.187	X=0.232	L=0.025
64	11525	TYPE=1	R=0.187	X=0.232	L=0.070
66	65	TYPE=1	R=0.187	X=0.232	L=0.062
65	11525	TYPE=1	R=0.187	X=0.232	L=0.0465
66	67	TYPE=1	R=0.187	X=0.232	L=0.038
67	11525	TYPE=1	R=0.187	X=0.232	L=0.024
66	55	TYPE=1	R=0.093	X=0.116	L=0.059



68	69	TYPE=1	R=0.187	X=0.232	L=0.022	
69	70	TYPE=1	R=0.187	X=0.232	L=0.024	
70	71	TYPE=1	R=0.187	X=0.232	L=0.025	
71	15511	TYPE=1	R=0.093	X=0.116	L=0.019	
71	21512	TYPE=1	R=0.187	X=0.116	L=0.096	
15511	72	TYPE=1	R=0.187	X=0.232	L=0.0315	
15511	73	TYPE=1	R=0.187	X=0.232	L=0.067	
73	21515	TYPE=1	R=0.187	X=0.232	L=0.147	
72	11510	TYPE=1	R=0.187	X=0.232	L=0.0665	
42509	74	TYPE=1	R=0.187	X=0.232	L=0.057	
42509	62	TYPE=1	R=0.187	X=0.232	L=0.020	
74	11515	TYPE=1	R=0.187	X=0.232	L=0.075	
11515	77	TYPE=1	R=0.093	X=0.116	L=0.011	
77	75	TYPE=1	R=0.187	X=0.232	L=0.0615	
11515	78	TYPE=1	R=0.187	X=0.232	L=0.105	
75	24511	TYPE=1	R=0.187	X=0.232	L=0.0525	
24511	76	TYPE=1	R=0.187	X=0.232	L=0.1135	
76	77	TYPE=1	R=0.187	X=0.232	L=0.028	
78	42508	TYPE=1	R=0.187	X=0.232	L=0.118	
42508	80	TYPE=1	R=0.187	X=0.232	L=0.0145	
42508	81	TYPE=1	R=0.187	X=0.232	L=0.0915	
81	82	TYPE=1	R=0.187	X=0.232	L=0.0525	
80	79	TYPE=1	R=0.187	X=0.232	L=0.079	
79	21512	TYPE=1	R=0.187	X=0.232	L=0.139	
42508	83	TYPE=1	R=0.187	X=0.232	L=0.038	
83	24	TYPE=1	R=0.187	X=0.232	L=0.137	
80	15521	TYPE=1	R=0.187	X=0.232	L=0.0305	
15521	84	TYPE=1	R=0.187	X=0.232	L=0.072	
84	24506	TYPE=1	R=0.187	X=0.232	L=0.070	
12KV	SD11	TYPE=2	R=0.092	X=0.106	L=1.29	B=0.000135
SD11	SD11S1	TYPE=2	R=0.308	X=0.092	L=0.098	B=0.0000817
SD11	SD11S2	TYPE=2	R=0.308	X=0.092	L=0.533	B=0.0000817
SD11S2	SD11S3	TYPE=2	R=0.308	X=0.092	L=0.032	B=0.0000817
SD11S2	SD11S4	TYPE=2	R=0.308	X=0.092	L=0.261	B=0.0000817
12KV	SD12	TYPE=2	R=0.092	X=0.106	L=0.605	B=0.000135
SD12	SD12S1	TYPE=2	R=0.092	X=0.106	L=0.511	B=0.000135
SD12S1	SD12S2	TYPE=2	R=0.308	X=0.092	L=0.254	B=0.0000817
SD12S1	SD12S3	TYPE=2	R=0.308	X=0.092	L=0.032	B=0.0000817
SD12	SD12S4	TYPE=2	R=0.092	X=0.106	L=0.433	B=0.000135
SD12S4	SD12S5	TYPE=2	R=0.193	X=0.086	L=0.253	B=0.000097
SD12S5	SD12S6	TYPE=2	R=0.308	X=0.092	L=0.044	B=0.0000817
SD12S5	SD12S7	TYPE=2	R=0.308	X=0.092	L=0.039	B=0.0000817
SD12S5	SD12S8	TYPE=2	R=0.308	X=0.092	L=0.062	B=0.0000817
12KV	SD13	TYPE=2	R=0.092	X=0.106	L=1.154	B=0.000135
SD13	SD13S1	TYPE=2	R=0.308	X=0.092	L=0.027	B=0.0000817
SD13	SD13S2	TYPE=2	R=0.308	X=0.092	L=0.168	B=0.0000817
SD13	SD13S3	TYPE=2	R=0.308	X=0.092	L=0.054	B=0.0000817
SD13	SD13S4	TYPE=2	R=0.308	X=0.092	L=0.465	B=0.0000817
12KV	SD15	TYPE=2	R=0.092	X=0.106	L=2.216	B=0.000135
SD15	SD15S1	TYPE=2	R=0.308	X=0.092	L=0.186	B=0.0000817
SD15	SD15S2	TYPE=2	R=0.308	X=0.092	L=0.261	B=0.0000817
SD15S2	SD15S3	TYPE=2	R=0.308	X=0.092	L=0.290	B=0.0000817
SD15S2	SD15S4	TYPE=2	R=0.308	X=0.092	L=0.049	B=0.0000817
SD15S2	SD15S5	TYPE=2	R=0.308	X=0.092	L=0.109	B=0.0000817
SD15S2	SD15S6	TYPE=2	R=0.308	X=0.092	L=0.279	B=0.0000817

12KV	SD21	TYPE=2	R=0.092	X=0.106	L=1.016	B=0.000135
SD21	SD21S1	TYPE=2	R=0.308	X=0.092	L=0.129	B=0.0000817
SD21S1	SD21S2	TYPE=2	R=0.308	X=0.092	L=0.033	B=0.0000817
SD21S1	SD21S3	TYPE=2	R=0.308	X=0.092	L=0.671	B=0.0000817
SD21	SD21S4	TYPE=2	R=0.193	X=0.086	L=0.185	B=0.000097
SD21S4	SD21S5	TYPE=2	R=0.308	X=0.092	L=0.374	B=0.0000817
SD21S4	SD21S6	TYPE=2	R=0.308	X=0.092	L=0.283	B=0.0000817
SD21S4	SD21S7	TYPE=2	R=0.308	X=0.092	L=0.091	B=0.0000817
SD21S4	SD21S8	TYPE=2	R=0.308	X=0.092	L=0.038	B=0.0000817

12KV	SD22	TYPE=2	R=0.092	X=0.106	L=1.133	B=0.000135
SD22	SD22S1	TYPE=2	R=0.308	X=0.092	L=0.216	B=0.0000817
SD22S1	SD22S2	TYPE=2	R=0.308	X=0.092	L=0.165	B=0.0000817
SD22S1	SD22S3	TYPE=2	R=0.308	X=0.092	L=0.245	B=0.0000817
SD22S3	SD22S4	TYPE=2	R=0.308	X=0.092	L=0.026	B=0.0000817
SD22S3	SD22S5	TYPE=2	R=0.308	X=0.092	L=0.028	B=0.0000817

12KV	SD23	TYPE=2	R=0.092	X=0.106	L=2.448	B=0.000135
SD23	SD23S1	TYPE=2	R=0.308	X=0.092	L=0.123	B=0.0000817
SD23S1	SD23S2	TYPE=2	R=0.308	X=0.092	L=0.029	B=0.0000817
SD23S1	SD23S3	TYPE=2	R=0.308	X=0.092	L=0.278	B=0.0000817
SD23S1	SD23S4	TYPE=2	R=0.308	X=0.092	L=0.295	B=0.0000817
SD23S1	SD23S5	TYPE=2	R=0.308	X=0.092	L=0.041	B=0.0000817

12KV	SD24	TYPE=2	R=0.092	X=0.106	L=1.224	B=0.000135
SD24	SD24S1	TYPE=2	R=0.122	X=0.118	L=0.275	B=0.000116
SD24S1	SD24S2	TYPE=2	R=0.308	X=0.092	L=0.039	B=0.0000817
SD24S1	SD24S3	TYPE=2	R=0.122	X=0.118	L=0.399	B=0.000116
SD24S3	SD24S4	TYPE=2	R=0.308	X=0.092	L=0.028	B=0.0000817
SD24S3	SD24S5	TYPE=2	R=0.308	X=0.092	L=0.288	B=0.0000817
SD24	SD24S6	TYPE=2	R=0.308	X=0.092	L=0.129	B=0.0000817
SD24S6	SD24S7	TYPE=2	R=0.308	X=0.092	L=0.016	B=0.0000817
SD24S6	SD24S8	TYPE=2	R=0.308	X=0.092	L=0.273	B=0.0000817
SD24S8	SD24S9	TYPE=2	R=0.308	X=0.092	L=0.365	B=0.0000817
SD24S8	SD24S10	TYPE=2	R=0.308	X=0.092	L=0.365	B=0.0000817

END  
TRANSFORMERS

SD11S1	11510	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD11S3	11515	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD11S4	11525	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD12S2	12508	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD12S3	12510	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD12S6	12511	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD12S7	12512	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD12S8	12525	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD13S1	13507	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD13S2	42507	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD13S3	42508	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD13S4	42509	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD15S3	15511	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD15S4	15512	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD15S1	15514	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD15S5	15519	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD15S6	15521	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0

SD21S5	21504	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD21S6	21509	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD21S2	21512	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD21S7	21515	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD21S3	21528	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD21S8	42506	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD22S2	22508	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD22S4	22517	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD22S5	22519	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD22S1	22530	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD23S2	23512	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD23S3	23514	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD23S4	23518	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD23S5	23519	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD24S7	24506	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
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SD24S5	24512	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD24S4	24520	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD24S2	24522	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0
SD24S10	42524	SN=0.5	UN1=12.00	UN2=0.40	EX12=0.049	ER12=0.013	FI=0.0

END

## LOADS

2	P=0.025	Q=0.016
3	P=0.057	Q=0.035
4	P=0.093	Q=0.058
5	P=0.075	Q=0.047
6	P=0.085	Q=0.053
9	P=0.042	Q=0.026
10	P=0.063	Q=0.039
13	P=0.156	Q=0.097
15	P=0.143	Q=0.088
16	P=0.207	Q=0.129
19	P=0.169	Q=0.105
20	P=0.114	Q=0.071
21	P=0.127	Q=0.079
22	P=0.047	Q=0.029
23	P=0.170	Q=0.106
25	P=0.119	Q=0.074
26	P=0.027	Q=0.017
27	P=0.246	Q=0.154
28	P=0.076	Q=0.047
29	P=0.044	Q=0.028
30	P=0.318	Q=0.197
31	P=0.068	Q=0.042
33	P=0.163	Q=0.101
34	P=0.178	Q=0.111
35	P=0.053	Q=0.033
36	P=0.229	Q=0.142
41	P=0.054	Q=0.034
42	P=0.174	Q=0.108
43	P=0.161	Q=0.100
44	P=0.292	Q=0.182
47	P=0.208	Q=0.129
48	P=0.212	Q=0.132
49	P=0.207	Q=0.129

51	P=0.170	Q=0.106
52	P=0.212	Q=0.132
56	P=0.216	Q=0.134
57	P=0.076	Q=0.048
59	P=0.170	Q=0.106
60	P=0.053	Q=0.033
61	P=0.077	Q=0.048
63	P=0.027	Q=0.017
64	P=0.127	Q=0.079
65	P=0.042	Q=0.026
67	P=0.062	Q=0.039
68	P=0.018	Q=0.011
69	P=0.116	Q=0.072
70	P=0.079	Q=0.049
71	P=0.106	Q=0.066
72	P=0.225	Q=0.140
73	P=0.025	Q=0.025
74	P=0.194	Q=0.121
75	P=0.167	Q=0.104
76	P=0.025	Q=0.016
78	P=0.033	Q=0.021
79	P=0.085	Q=0.053
81	P=0.039	Q=0.024
82	P=0.008	Q=0.005
83	P=0.189	Q=0.118
84	P=0.049	Q=0.031
86	P=0.170	Q=0.105
87	P=0.078	Q=0.048
88	P=0.088	Q=0.054
89	P=0.115	Q=0.071
11510	P=0.058	Q=0.036
12508	P=0.138	Q=0.086
12511	P=0.055	Q=0.034
12525	P=0.356	Q=0.221
13507	P=0.595	Q=0.369
15514	P=0.068	Q=0.042
21504	P=0.127	Q=0.079
21509	P=0.252	Q=0.157
22517	P=0.099	Q=0.094
22530	P=0.089	Q=0.055
23519	P=0.051	Q=0.032
24511	P=0.076	Q=0.048
24512	P=0.110	Q=0.069
42524	P=0.082	Q=0.051

END

SHUNT IMPEDANCES

11510	Q=-0.075	UN=0.40
11515	Q=-0.075	UN=0.40
11525	Q=-0.075	UN=0.40
12508	Q=-0.075	UN=0.40
12510	Q=-0.075	UN=0.40
12511	Q=-0.075	UN=0.40
12512	Q=-0.075	UN=0.40
12525	Q=-0.075	UN=0.40
13507	Q=-0.075	UN=0.40
15511	Q=-0.075	UN=0.40
15512	Q=-0.075	UN=0.40
15514	Q=-0.075	UN=0.40
15519	Q=-0.075	UN=0.40
15521	Q=-0.075	UN=0.40

21504 Q=-0.075 UN=0.40  
21509 Q=-0.075 UN=0.40  
21512 Q=-0.075 UN=0.40  
21515 Q=-0.075 UN=0.40  
21528 Q=-0.075 UN=0.40  
22508 Q=-0.075 UN=0.40  
22517 Q=-0.075 UN=0.40  
22519 Q=-0.075 UN=0.40  
22530 Q=-0.075 UN=0.40  
23512 Q=-0.075 UN=0.40  
23514 Q=-0.075 UN=0.40  
23518 Q=-0.075 UN=0.40  
23519 Q=-0.075 UN=0.40  
24506 Q=-0.075 UN=0.40  
24511 Q=-0.075 UN=0.40  
24512 Q=-0.075 UN=0.40  
24520 Q=-0.075 UN=0.40  
24522 Q=-0.075 UN=0.40  
42506 Q=-0.075 UN=0.40  
42507 Q=-0.075 UN=0.40  
42508 Q=-0.075 UN=0.40  
42509 Q=-0.075 UN=0.40  
42524 Q=-0.075 UN=0.40

END

POWER INSTRUCTIONS

12KV TYPE=NODE RTYP=SW U=12.00 FI=40.00 TOL=0.001

END

END

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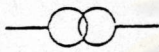

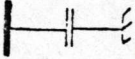
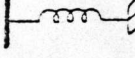




APPENDIX 2

LOAD FLOW SOLUTIONS

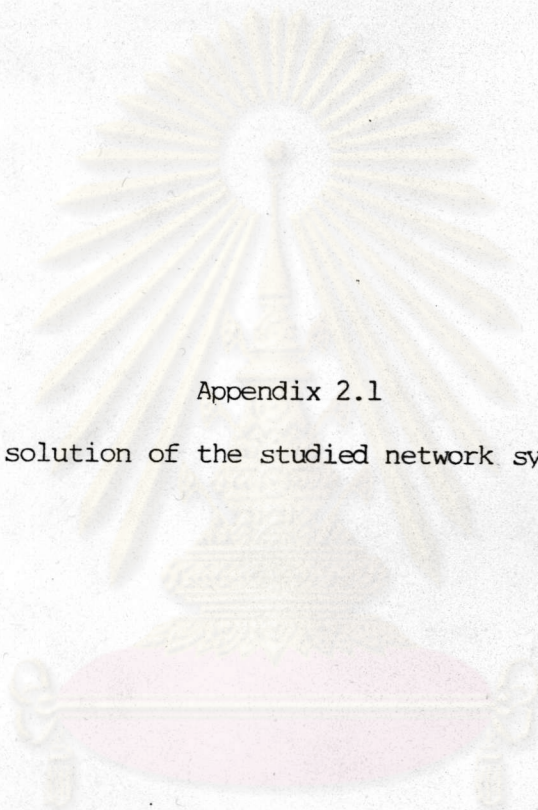
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## SIMBOLS USED IN THE NETWORK DIAGRAM

SYMBOL	DESCRIPTION
	AC-Line
	Two-winding transformer
	Load
	Shunt capacitor
	Shunt reactor
	Generator
	Power exchange to nodes without coordinates
U	Magnitude of bus voltage
FI	Phase angle of bus voltage

- Value shown in figures is in  $P=KW$ ,  $Q=KVAR$

- Base power of the network is 1 MVA.



Appendix 2.1

The load flow solution of the studied network system (base case)

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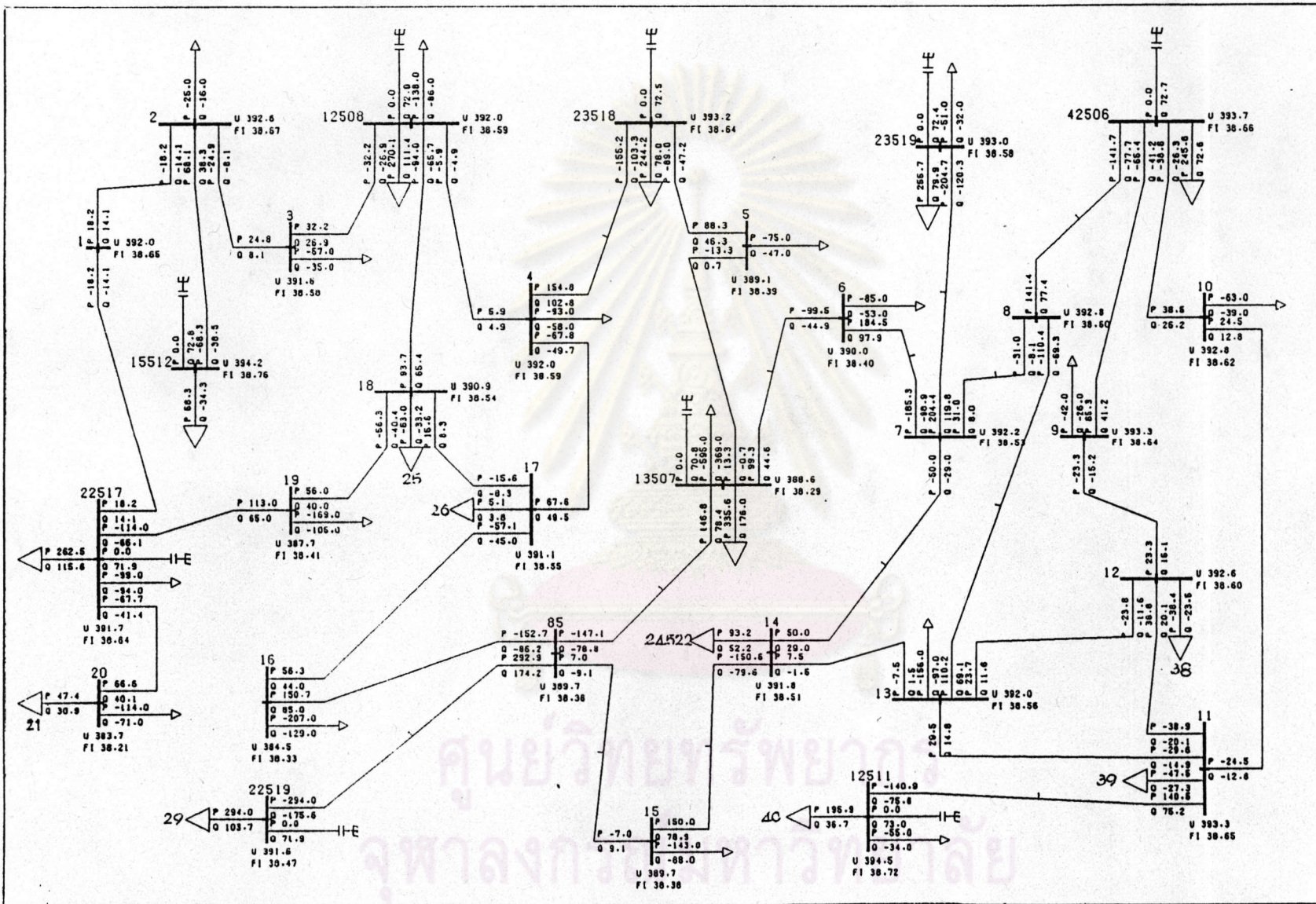


