

Project: IEEE 14 BUS
Location:
Contract:
Engineer:
Filename: kkk

ETAP
19.0.1C

Study Case: SC

Page: 1
Date: 12-10-2022
SN:
Revision: Base
Config.: Normal

Electrical Transient Analyzer Program

Short-Circuit Analysis

ANSI Standard

3-Phase, LG, LL, & LLG Fault Currents

1/2 Cycle Network

	Swing	V-Control	Load	Total
Number of Buses:	1	4	23	28

	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	3	0	0	0	17	14	34

	Synchronous Generator	Power Grid	Synchronous Motor	Induction Machines	Lumped Load	Total
Number of Machines:	5	0	0	0	11	16

System Frequency: 60.00
Unit System: English
Project Filename: kkk
Output Filename: C:\Users\Nahendra\Desktop\project_code\Untitled.SA2S

Project: IEEE 14 BUS

Location:

Contract:

Engineer:

Filename: kkk

ETAP

19.0.1C

Study Case: SC

Page: 2

Date: 12-10-2022

SN:

Revision: Base

Config.: Normal

Adjustments

<u>Tolerance</u>	<u>Apply Adjustments</u>	<u>Individual /Global</u>	<u>Percent</u>
Transformer Impedance:	Yes	Individual	
Reactor Impedance:	Yes	Individual	
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

<u>Temperature Correction</u>	<u>Apply Adjustments</u>	<u>Individual /Global</u>	<u>Degree C</u>
Transmission Line Resistance:	Yes	Individual	
Cable / Busway Resistance:	Yes	Individual	

Project: IEEE 14 BUS

Location:

Contract:

Engineer:

Filename: kkk

ETAP

19.0.1C

Study Case: SC

Page: 3

Date: 12-10-2022

SN:

Revision: Base

Config.: Normal

Bus Input Data

Bus					Initial Voltage	
ID	Type	Nom. kV	Base kV	Sub-sys	%Mag.	Ang.
B1	SWNG	1.000	1.000	1	106.00	0.00
B2	Gen.	1.000	1.000	1	104.50	-4.98
B3	Load	1.000	1.000	1	102.00	-8.78
B4	Gen.	1.000	1.000	1	101.00	0.00
B5	Load	1.000	1.000	1	101.90	0.00
Bus1	Load	1.000	1.000	1	100.00	0.00
Bus2	Load	1.000	1.000	1	100.00	0.00
Bus 6 L_6	Gen.	1.000	1.000	1	107.00	-30.00
Bus 7 Z_7	Load	1.000	1.000	1	106.20	-30.00
Bus 8 T_8	Gen.	1.000	1.000	1	109.00	-30.00
Bus9	Load	1.000	1.000	1	100.00	0.00
Bus 9 L_9	Load	1.000	1.000	1	105.60	-30.00
Bus10	Load	1.000	1.000	1	100.00	0.00
Bus 10 L_10	Load	1.000	1.000	1	105.10	-30.00
Bus11	Load	1.000	1.000	1	100.00	0.00
Bus 11 L_11	Load	1.000	1.000	1	105.70	-30.00
Bus12	Load	1.000	1.000	1	100.00	0.00
Bus 12 L_12	Load	1.000	1.000	1	105.50	-30.00
Bus 13 L_13	Load	1.000	1.000	1	105.00	-30.00
Bus 14 L_14	Load	1.000	1.000	1	103.60	-30.00
F1	Load	1.000	1.000	1	100.00	0.00
F1_1	Load	1.000	1.000	1	100.00	0.00
F2	Load	1.000	1.000	1	100.00	0.00
F2_2	Load	1.000	1.000	1	100.00	0.00
F3	Load	1.000	1.000	1	100.00	0.00
F3_3	Load	1.000	1.000	1	100.00	0.00
F4	Load	1.000	1.000	1	100.00	0.00
F4_4	Load	1.000	1.000	1	100.00	0.00

28 Buses Total

All voltages reported by ETAP are in % of bus Nominal kV.