Figure A 2.1.1

The single line diagram with load flow solution base case in area 1

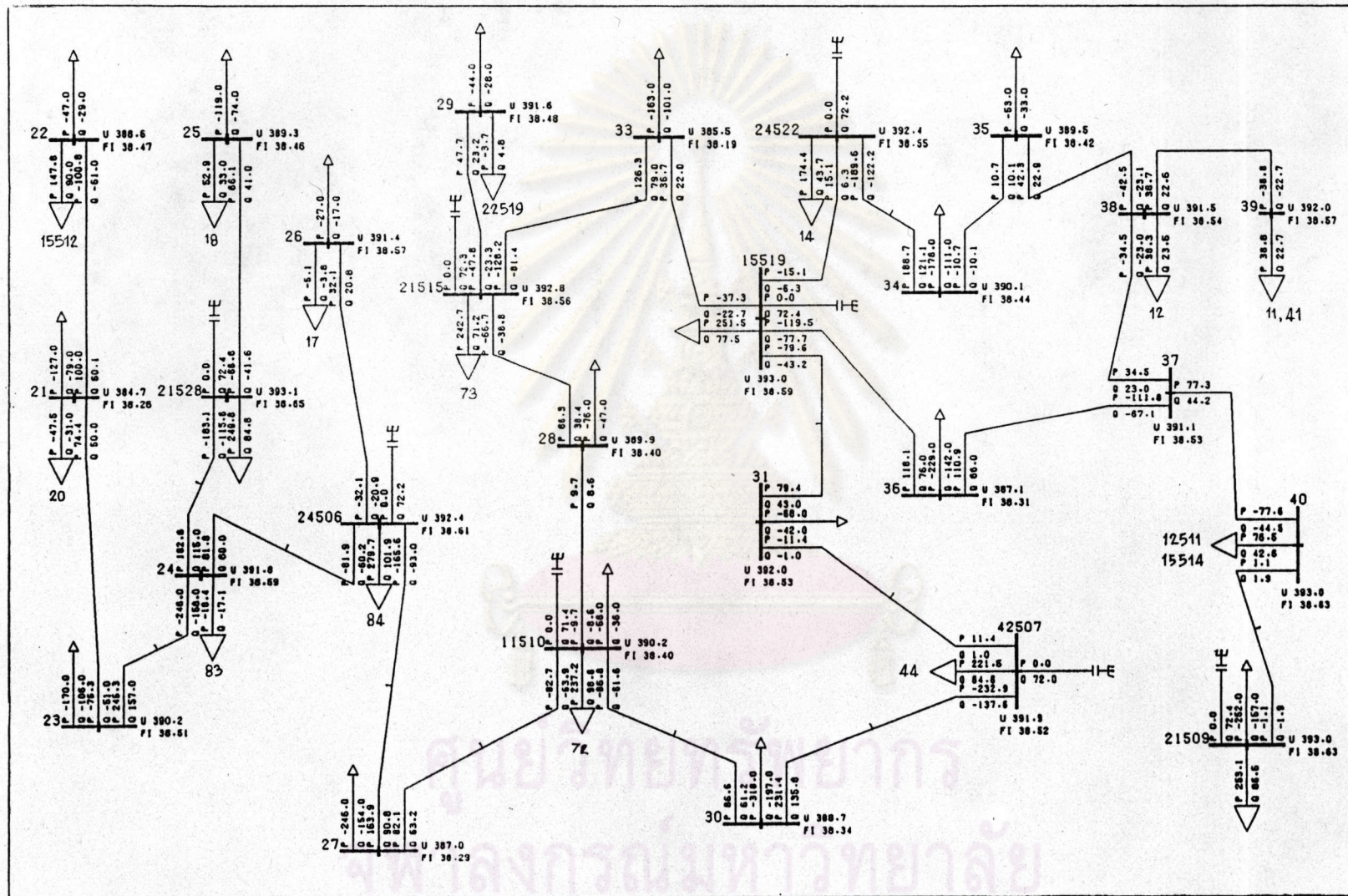


Figure A 2.1.2

The single line diagram with load flow solution base case in area 2

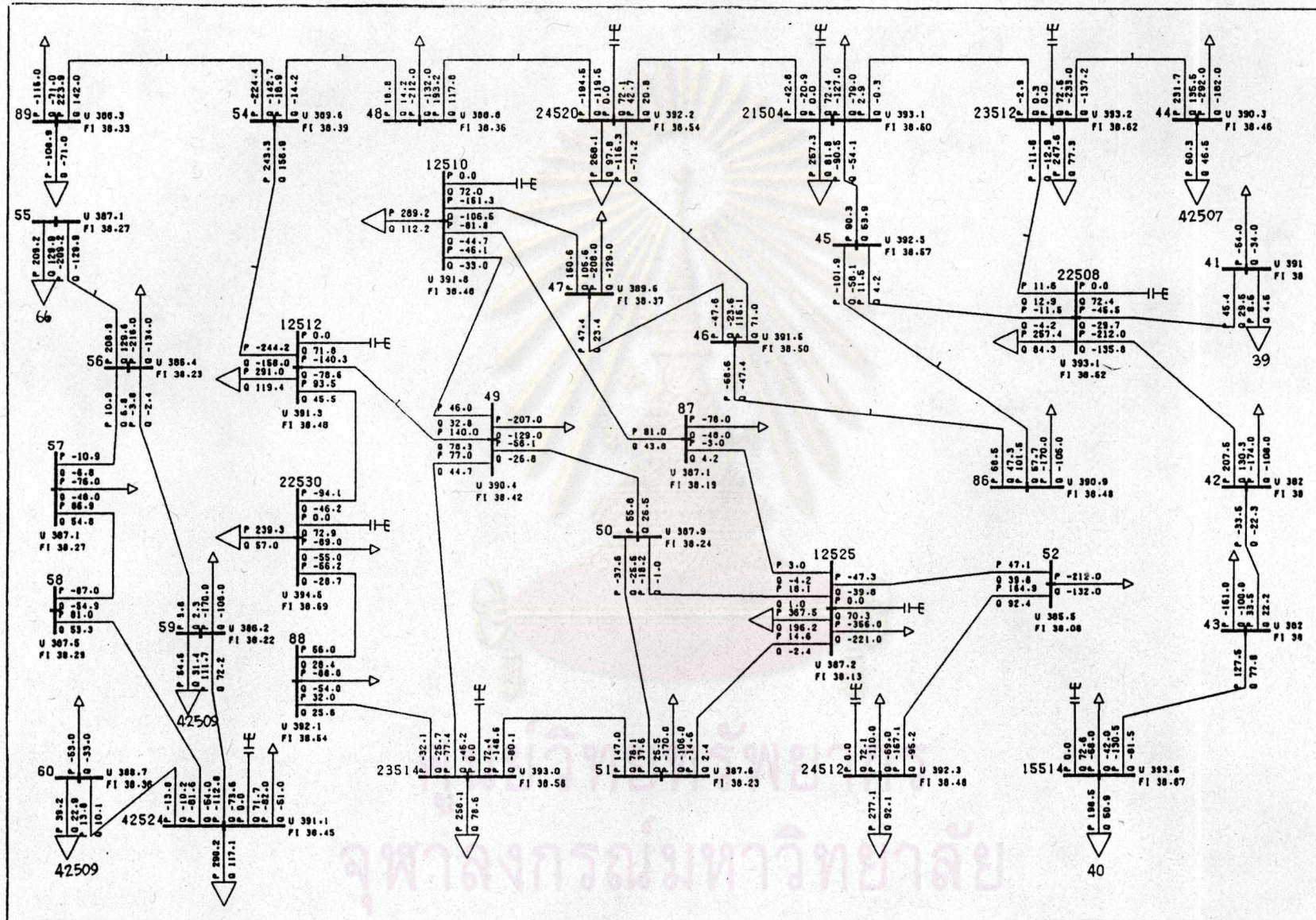


Figure A 2.1.3

The single line diagram with load flow solution base case in area 3

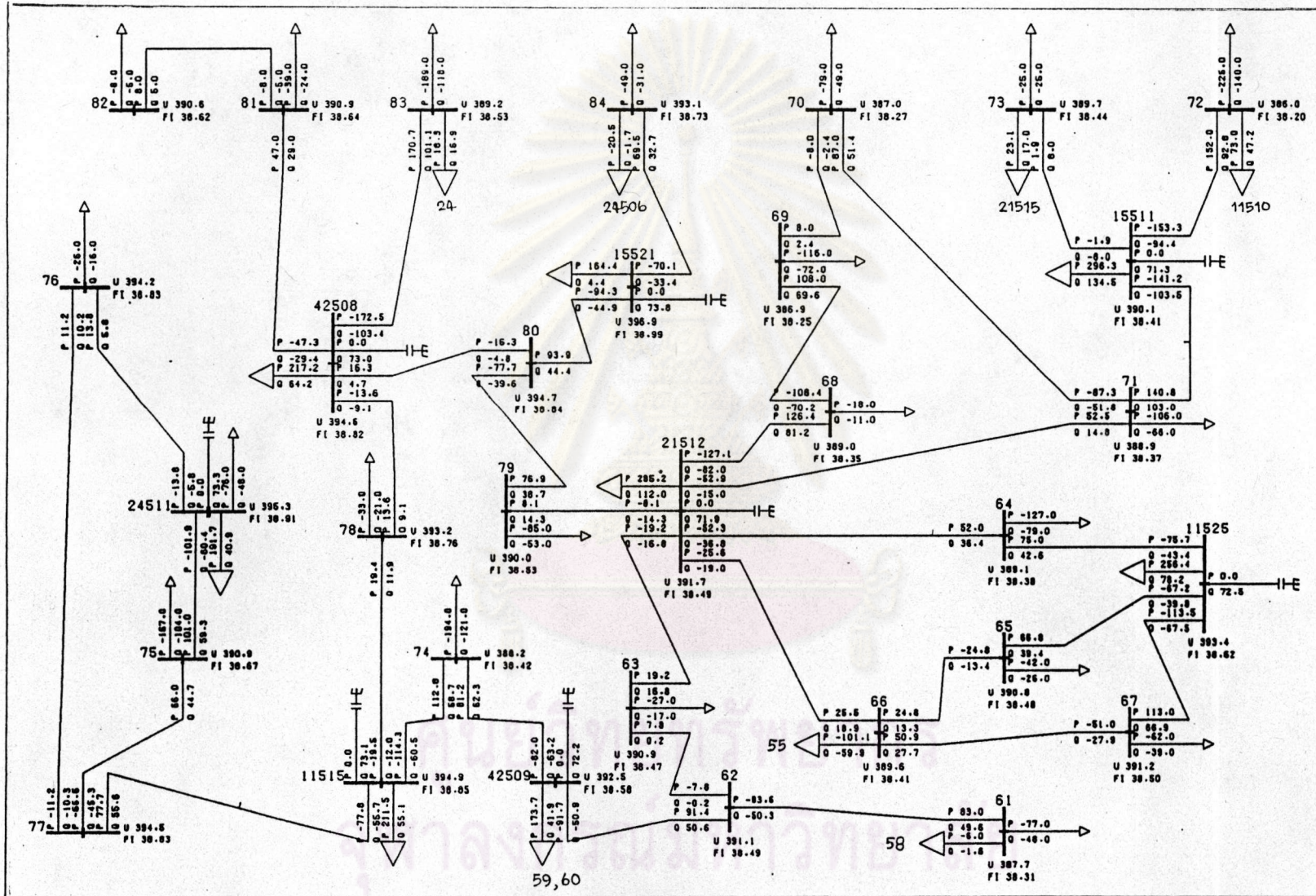


Figure A 2.1.4

The single line diagram with load flow solution base case in area 4

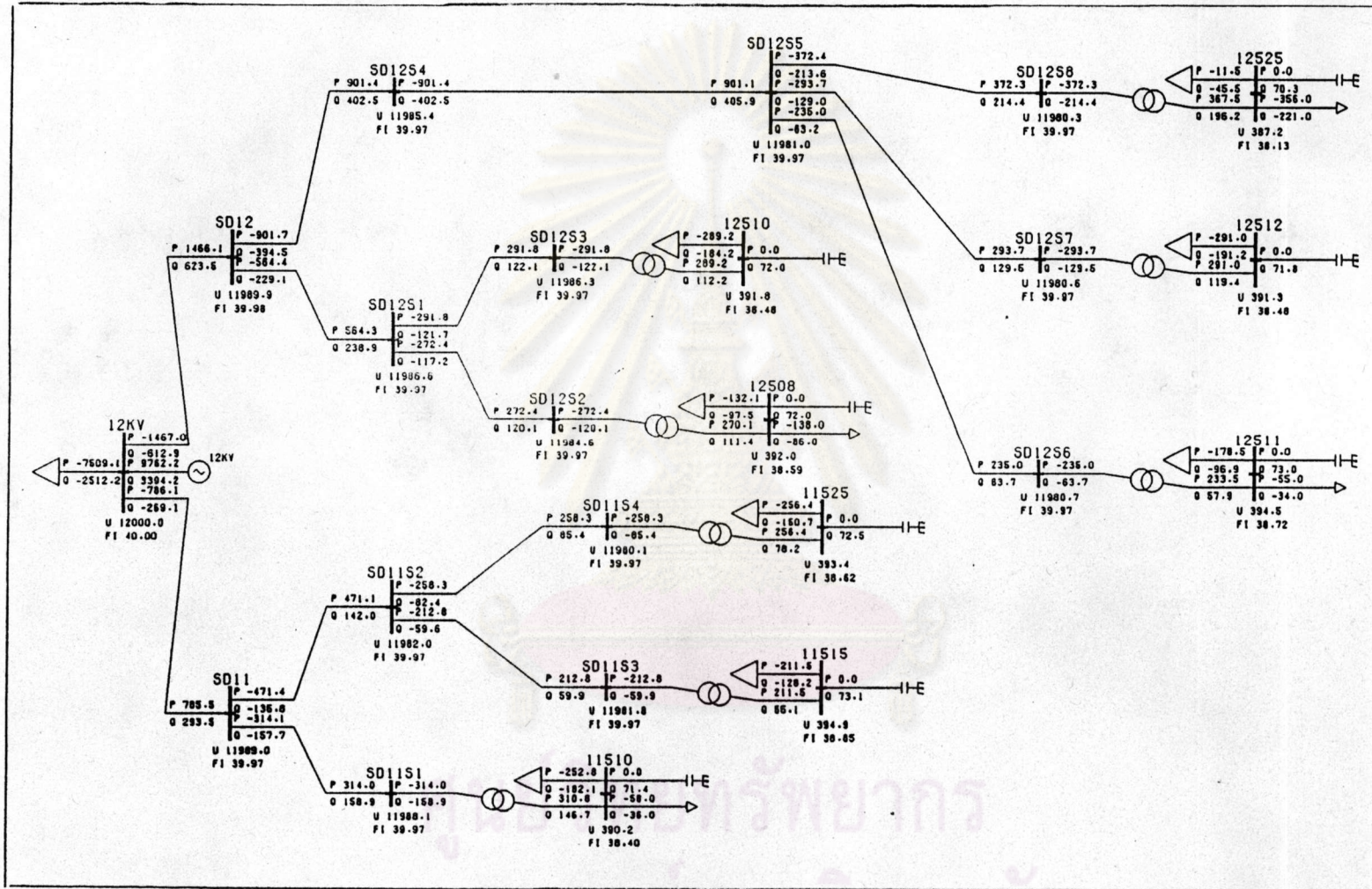


Figure A 2.1.5

The single line diagram with load flow solution in the feeders 12 Kv SD11 and SD12

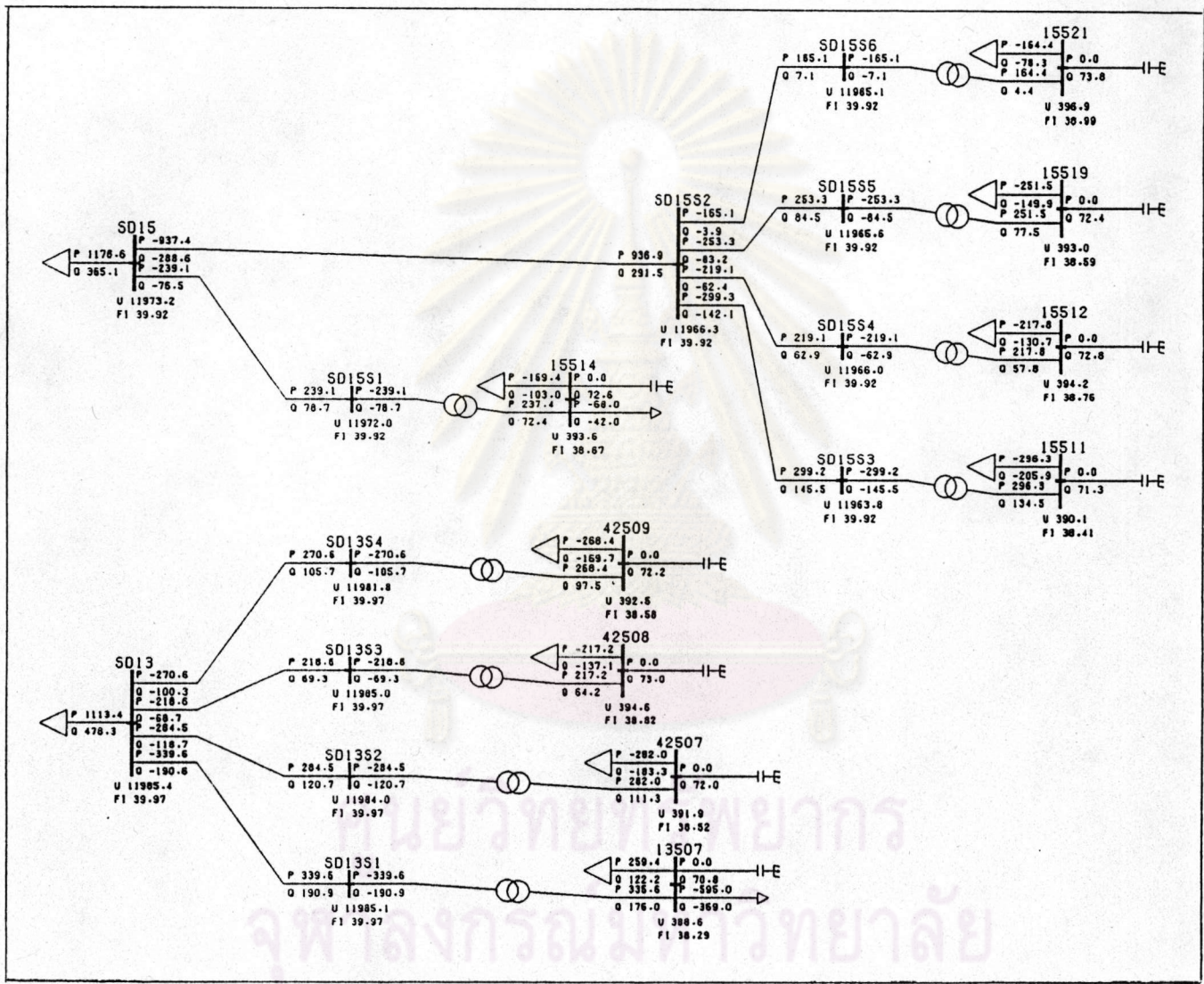


Figure A 2.1.6

The single line diagram with load flow solution in the feedres 12 Kv SD13 and SD15

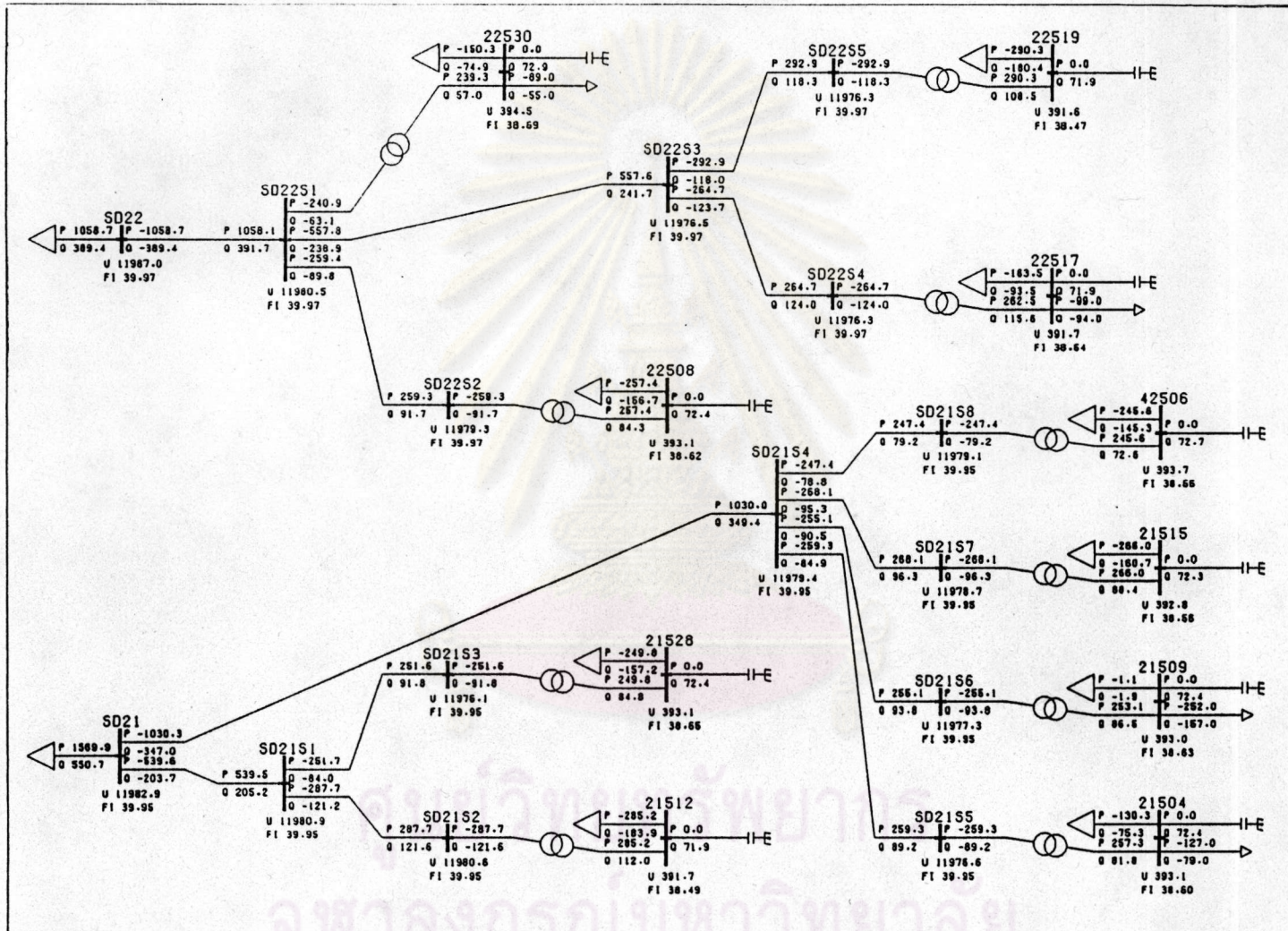


Figure A 2.1.7

The single line diagram with load flow solution in the feeders 12 Kv SD21 and SD22

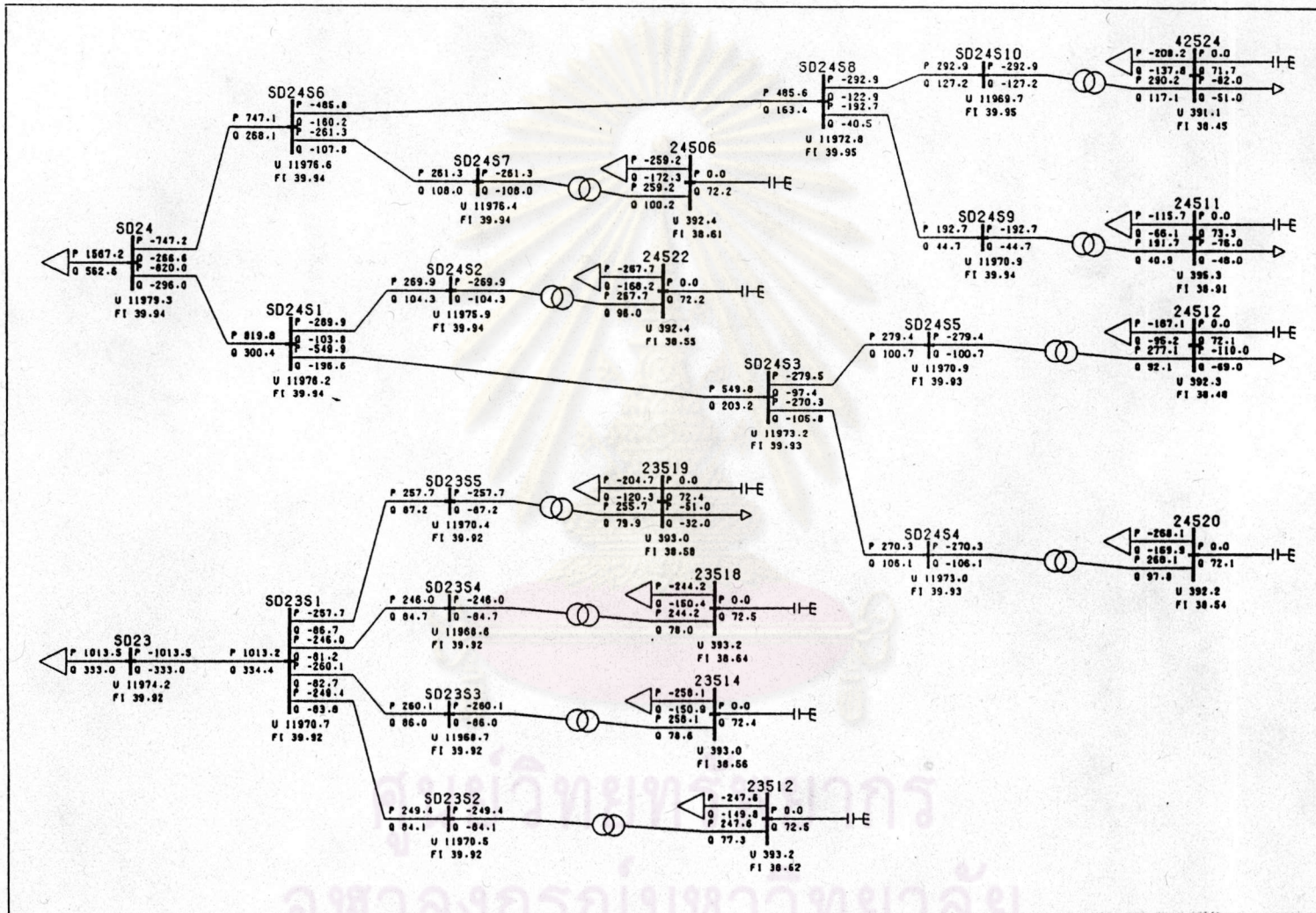
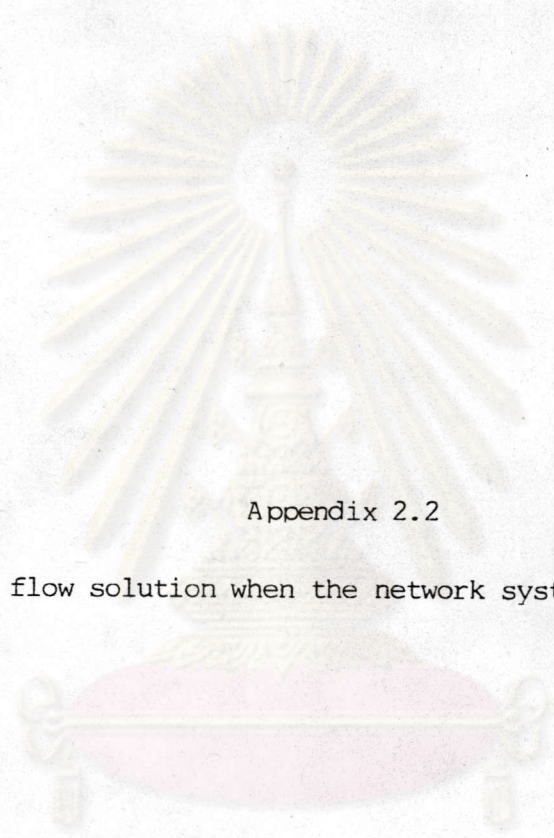


Figure A 2.1.8

The single line diagram with load flow solution in the feeders 12 Kv SD23 and SD24





Appendix 2.2

The load flow solution when the network system load increased

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

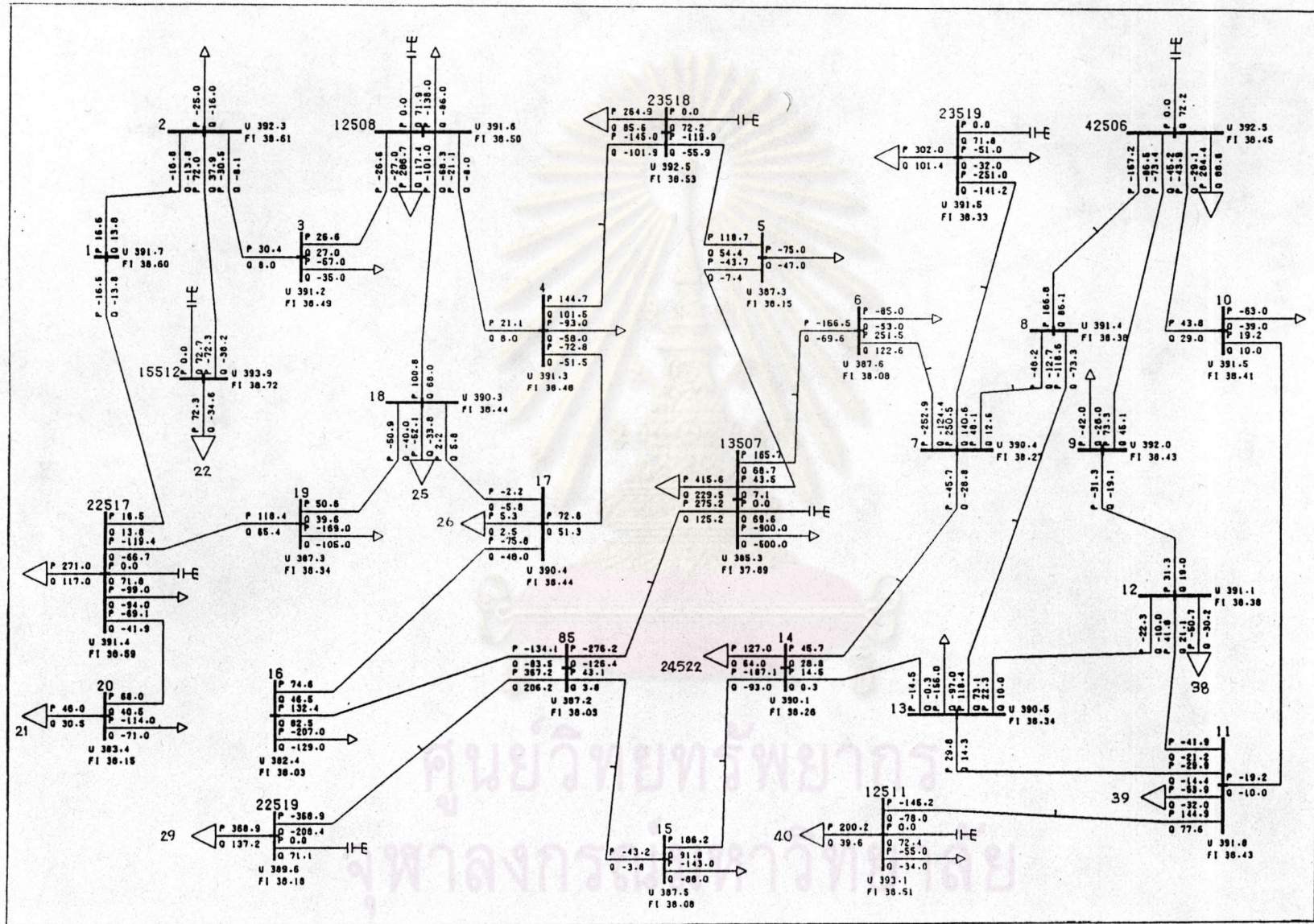


Figure A 2.2.1

The single line diagram with load flow solution in area I when the network system load increased

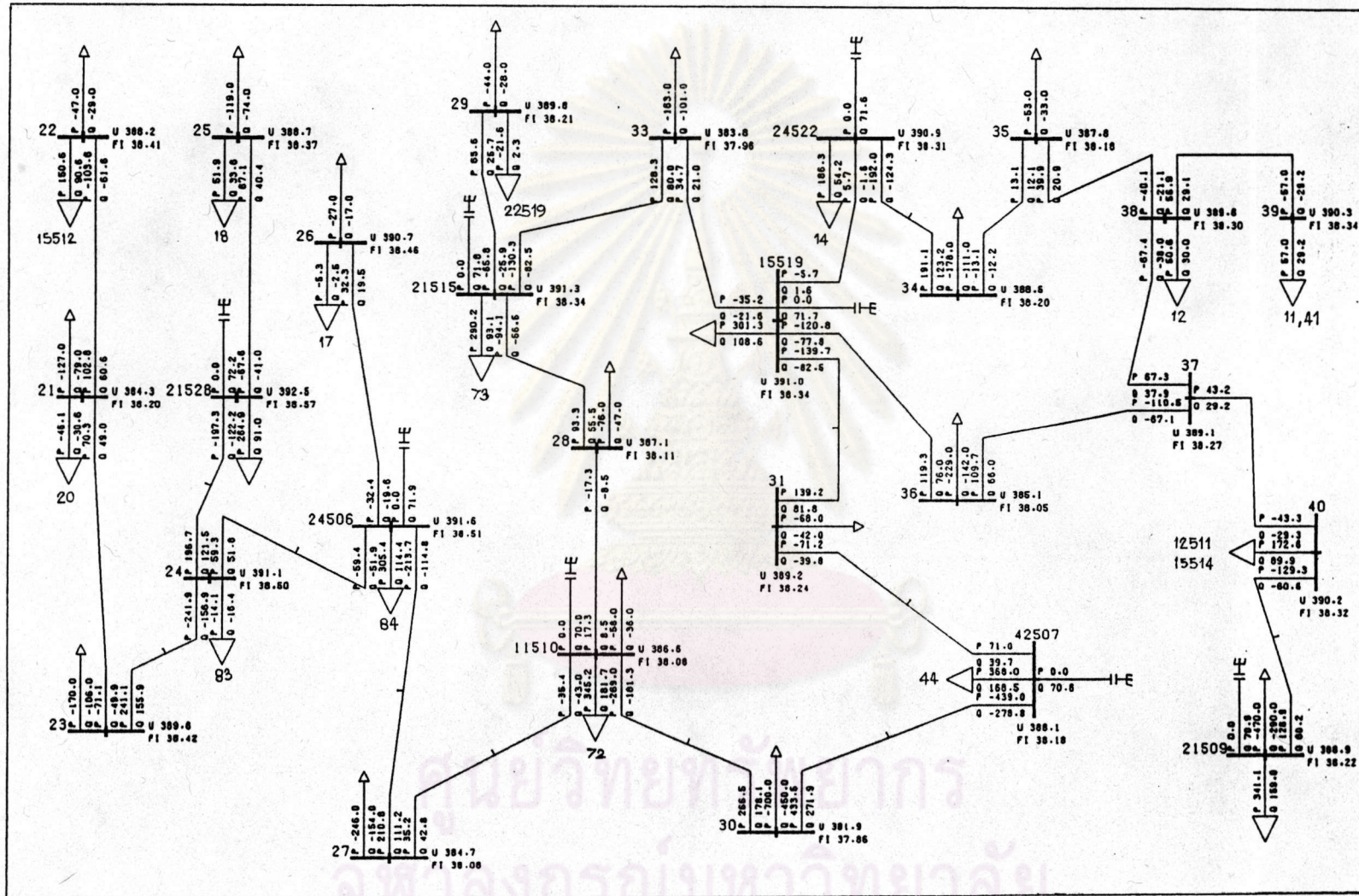


Figure A 2.2.2

The single line diagram with load flow solution in area 2 when the network system load increased

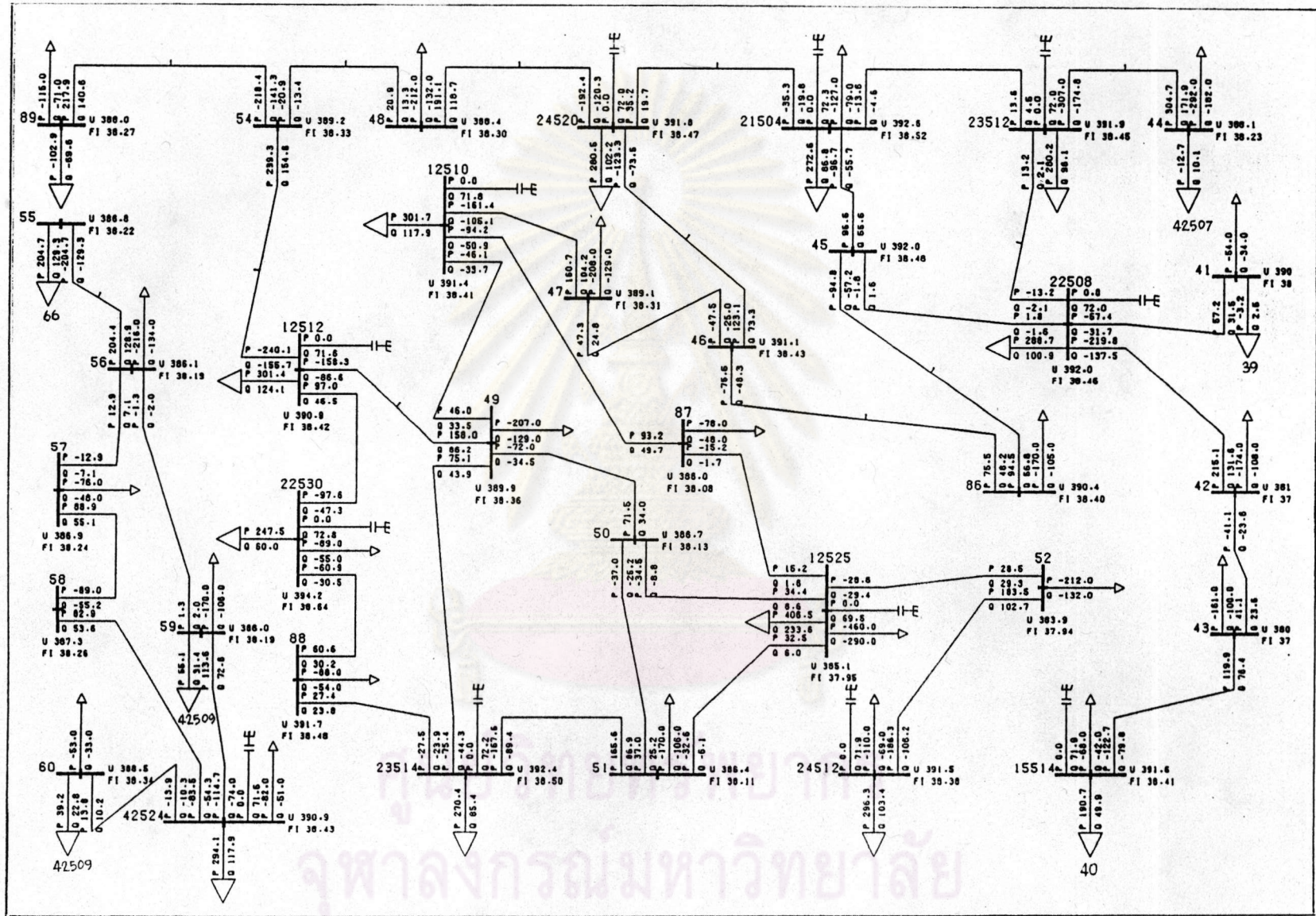


Figure A 2.2.3

The single line diagram with load flow solution in area 3 when the network system load increased

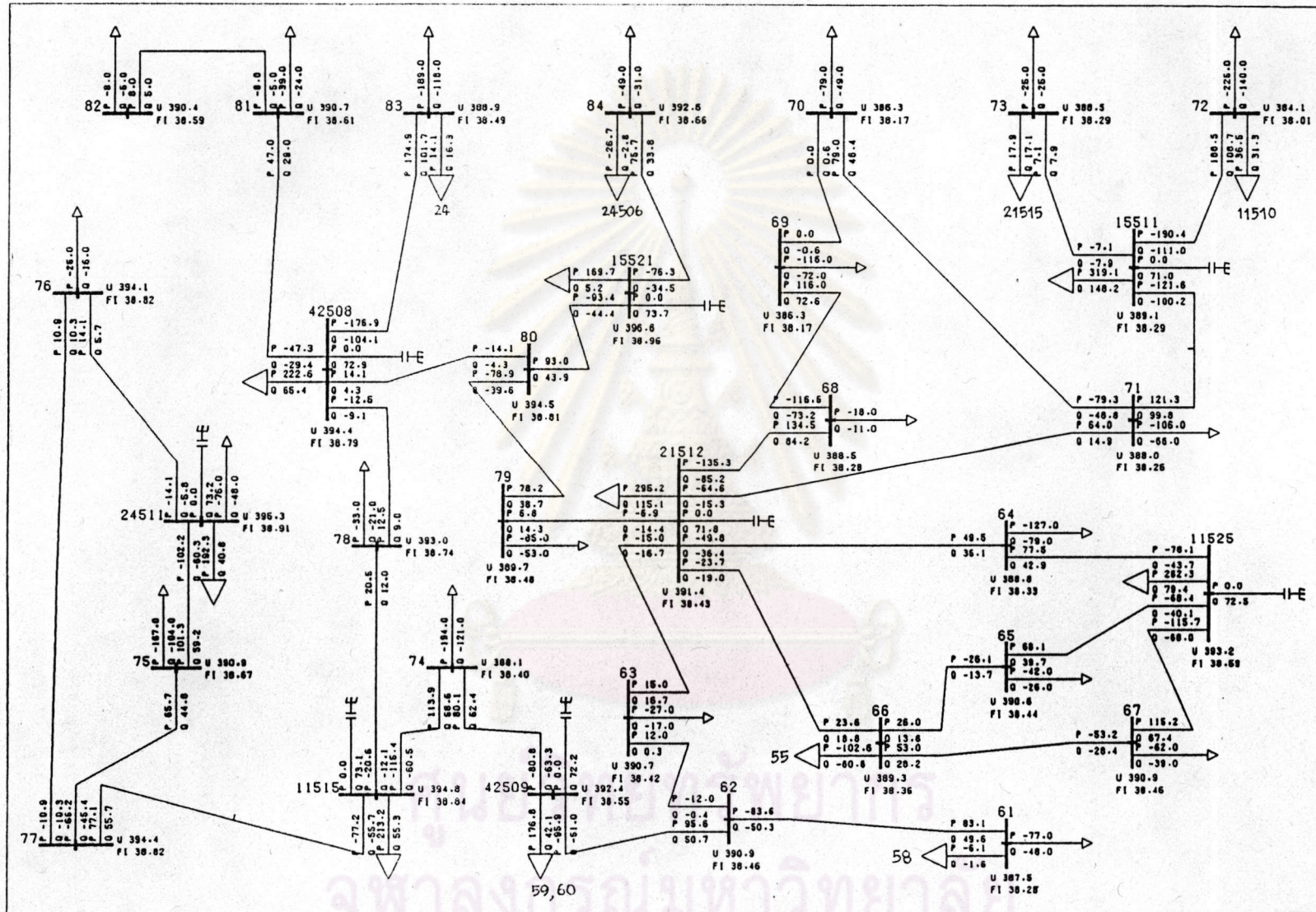
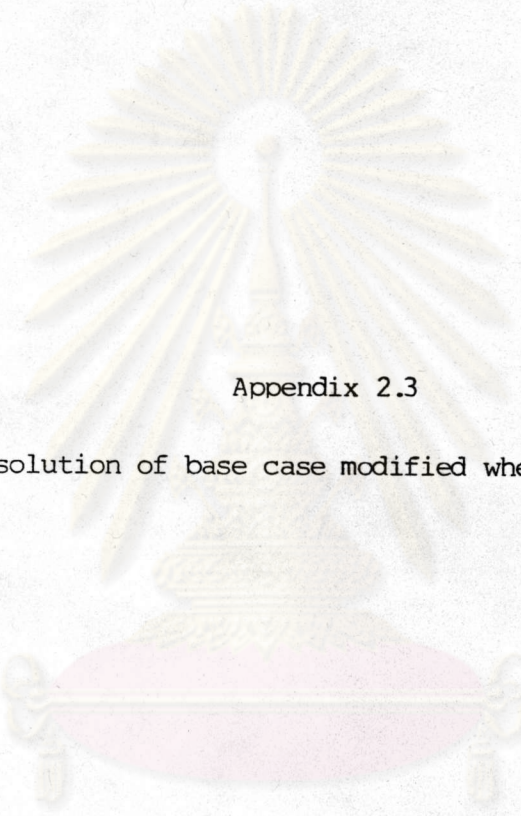


Figure A 2.2.4

The single line diagram with load flow solution in area 4 when the network system load increased