Base kV values of buses are calculated and used internally by ETAP.

Project: IEEE 14 BUS

Location:

Contract:

Engineer:

Filename: kkk

ETAP

19.0.1C

Study Case: SC

Page: 4

Date: 12-10-2022

SN:

Revision: Base

Config.: Normal

2-Winding Transformer Input Data

Transformer	Rating					Z Variation			% Tap Setting		Adjusted	Phase Shift	
ID	MVA	Prim. kV	Sec. kV	% Z	X/R	+ 5%	- 5%	% Tol.	Prim.	Sec.	% Z	Type	Angle
4_7	100.000	1.000	1.000	20.91	999.00	0	0	0	-2.200	0	20.91	Dyn	30.00
4_9	100.000	1.000	1.000	55.62	999.00	0	0	0	-3.100	0	55.62	Dyn	30.00
5_6	100.000	1.000	1.000	25.20	999.00	0	0	0	-6.800	0	25.20	Dyn	30.00

2-Winding Transformer Grounding Input Data

Transformer	Rating			Grounding									
	ID	MVA	Prim. kV	Sec. kV	Conn.	Primary				Secondary			
					Type	Type	kV	Amp	ohm	Type	kV	Amp	ohm
4_7		100.000	1.000	1.000	D/Y					Solid			
4_9		100.000	1.000	1.000	D/Y					Solid			
5_6		100.000	1.000	1.000	D/Y					Solid			

Impedance Input Data

Immedance	Positive Sequence Impedanc			Zero Sequence Impedance			
ID	R	X	Y	R0	X0	Y0	Unit
1_5	5.403	22.304	4.92	5.403	22.304	4.92	% in 1.000 kV base and 100.0 MVA base
3_4	6.701	17.103	1.28	6.701	17.103	1.28	% in 1.000 kV base and 100.0 MVA base
4_5	1.335	4.211	0	1.335	4.211	0	% in 1.000 kV base and 100.0 MVA base
6_11	9.498	19.89	0	9.498	19.89	0	% in 1.000 kV base and 100.0 MVA base
6_12	12.291	25.581	0	12.291	25.581	0	% in 1.000 kV base and 100.0 MVA base
6_13	6.615	13.027	0	6.615	13.027	0	% in 1.000 kV base and 100.0 MVA base
7_8	0	17.615	0	0	17.615	0	% in 1.000 kV base and 100.0 MVA base
7_9	0	11.001	0	0	11.001	0	% in 1.000 kV base and 100.0 MVA base
9_10	3.181	8.45	0	3.181	8.45	0	% in 1.000 kV base and 100.0 MVA base
9_14	12.711	27.038	0	12.711	27.038	0	% in 1.000 kV base and 100.0 MVA base
10_11	8.205	19.207	0	8.205	19.207	0	% in 1.000 kV base and 100.0 MVA base
12_13	22.092	19.988	0	22.092	19.988	0	% in 1.000 kV base and 100.0 MVA base
13_14	17.093	34.802	0	17.093	34.802	0	% in 1.000 kV base and 100.0 MVA base
line1	1.938	5.917	5.28	1.938	5.917	5.28	% in 1.000 kV base and 100.0 MVA base
line2	5.695	17.388	3.46	5.695	17.388	3.46	% in 1.000 kV base and 100.0 MVA base
line3	4.699	19.797	4.38	4.699	19.797	4.38	% in 1.000 kV base and 100.0 MVA base

Project: IEEE 14 BUS

ETAP

Page: 5

Location:

19.0.1C

Date: 12-10-2022

Contract:

SN:

Engineer:

Study Case: SC

Revision: Base

Filename: kkk

Config.: Normal

Impedance Input Data

Impedance		Positive Sequence Impedance			Zero Sequence Impedance			Unit
ID		R	X	Y	R0	X0	Y0	
line4		5.811	17.632	3.4	5.811	17.632	3.4	% in 1.000 kV base and 100.0 MVA base