Appendix 2.3

The load flow solution of base case modified when the first emergency occurs

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

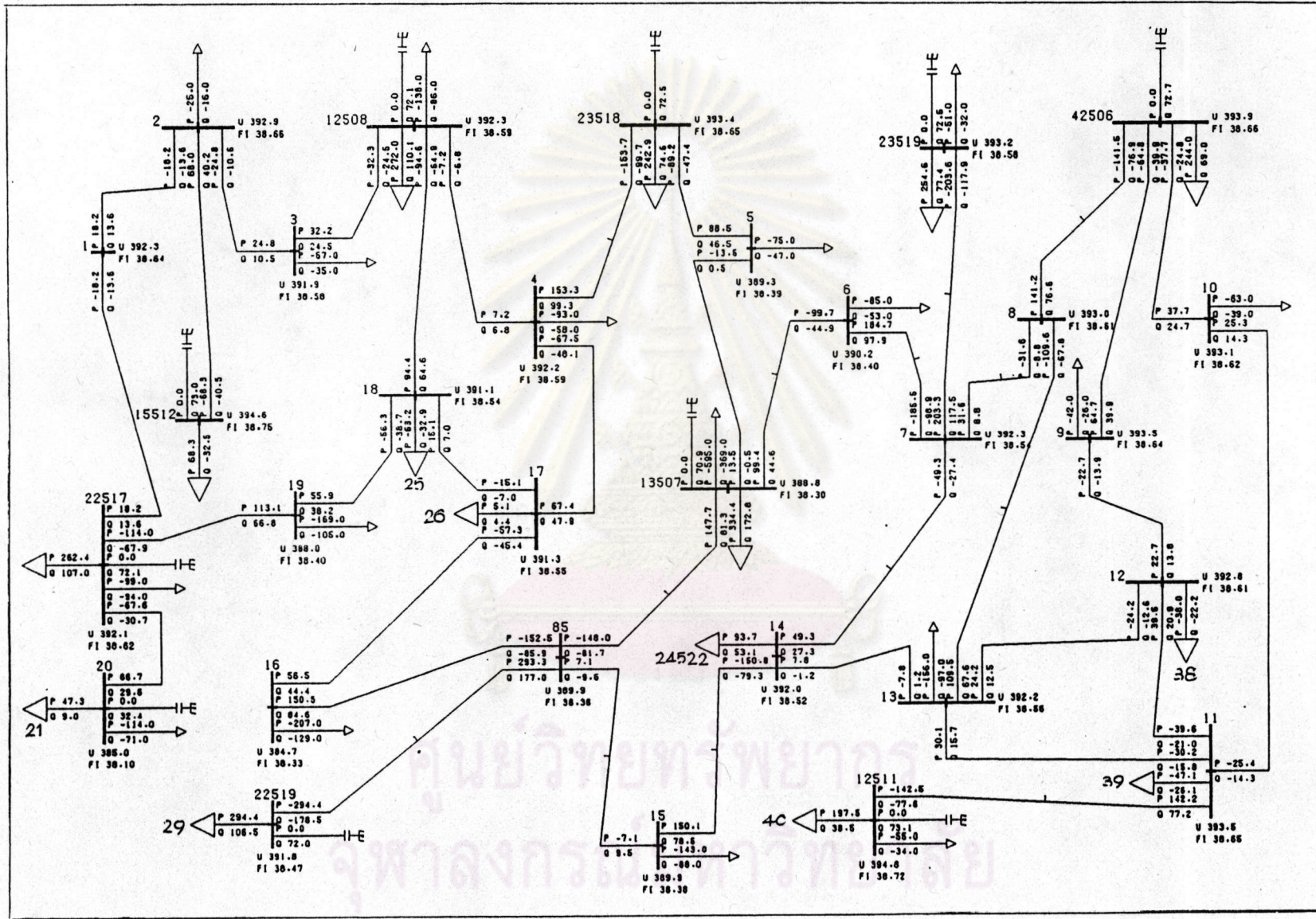


Figure A 2.3.1

The single line diagram with load flow solution in area 1 when the first emergency occurs

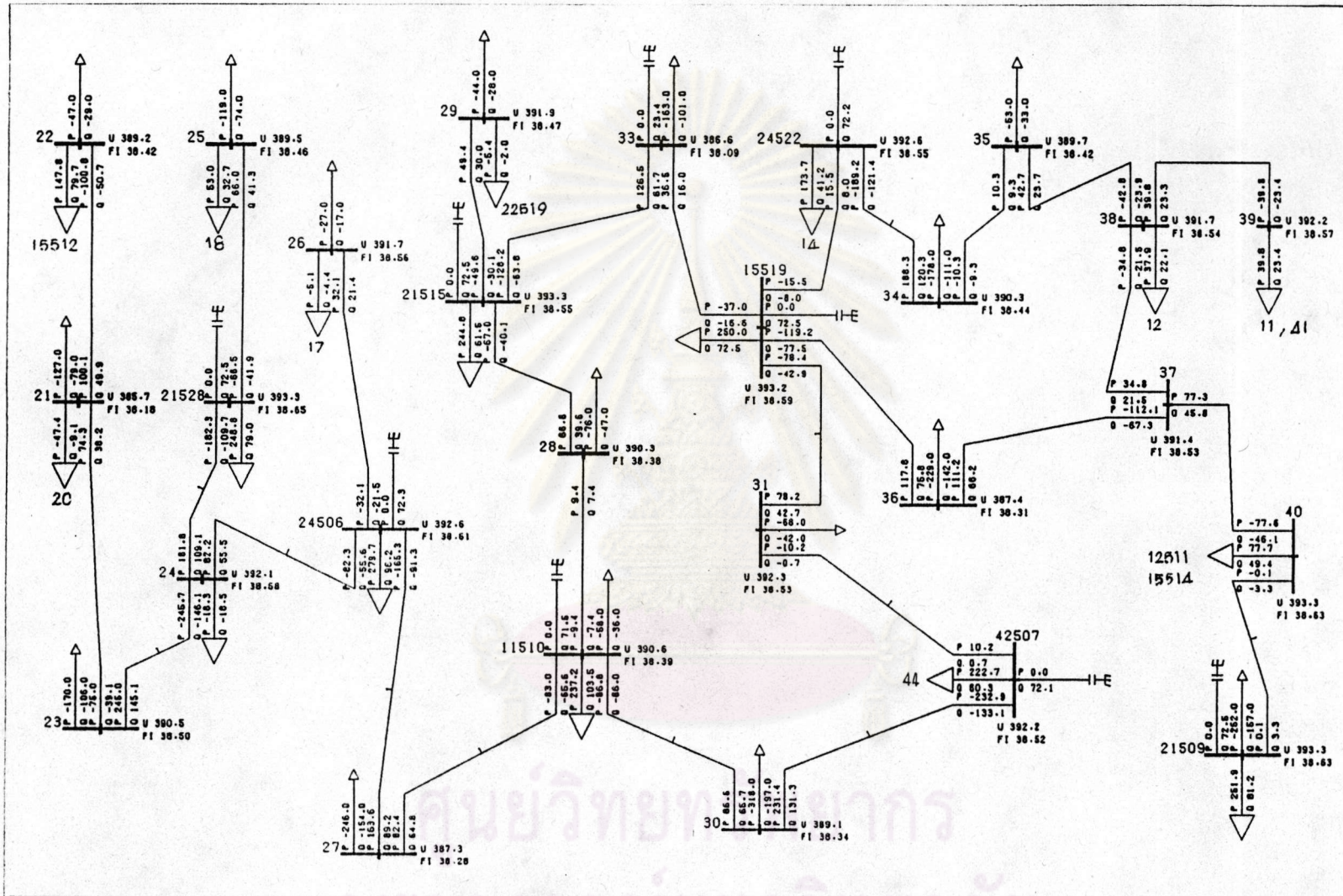


Figure A 2.3.2

The single line diagram with load flow solution in area 2 when the first emergency occurs



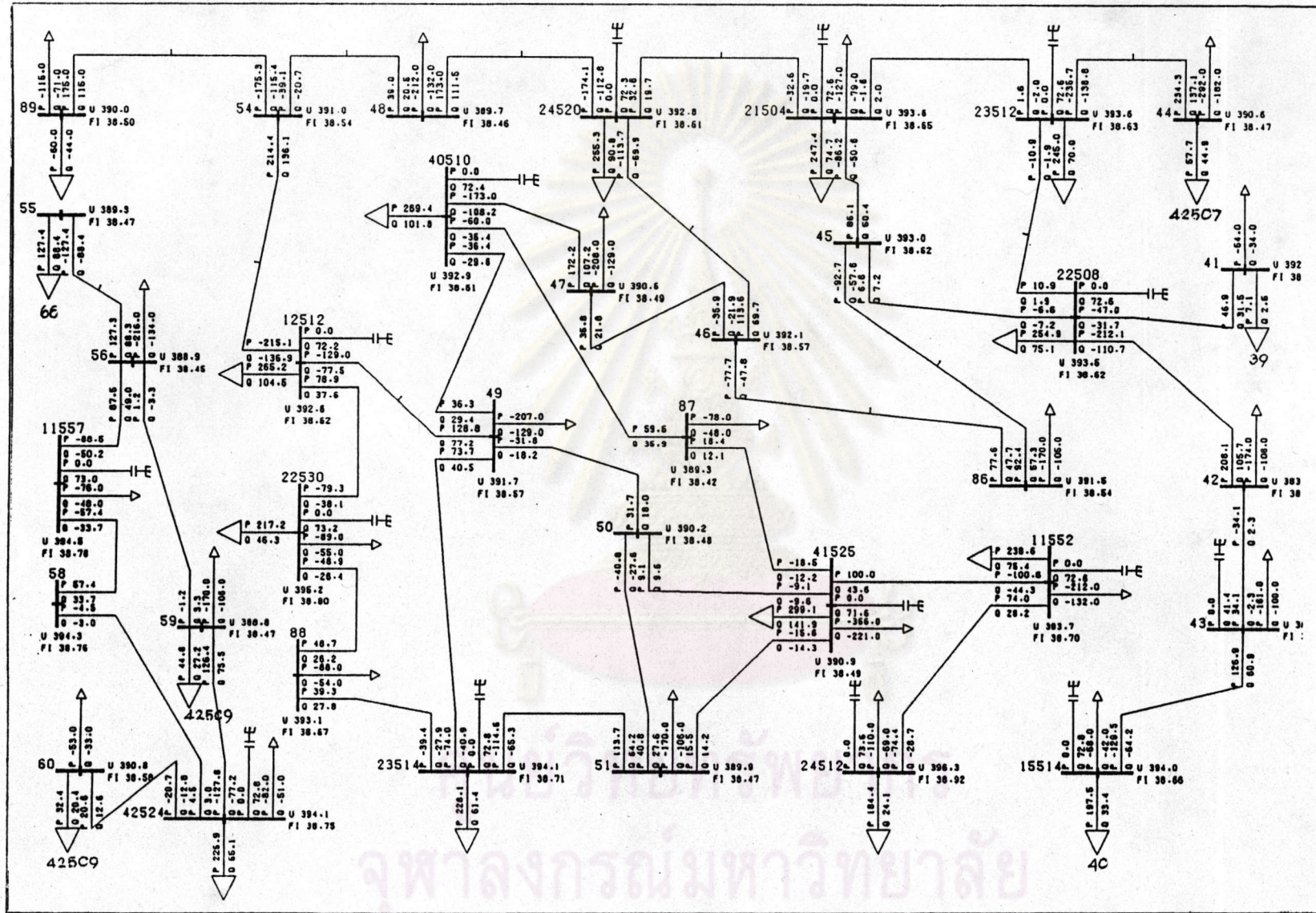


Figure A 2.3.3

The single line diagram with load flow solution in area 3 when the first emergency occurs

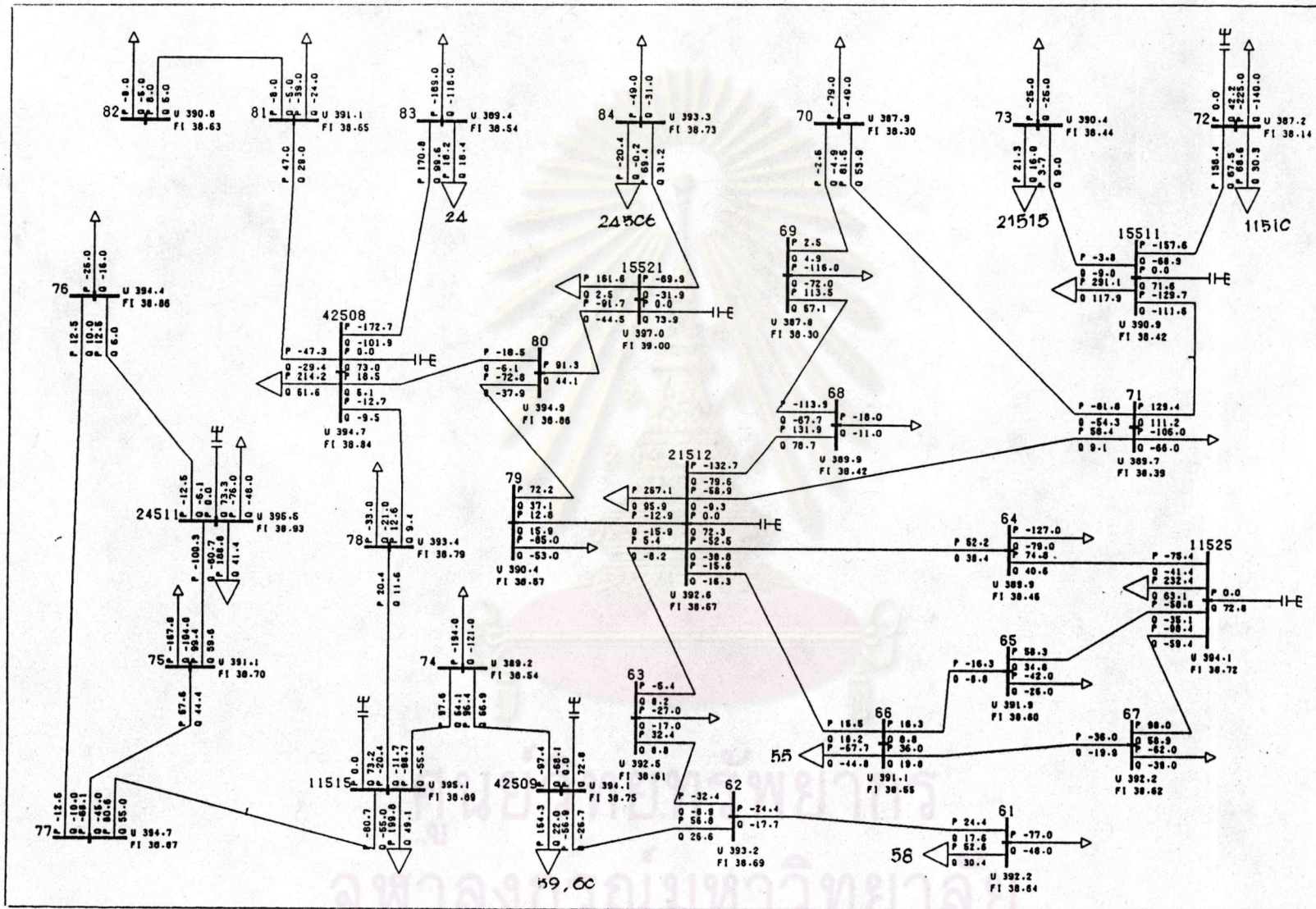
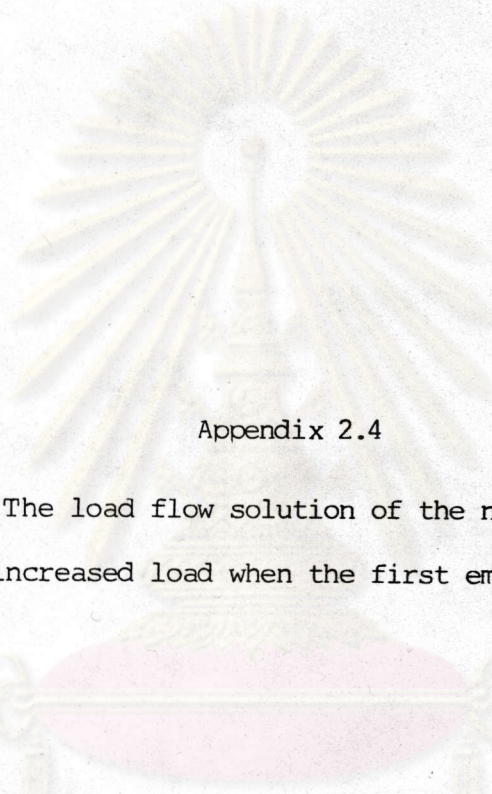


Figure A 2.3.4

The single line diagram with load flow solution in area 4 when the first emergency occurs



Appendix 2.4

The load flow solution of the network  
system increased load when the first emergency occurs

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

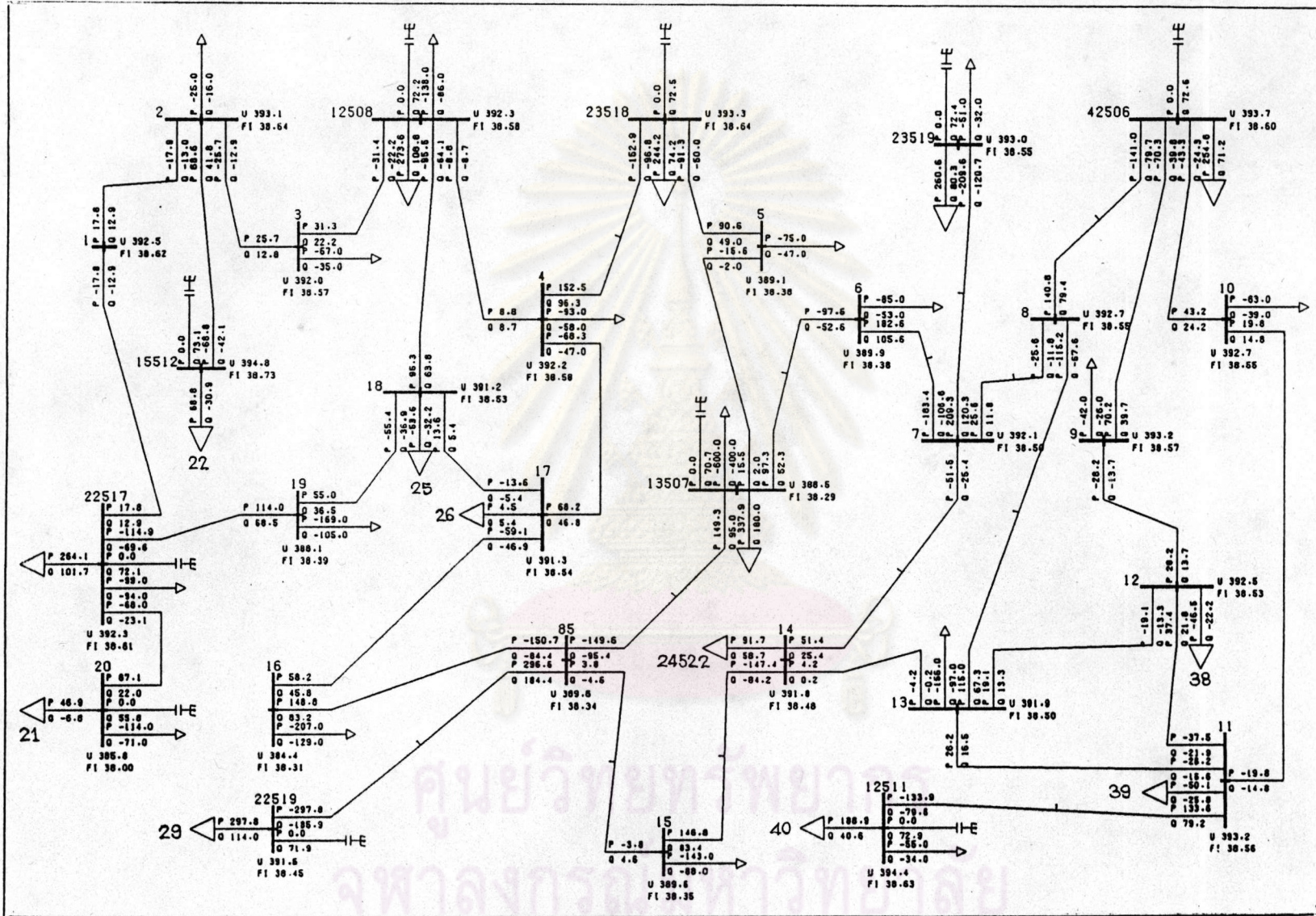


Figure A 2.4.1

The single line diagram with load flow solution in area 1  
 ( the network system increased load when the first emergency occurs )

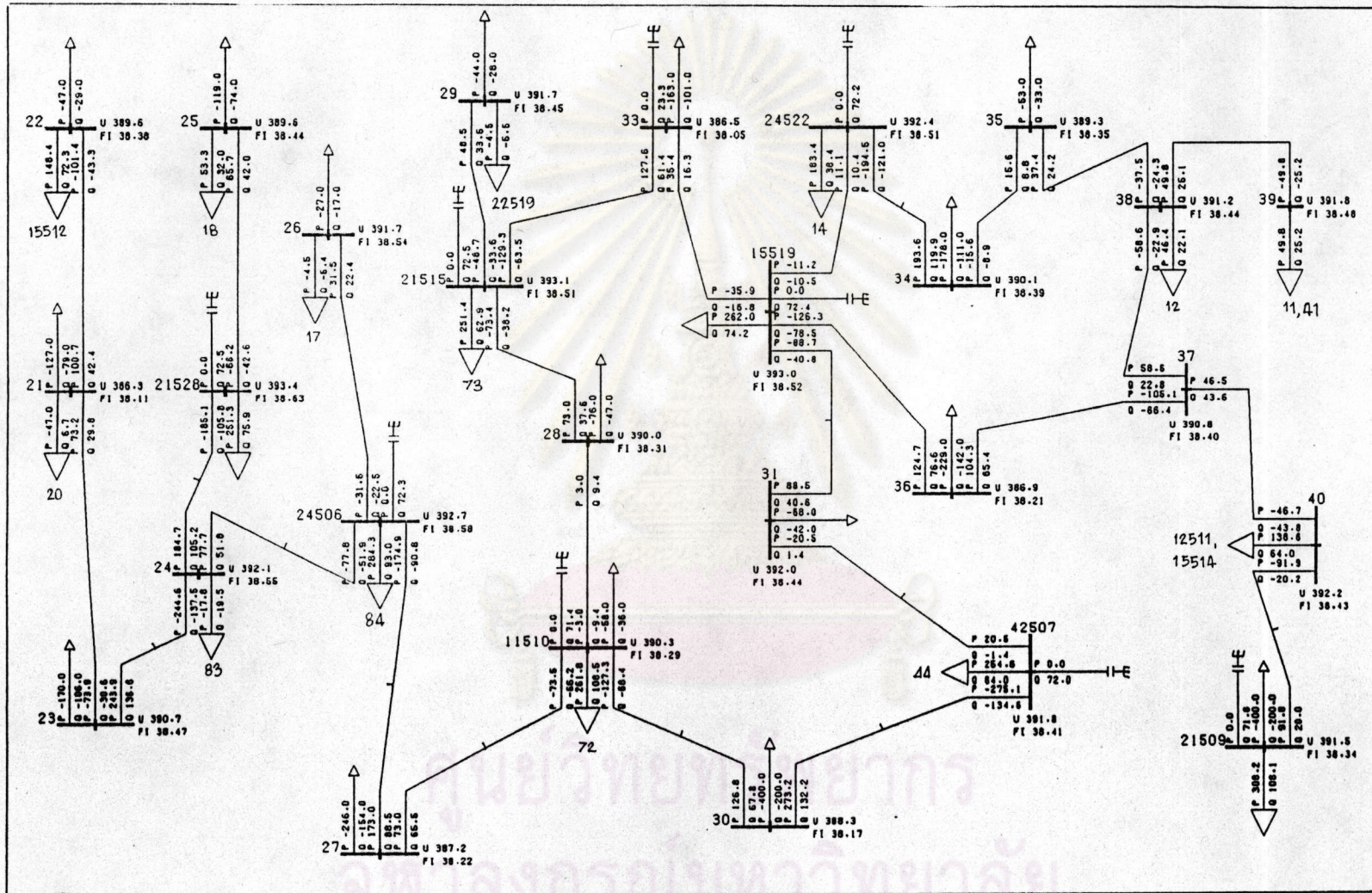


Figure A 2.4.2

The single line diagram with load flow solution in area 2  
 ( the network system increased load when the first emergency occurs )

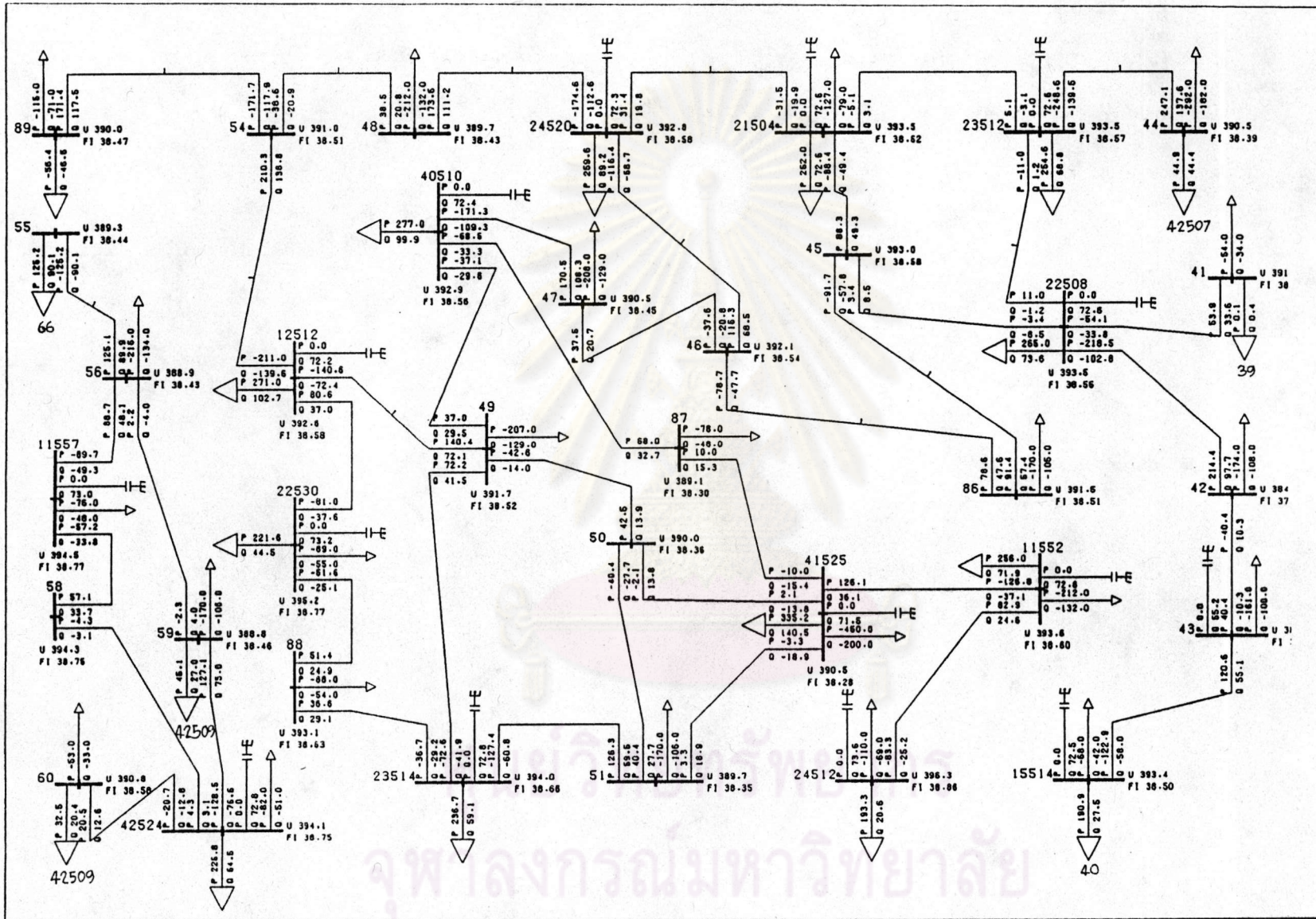


Figure A 2.4.3

The single line diagram with load flow solution in area 3

( the network system increased load when the first emergency occurs )

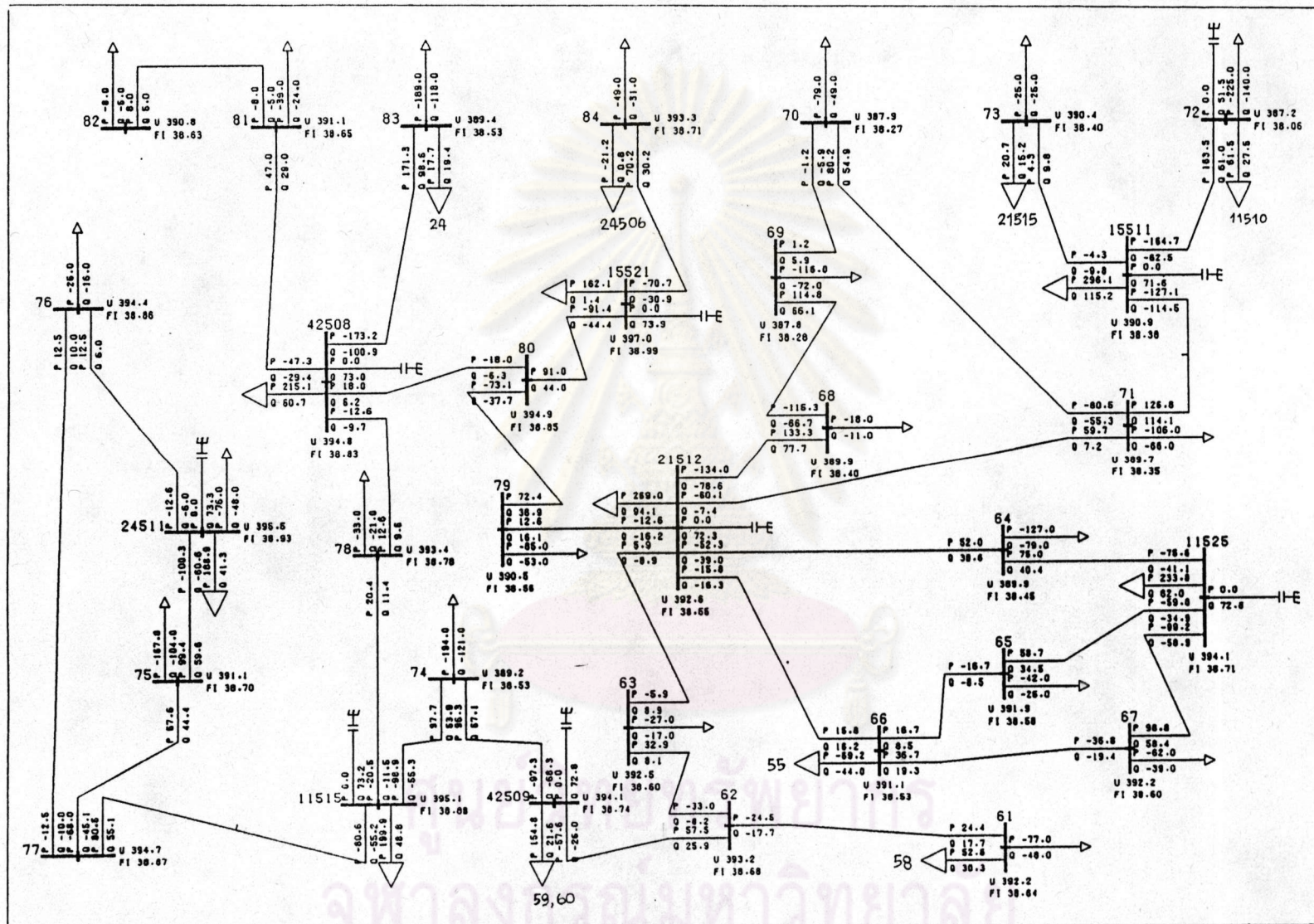
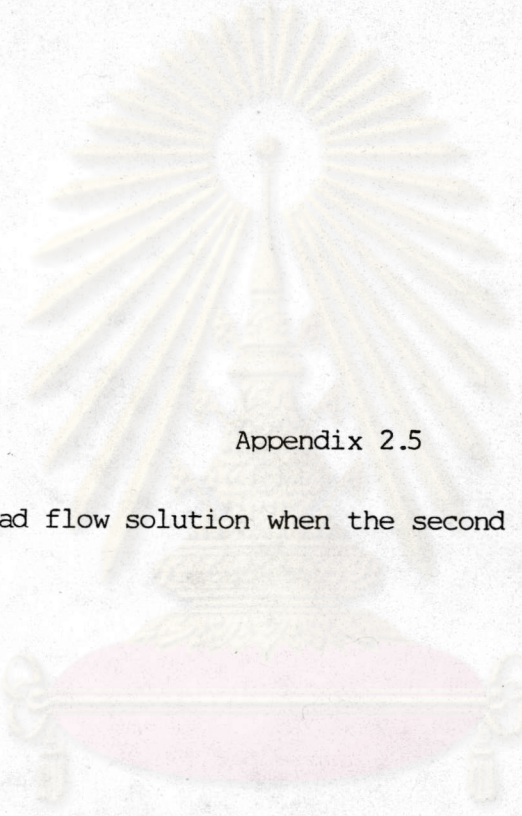


Figure A 2.4.4

The single line diagram with load flow solution in area 4  
 ( the network system increased load when the first emergency occurs )



Appendix 2.5

The load flow solution when the second emergency occurs

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย



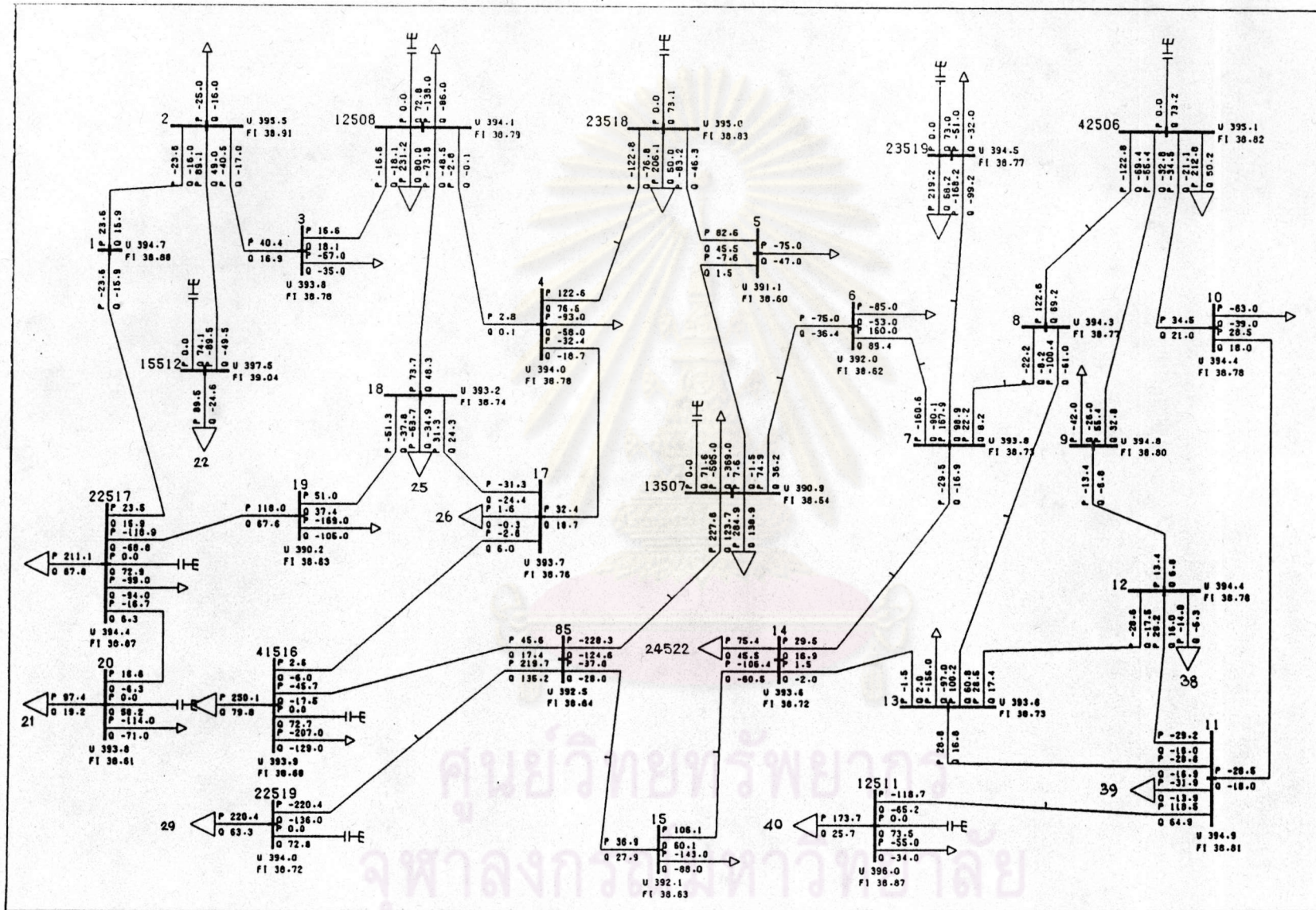


Figure A 2.5.1

The single line diagram with load flow solution  
in area 1 after modification when the second emergency occurs

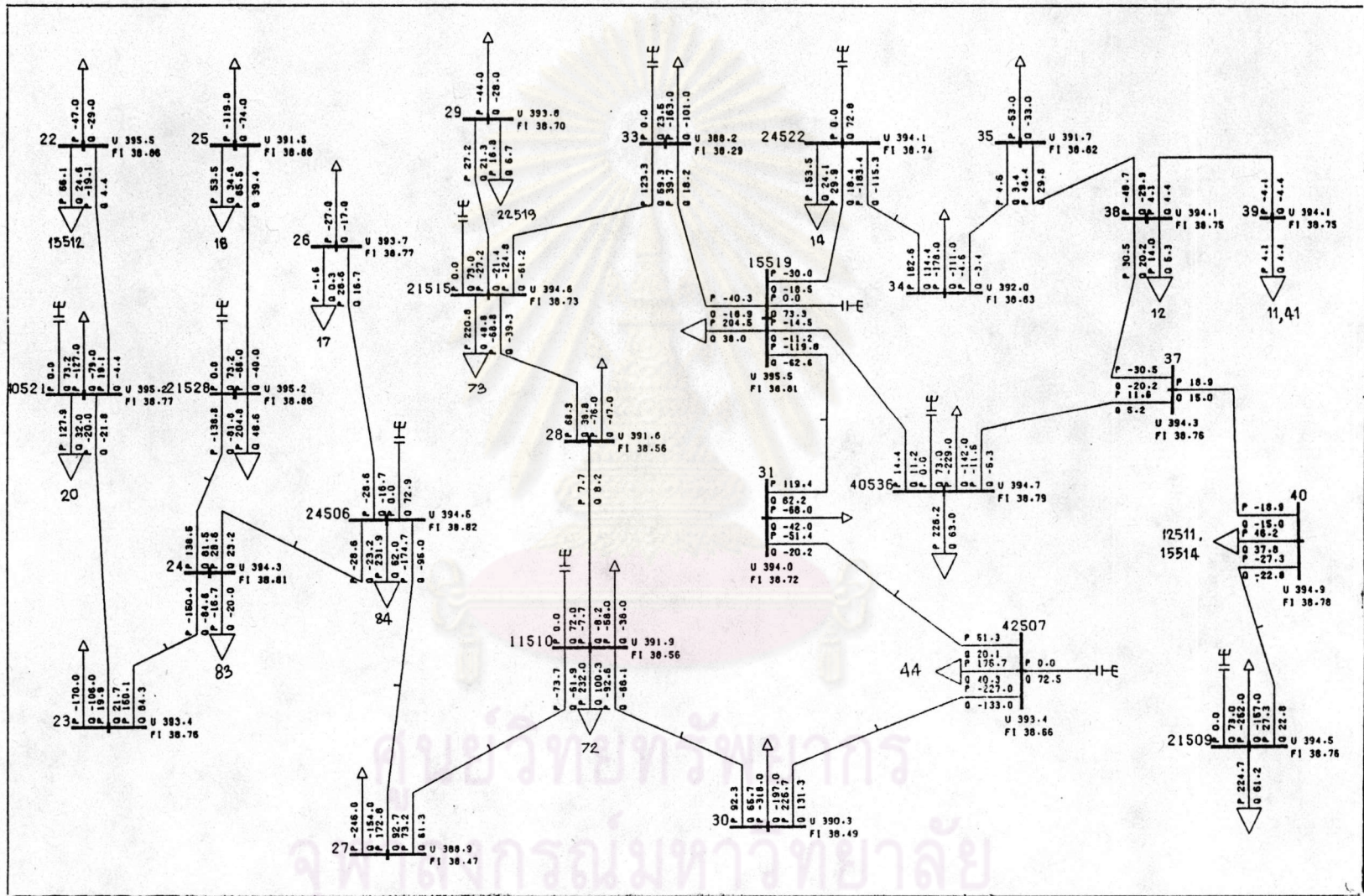


Figure A 2.5.2

The single line diagram with load flow solution  
 in area 2 after modification when the second emergency occurs

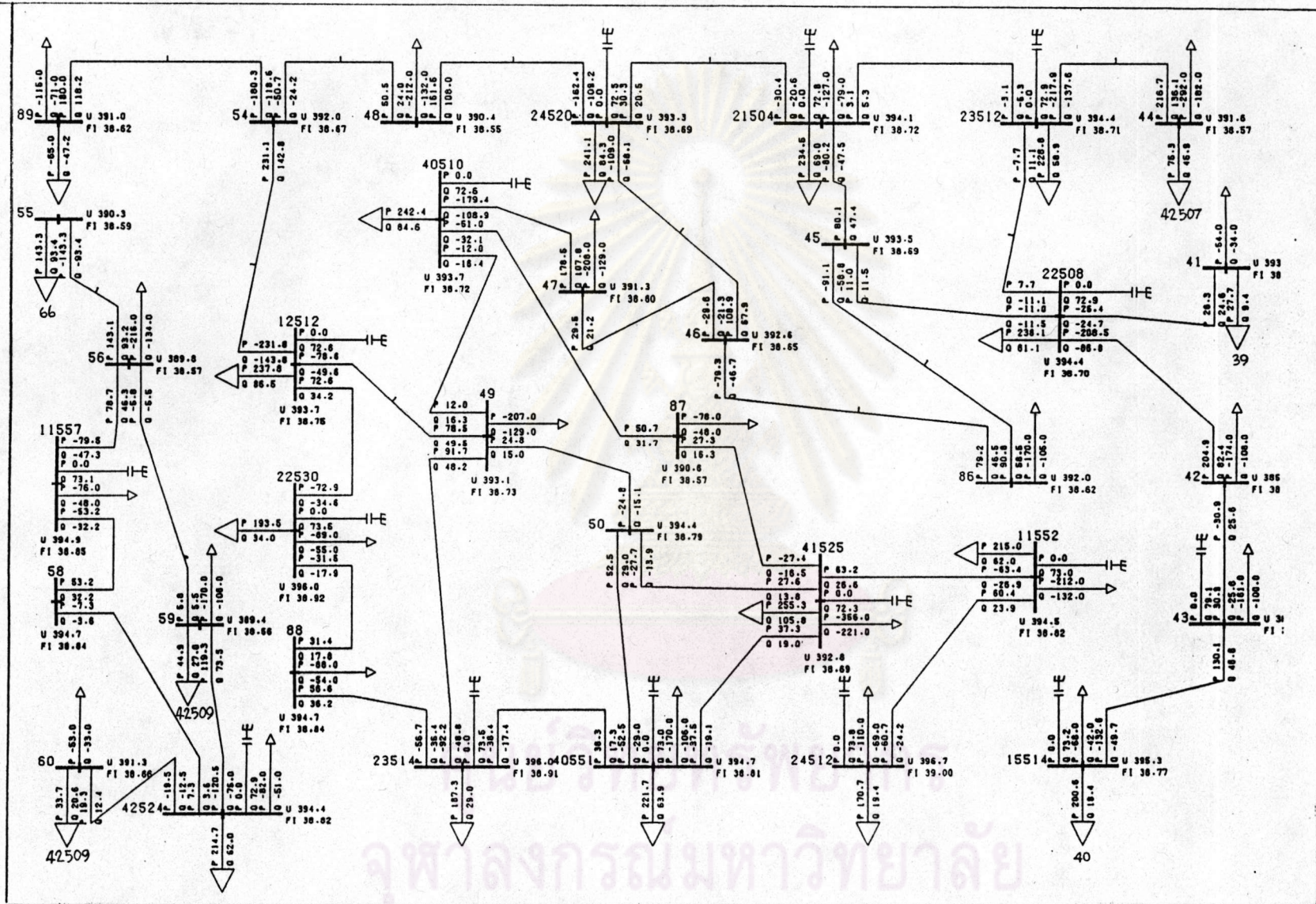


Figure A 2.5.3

The single line diagram with load flow solution  
in area 3 after modification when the second emergency occurs

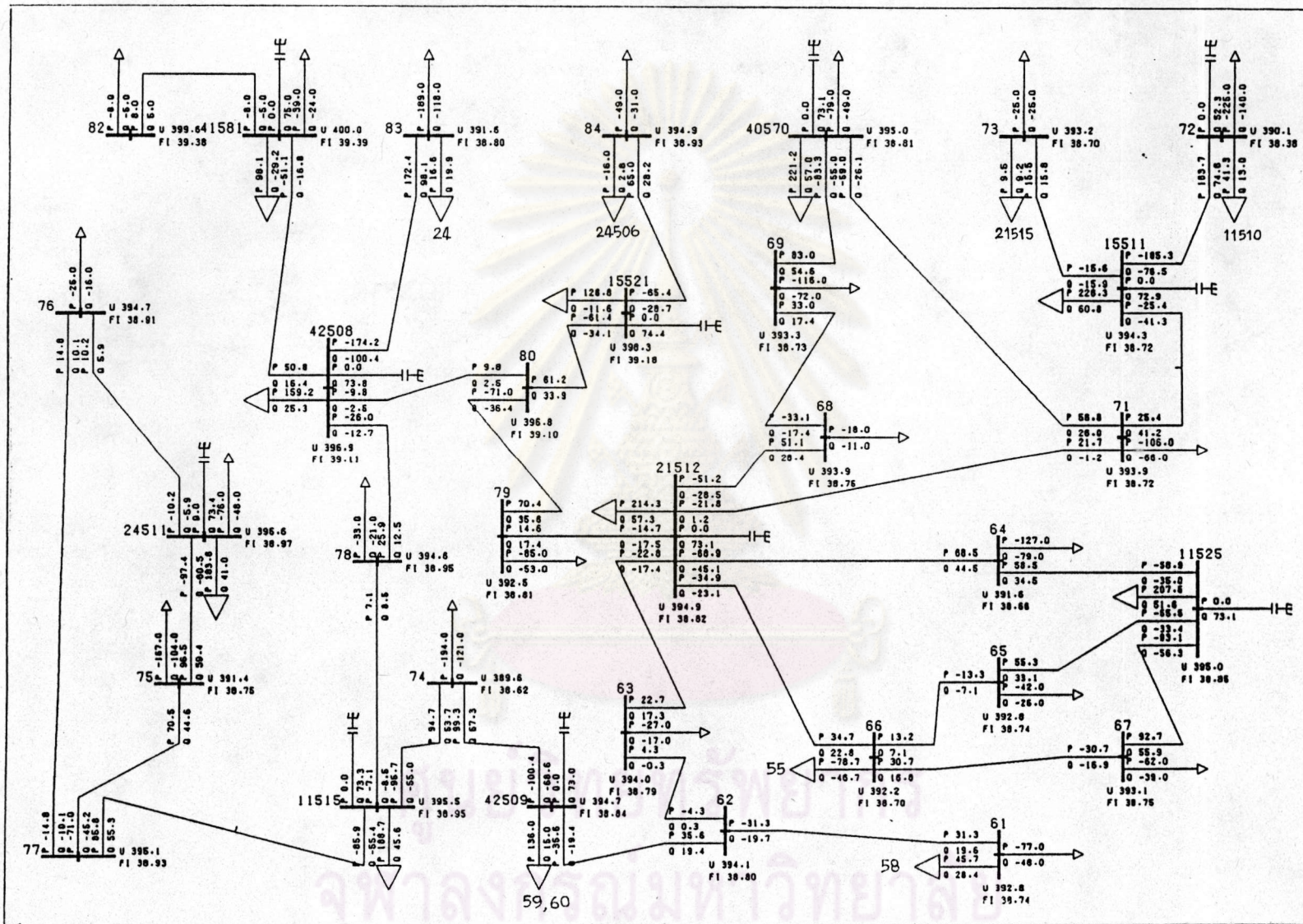
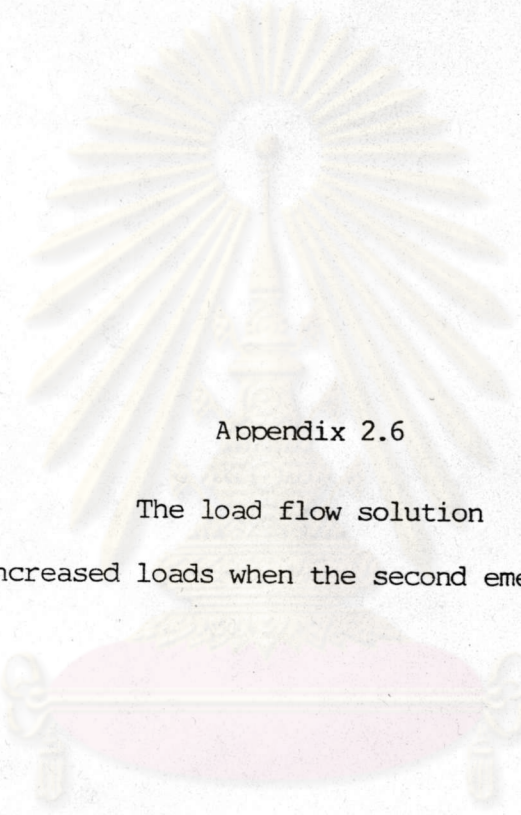


Figure A 2.5.4

The single line diagram with load flow solution in area 4 after modification when the second emergency occurs



Appendix 2.6

The load flow solution

were increased loads when the second emergency occurs

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

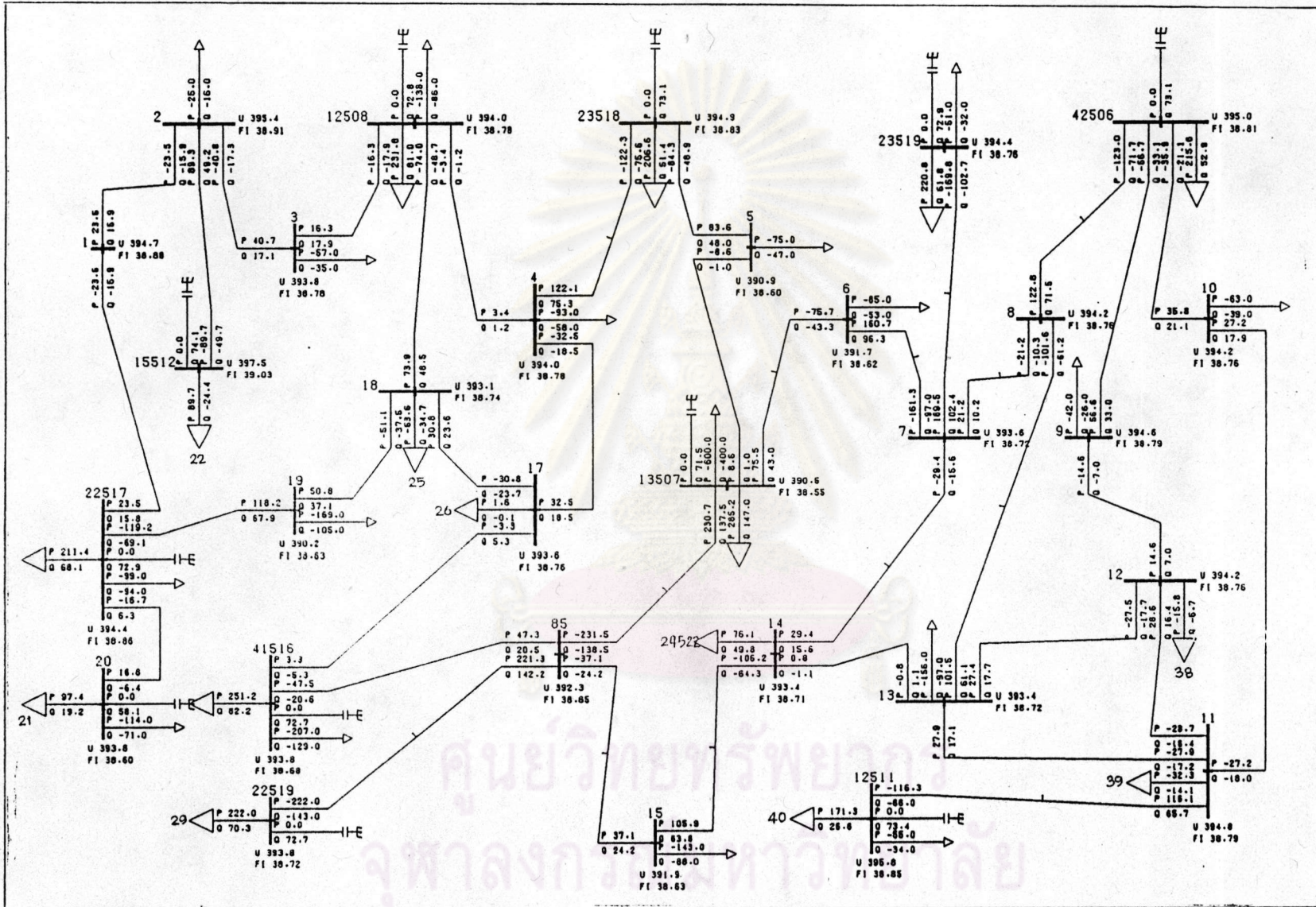


Figure A 2.6.1

The single line diagram with load flow solution of the network System were increased loads in area 1 when the second emergency occurs

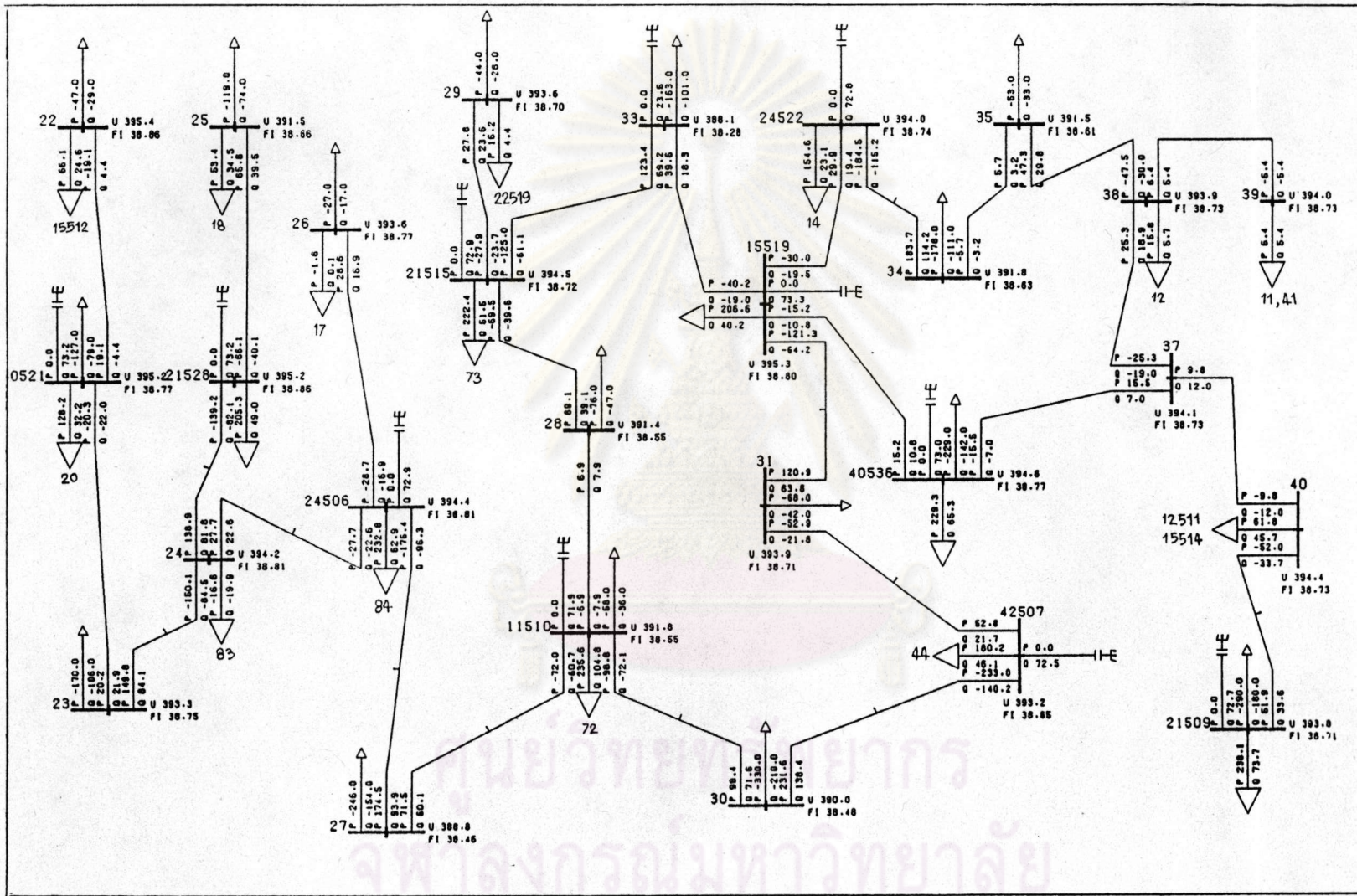


Figure A 2.6.2

The single line diagram with load flow solution of the network system were increased loads in area 2 when the second emergency occurs

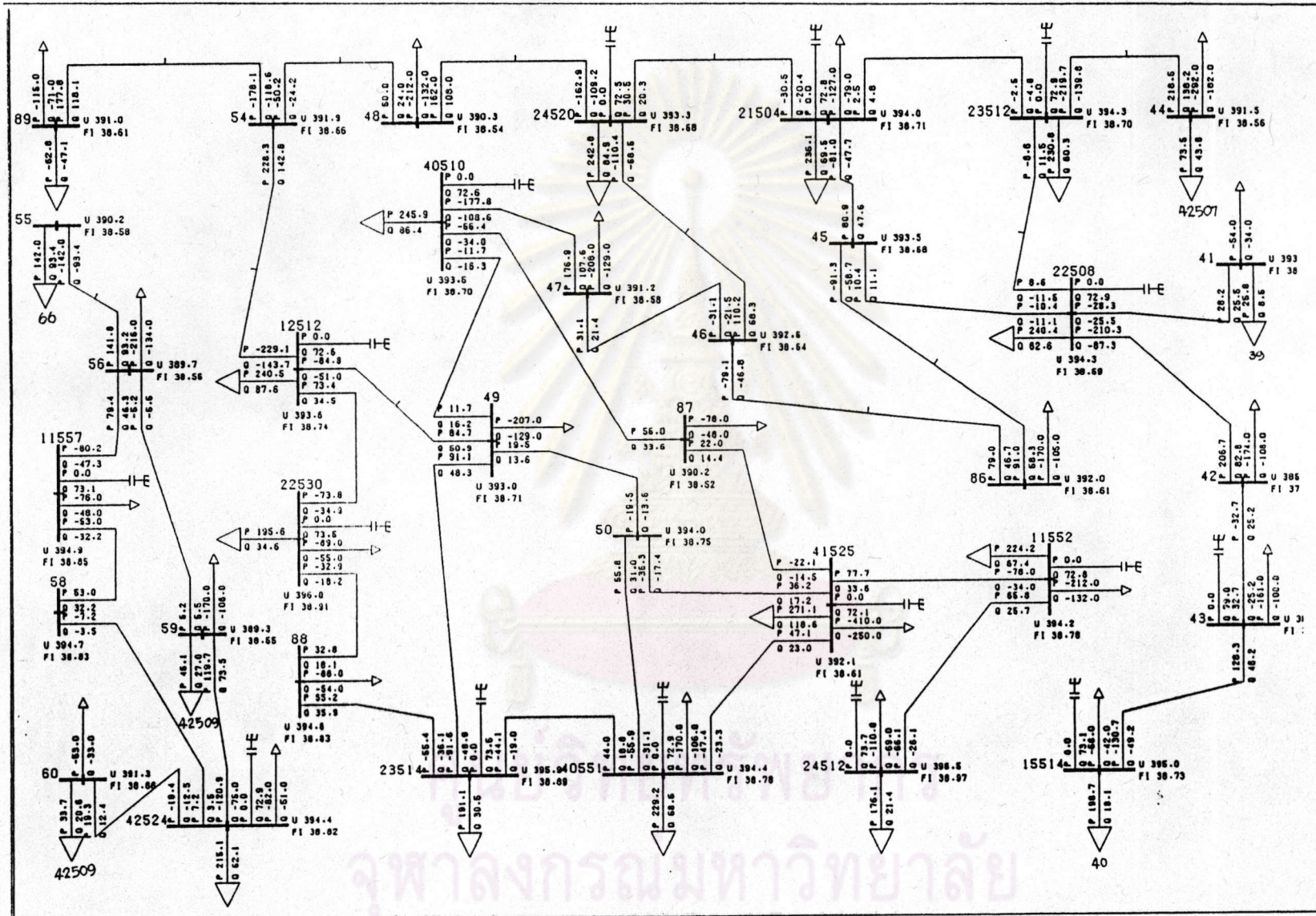


Figure A 2.6.3

The single line diagram with load flow solution of the network system were increased load in area 3 when the second emergency occurs



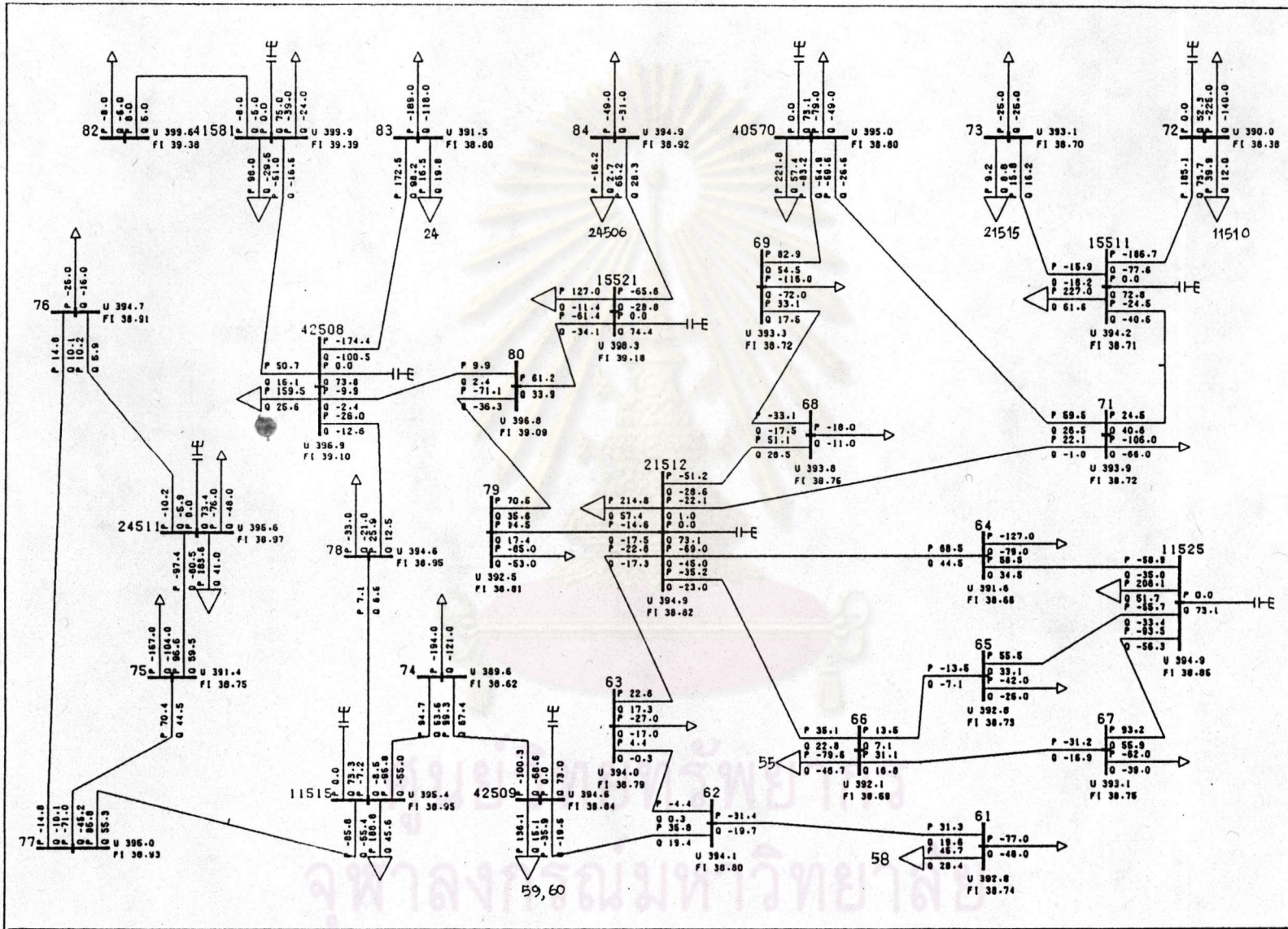


Figure A 2.6.4

The single line diagram with load flow solution of the network system were increased loads in area 4 when the second emergency occurs

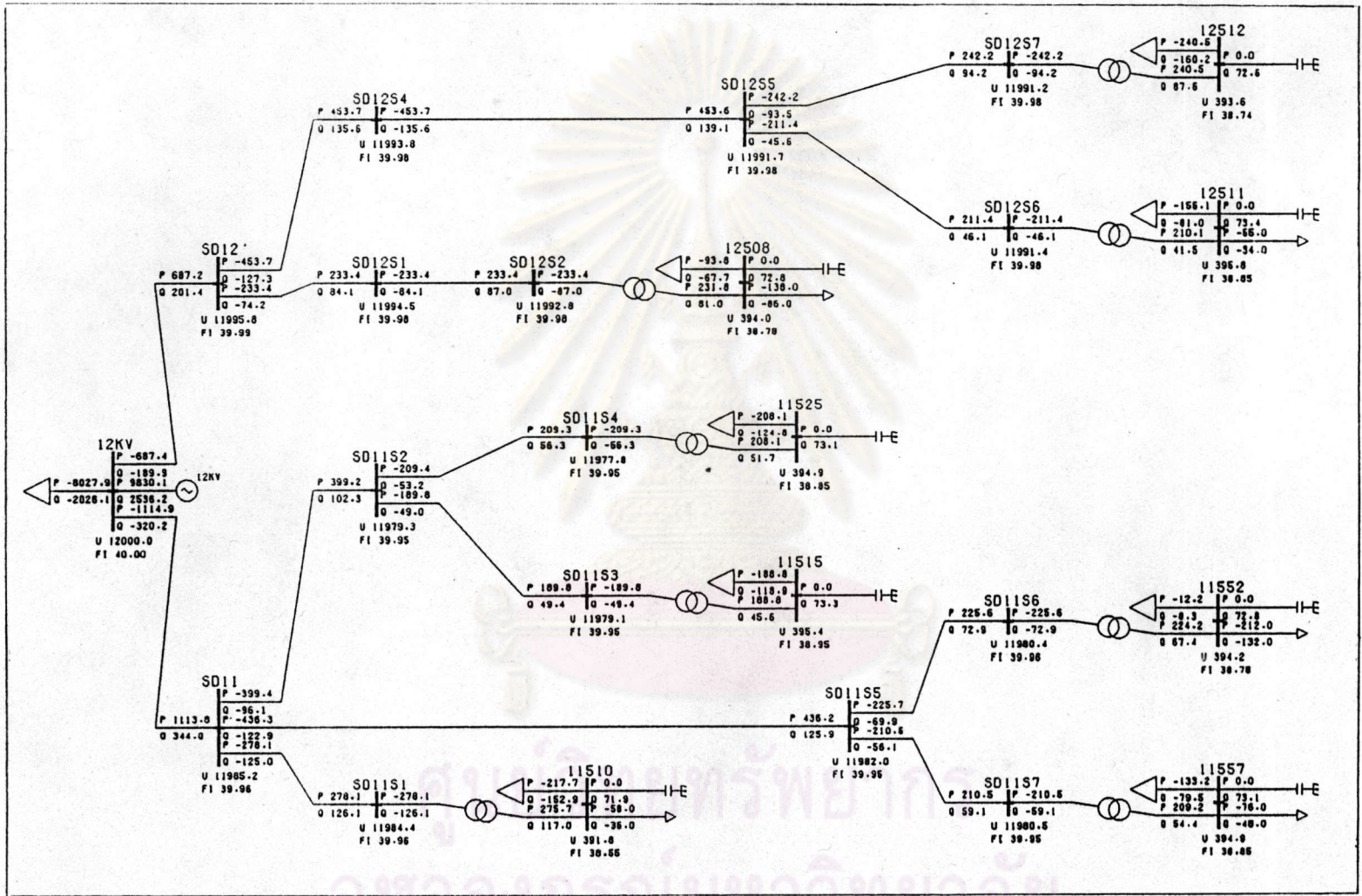


Figure A 2.6.5

The single line diagram with load flow solution of the network system were increased loads in the feeders 12 Kv SD11 and SD12 when the second emergency occurs

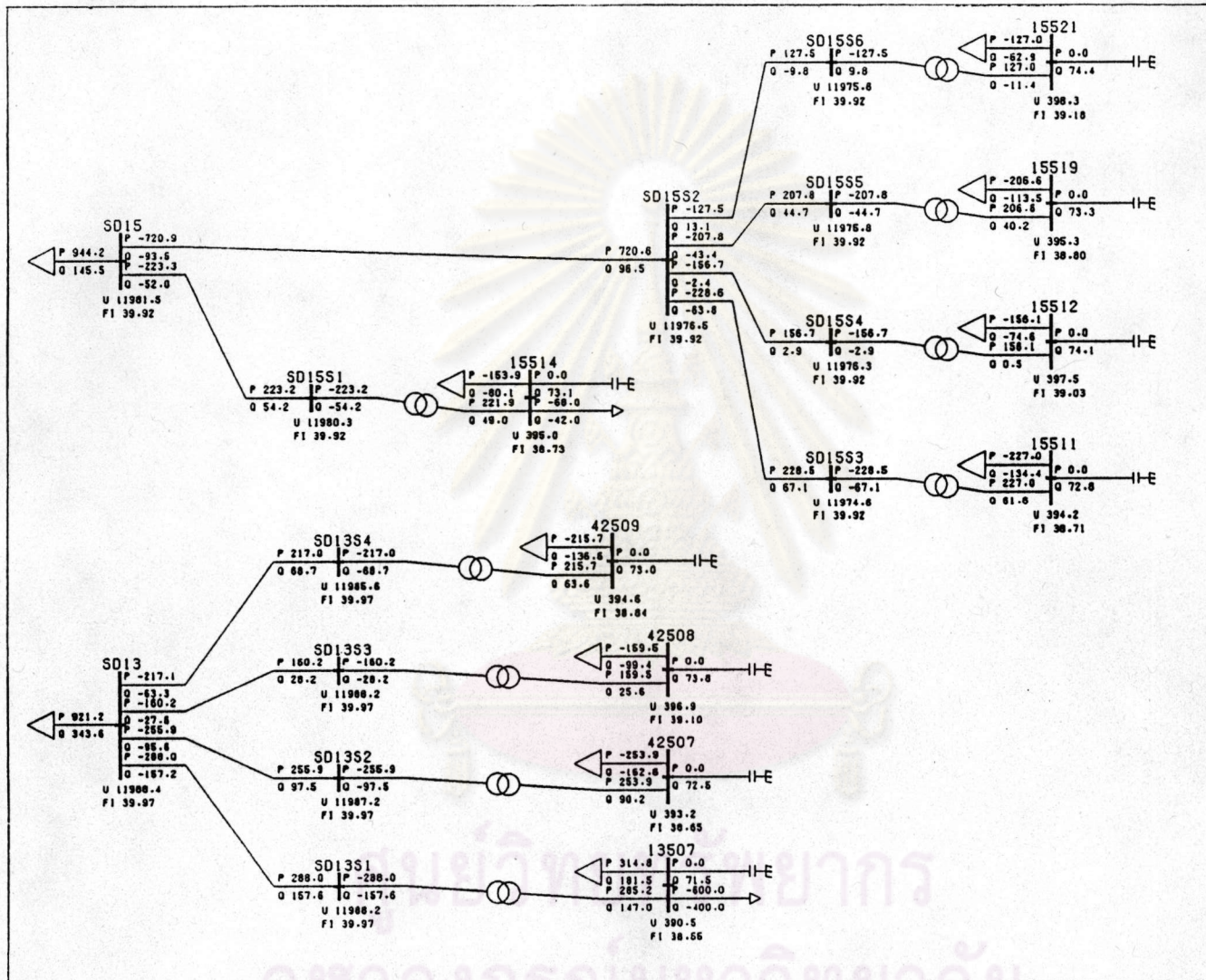


Figure A 2.6.6

The single line diagram with load flow solution of the network system were increased loads in the feeders 12 Kv SD13 and SD15 when the second emergency occurs

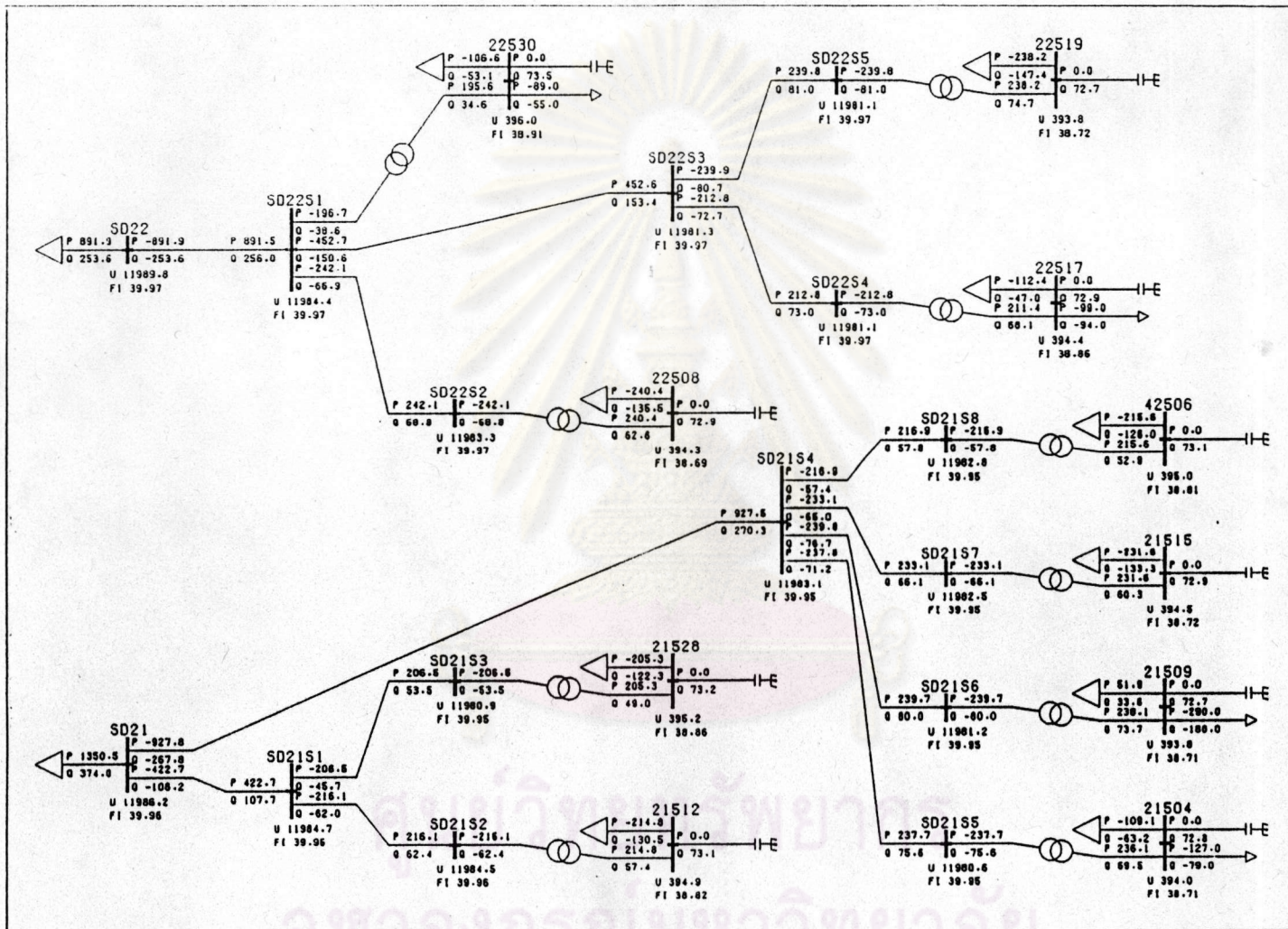


Figure A 2.6.7

The single line diagram with load flow solution of the network system were increased loads in the feeders 12 Kv SD21 and SD22 when the second emergency occurs

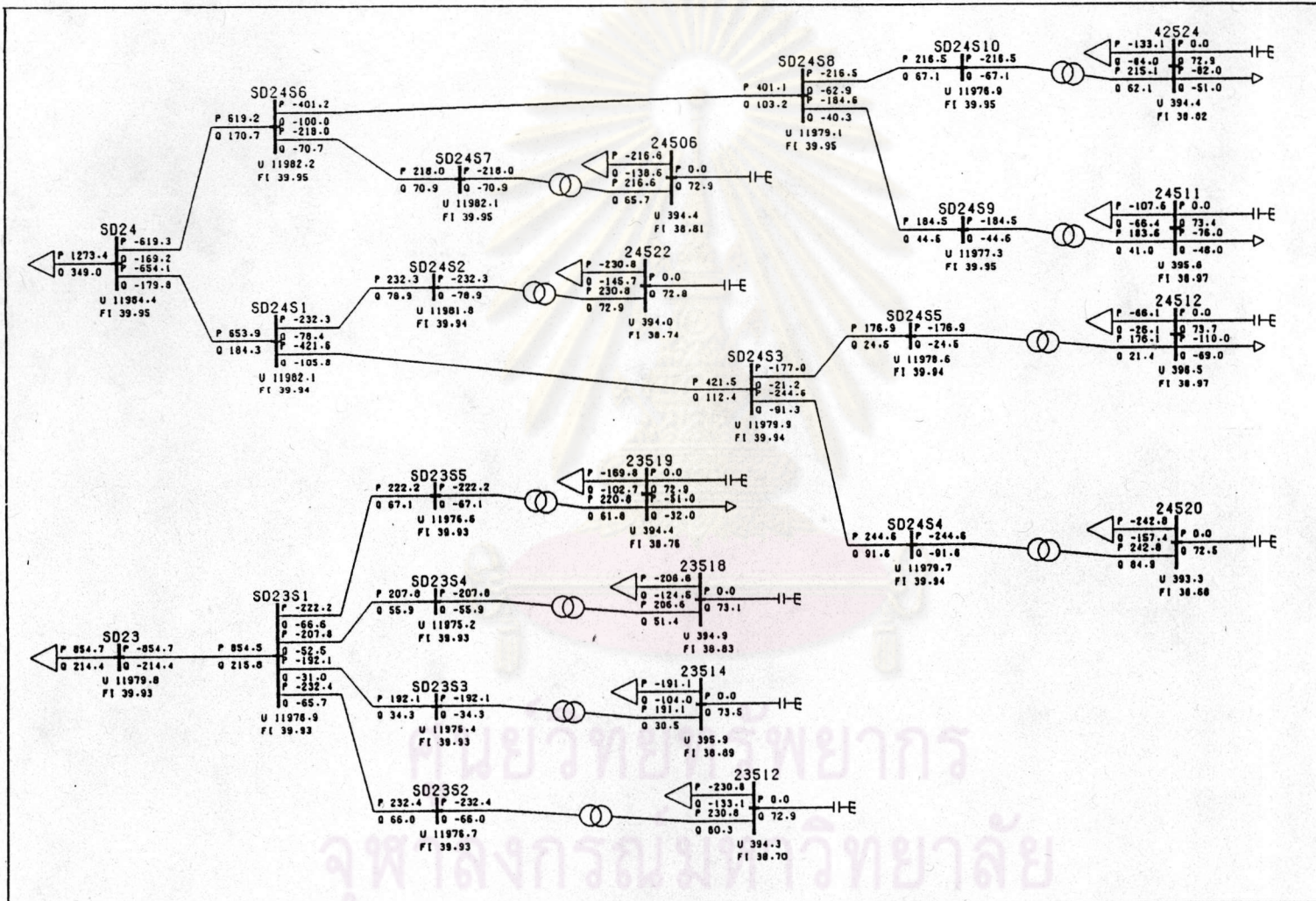


Figure A 2.6.8

The single line diagram with the load flow solution of the network system were increased loads in the feeders 12 Kv SD23 and SD24 when the second emergency occurs

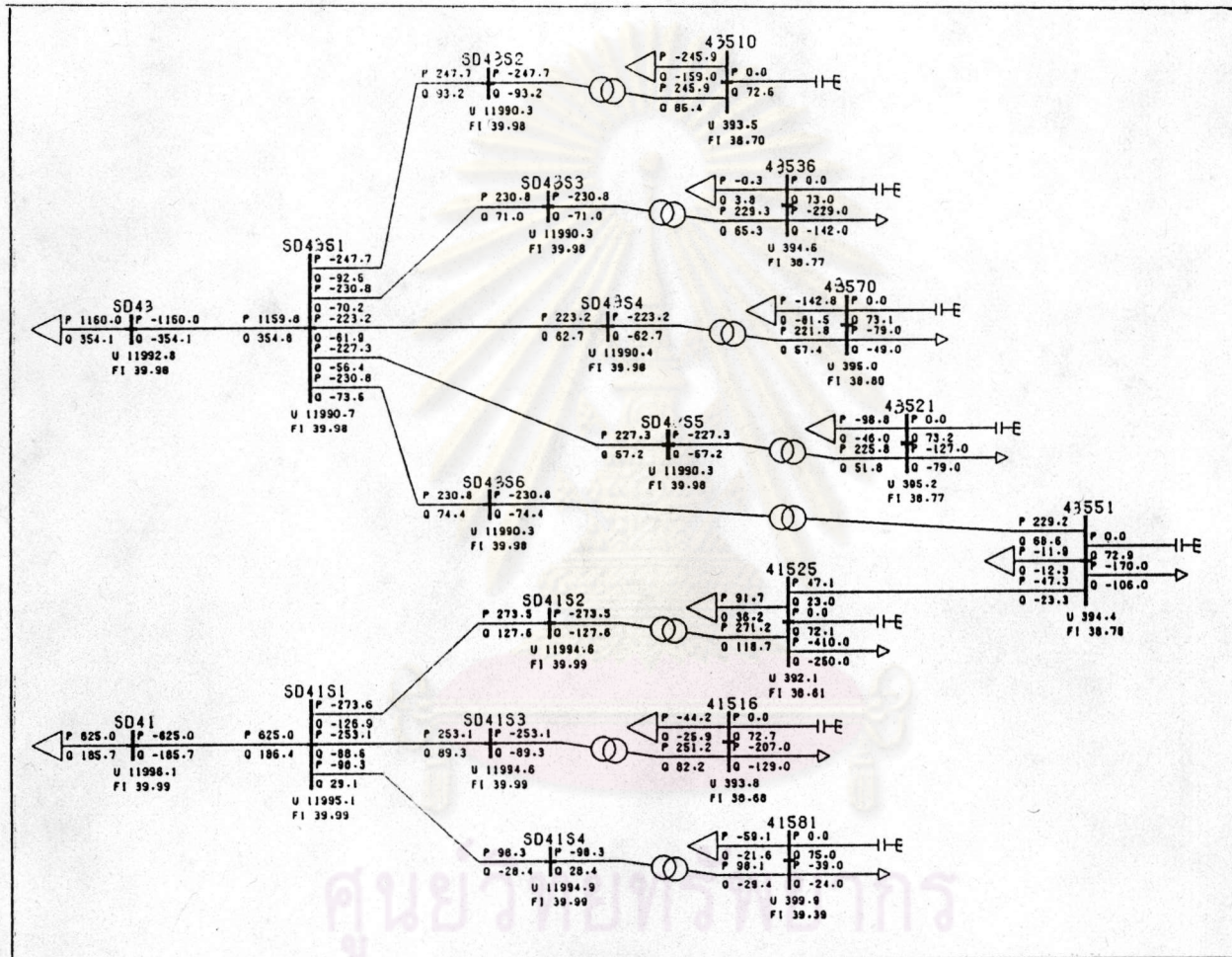
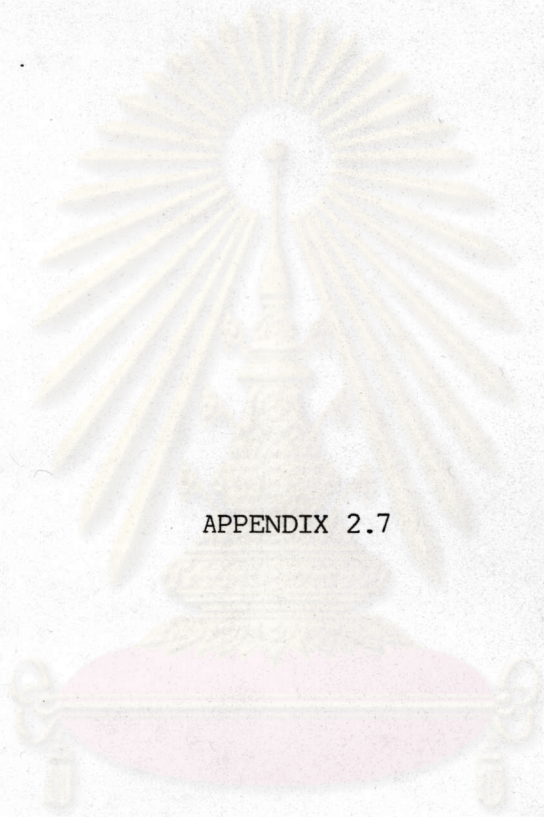


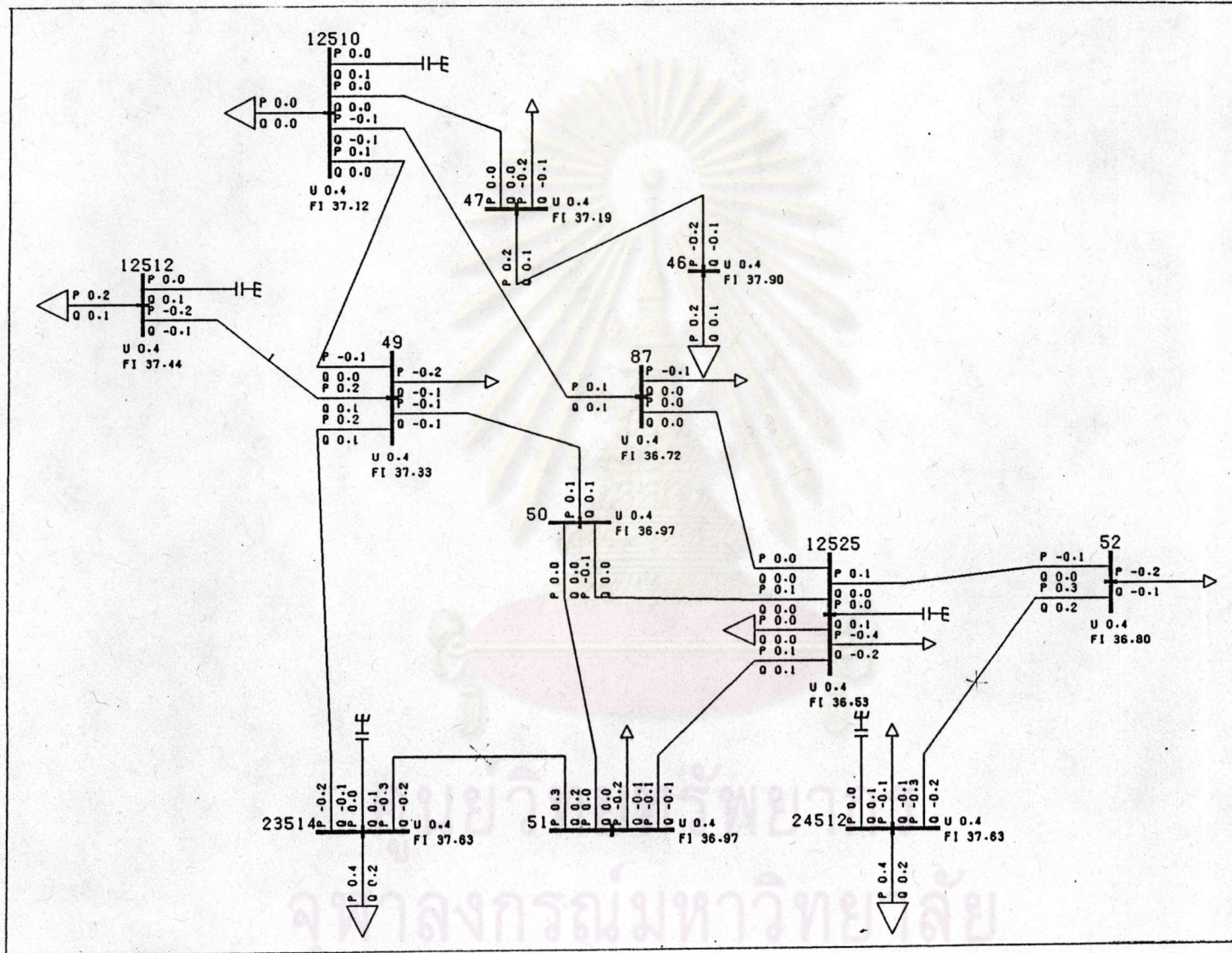
Figure A 2.6.9

The single line diagram with load flow solution of the network system were increased loads in the feeders 12 Kv SD43 and SD41 when the second emergency occurs



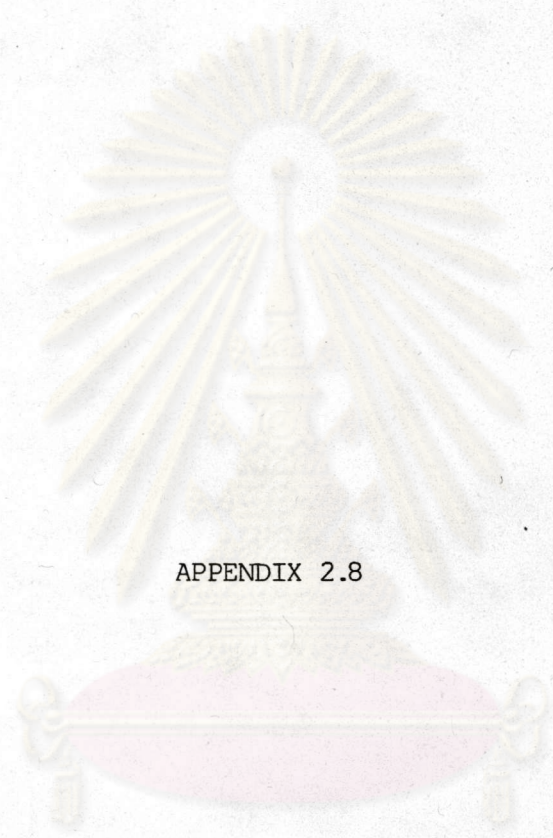
APPENDIX 2.7

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย



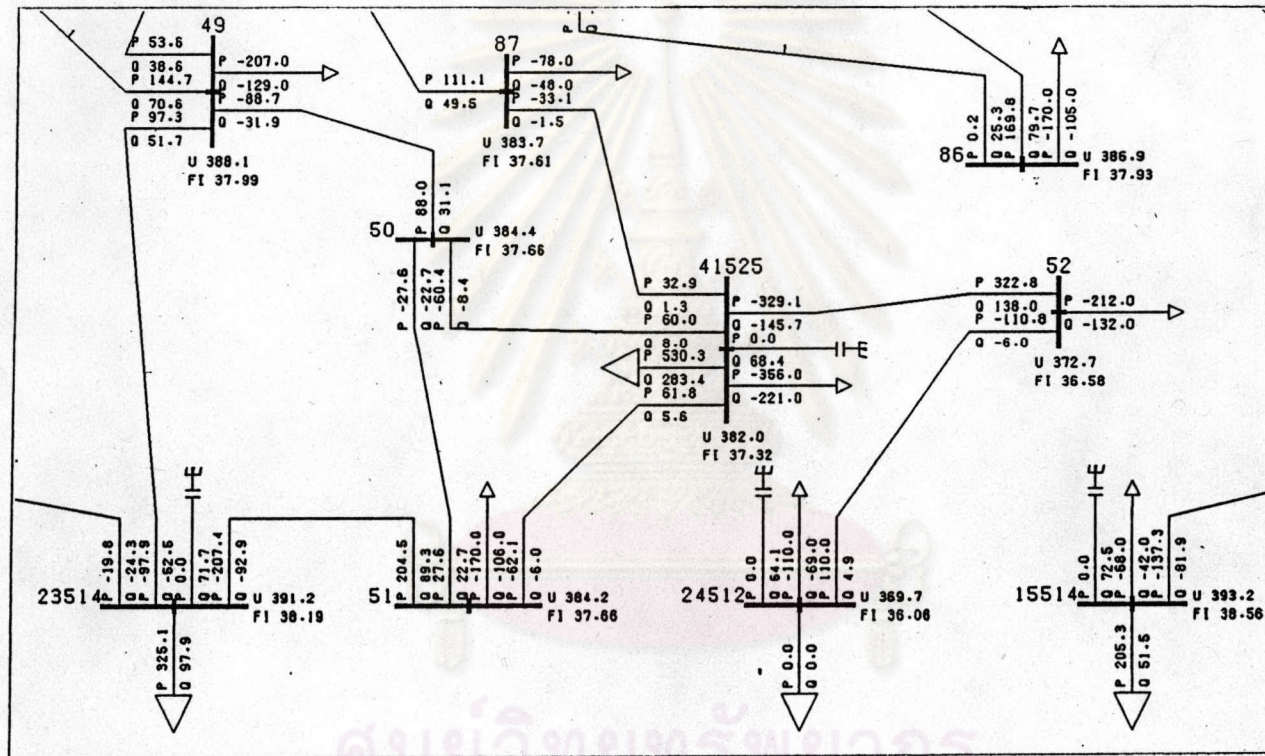
Feeder SD12 disconnected





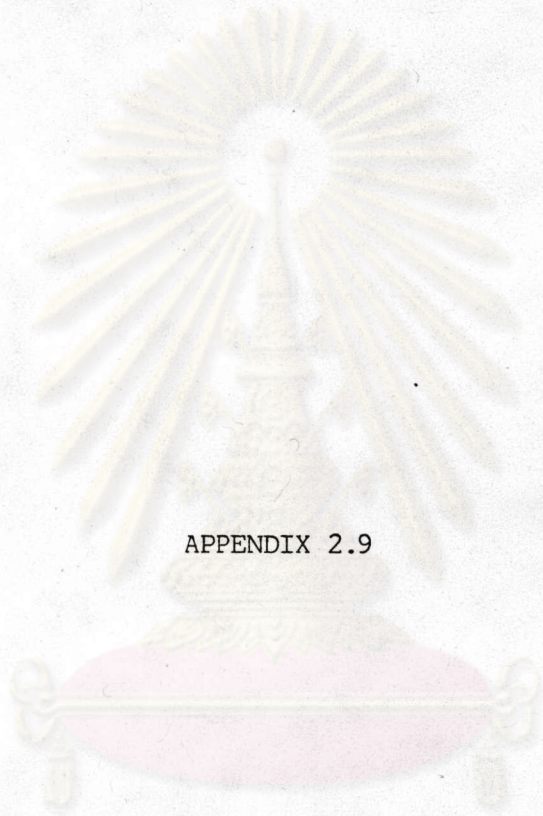
APPENDIX 2.8

ศูนย์วิจัยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย



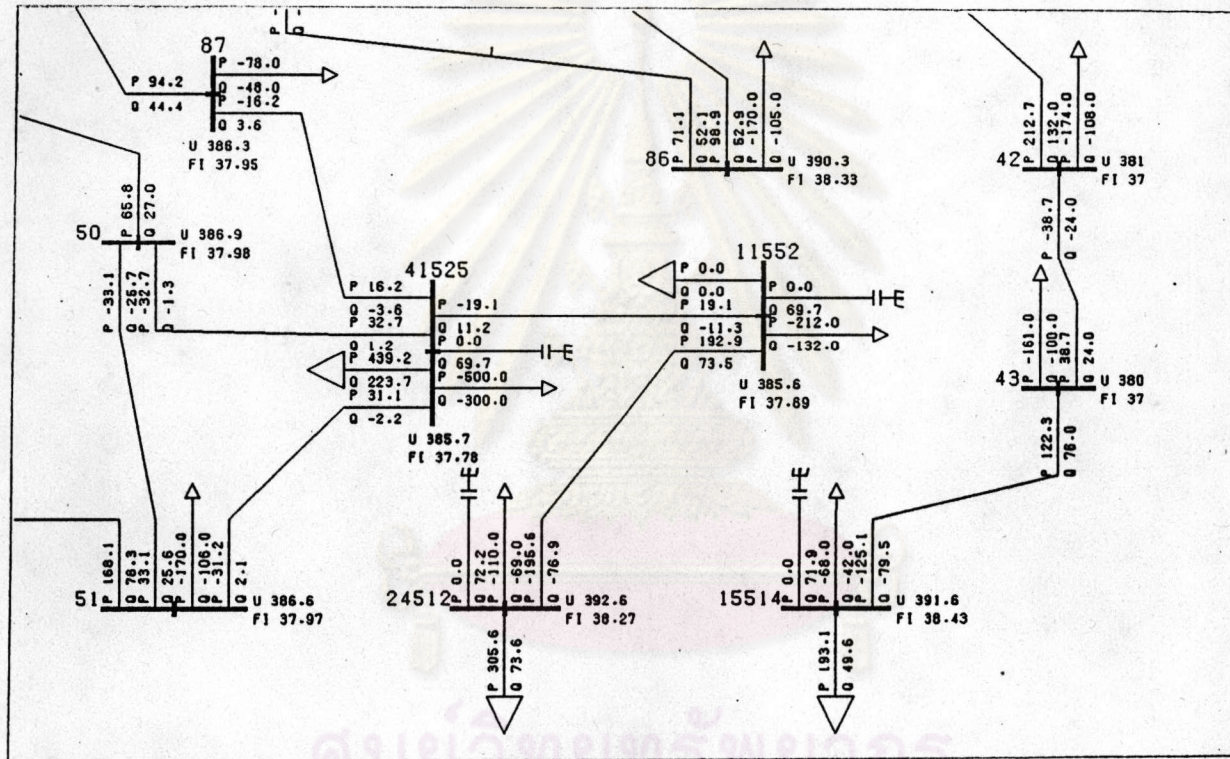
Feeder SD24 disconnected

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

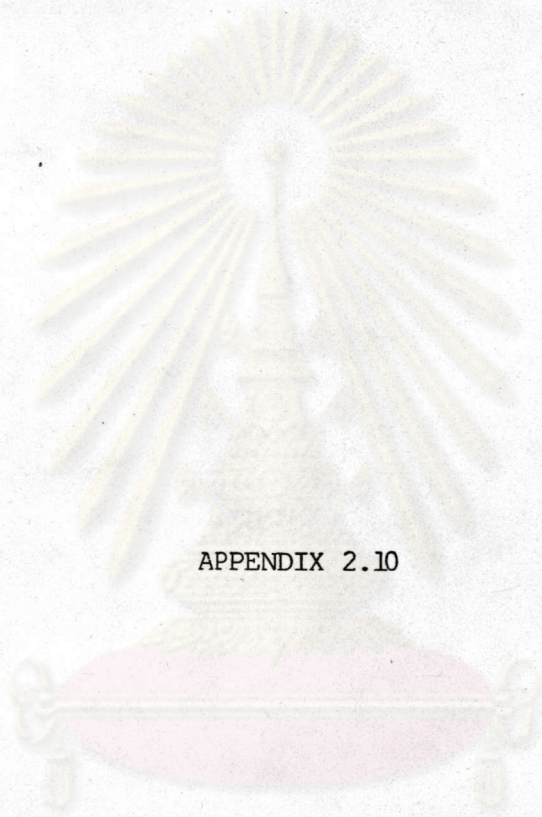


APPENDIX 2.9

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

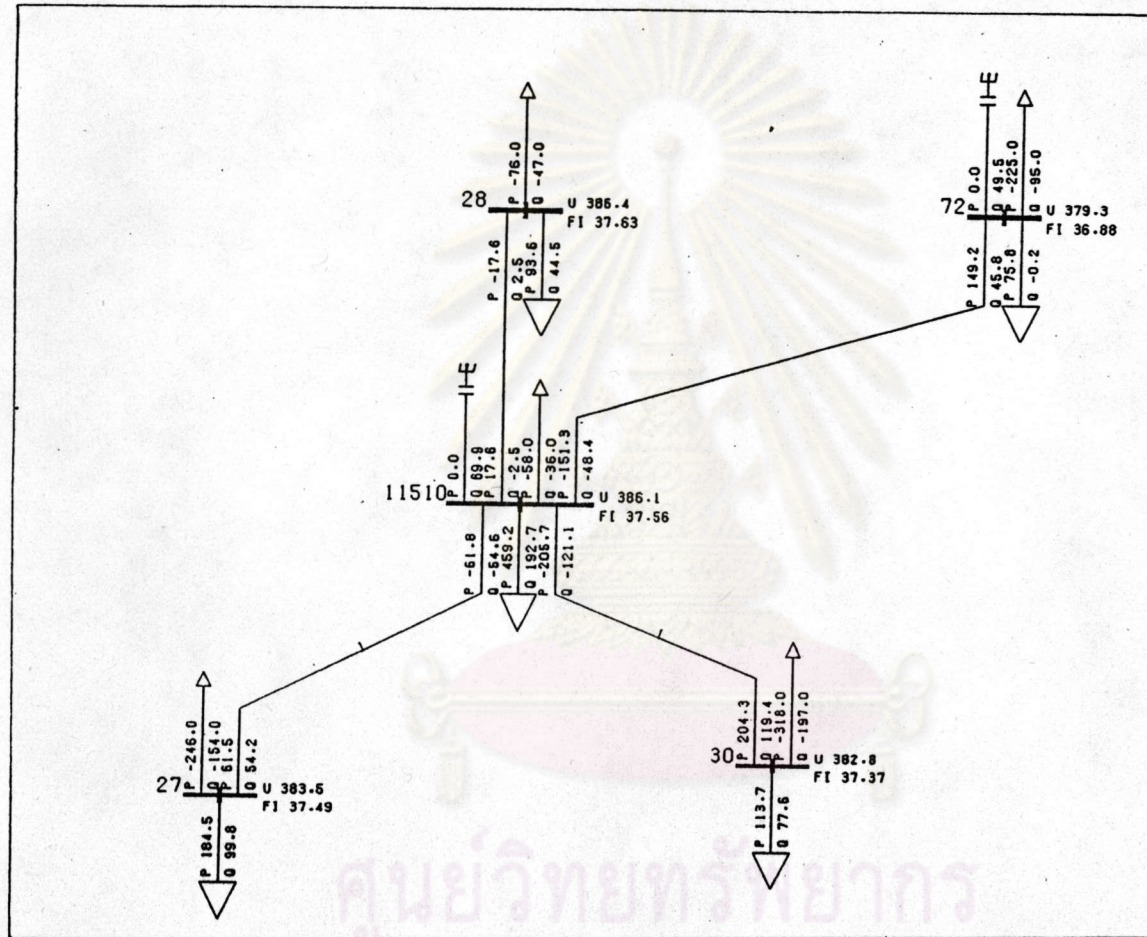


Feeder SD11 disconnected when load increased

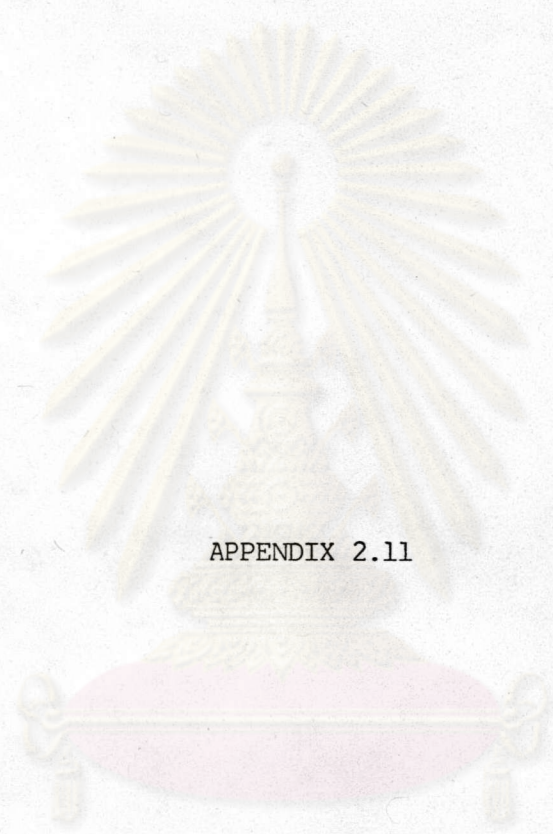


APPENDIX 2.10

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

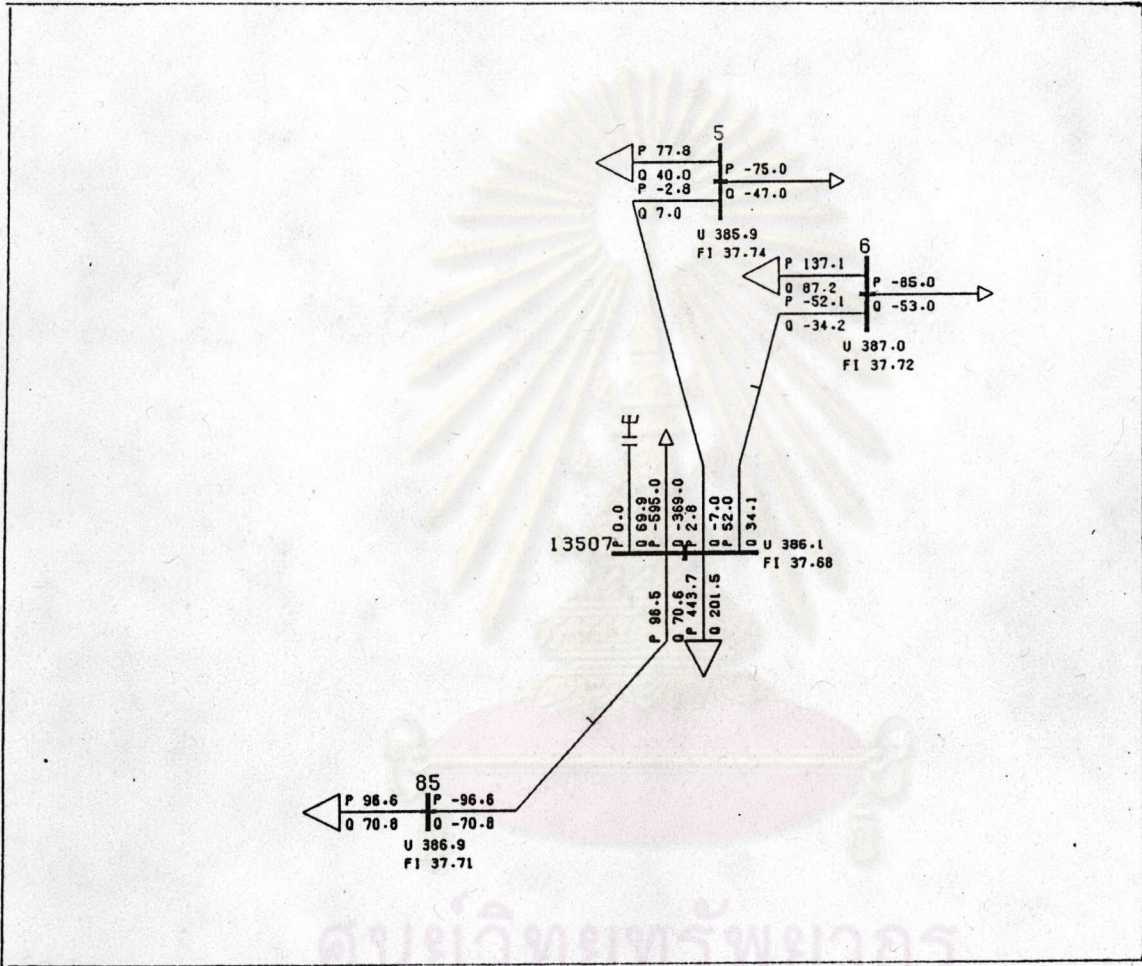


Feeders SD13 and SD15 disconnected



APPENDIX 2.11

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย



Feeders SD12 and SD21 disconnected



## VITA

The author of this thesis, Mr. Niwat Jongsukstidpun, was born in Nakhonratchasima, Thailand, on October 17, 1957. He received Graduate Diploma of Electrical Engineering from Chulalongkorn University in 1984.

At present, he has been working for Provincial Water Work Authority of Thailand (PWA) in Operation & Maintenance Department.



ศูนย์วิทยทรัพยากร  
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