Project: IEEE 14 BUS
Location:
Contract:
Engineer:
Filename: kkk

ETAP
19.0.1C

Study Case: SC

Page: 6
Date: 12-10-2022
SN:
Revision: Base
Config.: Normal

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVA			
ID	Type	From Bus	To Bus	R	X	Z	Y
4_7	2W XFMR	B5	Bus 7 Z_7	0.02	20.91	20.91	
4_9	2W XFMR	B5	Bus 9 L_9	0.06	55.62	55.62	
5_6	2W XFMR	B3	Bus 6 L_6	0.03	25.20	25.20	
1_5	Impedance	Bus1	Bus2	5.40	22.30	22.95	4.9200000
3_4	Impedance	Bus11	Bus12	6.70	17.10	18.37	1.2800000
4_5	Impedance	Bus10	Bus9	1.34	4.21	4.42	
6_11	Impedance	Bus 6 L_6	Bus 11 L_11	9.50	19.89	22.04	
6_12	Impedance	Bus 6 L_6	Bus 12 L_12	12.29	25.58	28.38	
6_13	Impedance	Bus 6 L_6	Bus 13 L_13	6.62	13.03	14.61	
7_8	Impedance	Bus 7 Z_7	Bus 8 T_8		17.62	17.62	
7_9	Impedance	Bus 7 Z_7	Bus 9 L_9		11.00	11.00	
9_10	Impedance	Bus 9 L_9	Bus 10 L_10	3.18	8.45	9.03	
9_14	Impedance	Bus 9 L_9	Bus 14 L_14	12.71	27.04	29.88	
10_11	Impedance	Bus 10 L_10	Bus 11 L_11	8.21	19.21	20.89	
12_13	Impedance	Bus 12 L_12	Bus 13 L_13	22.09	19.99	29.79	
13_14	Impedance	Bus 13 L_13	Bus 14 L_14	17.09	34.80	38.77	
line1	Impedance	F1	F1_1	1.94	5.92	6.23	5.2800000
line2	Impedance	F2_2	F2	5.70	17.39	18.30	3.4600000
line3	Impedance	F3	F3_3	4.70	19.80	20.35	4.3800000
line4	Impedance	F4	F4_4	5.81	17.63	18.56	3.4000000
CB1	Tie Breakr	B1	F1				
CB1_1	Tie Breakr	F1_1	B2				
CB2	Tie Breakr	B3	F2				
CB2_2	Tie Breakr	F2_2	B2				
CB3	Tie Breakr	F3	B2				
CB3_3	Tie Breakr	B4	F3_3				
CB4	Tie Breakr	F4	B2				
CB4_4	Tie Breakr	B5	F4_4				
CB11	Tie Breakr	B5	Bus10				
CB12	Tie Breakr	Bus9	B3				
CB13	Tie Breakr	Bus11	B4				
CB14	Tie Breakr	B5	Bus12				
sdf	Tie Breakr	B1	Bus1				
sdfsdf	Tie Breakr	B3	Bus2				

Project: IEEE 14 BUS

Location:

Contract:

Engineer:

Filename: kkk

ETAP

19.0.1C

Study Case: SC

Page: 7

Date: 12-10-2022

SN:

Revision: Base

Config.: Normal

Synchronous Generator Input Data

Synchronous Generator					Positive Seq. Impedance					Grounding			Zero Seq. Impedance		
					Rating										
ID	Type	MVA	kV	RPM	X"/R	% R	Adj.	Tol.	% Xd'	Conn.	Type	Amp	X/R	% R0	% X0
Gen_1	Steam Turbo	233.014	1.000	1800	19.00	1.000	19.00	0.0	28.00	Wye	Solid		7.00	1.000	7.00
Gen_2	Steam Turbo	58.290	1.000	1800	19.00	1.000	19.00	0.0	28.00	Wye	Solid		7.00	1.000	7.00
Gen_3	Steam Turbo	23.400	1.000	1800	19.00	1.000	19.00	0.0	28.00	Wye	Solid		7.00	1.000	7.00
Gen_6	Steam Turbo	12.200	1.000	1800	19.00	1.000	19.00	0.0	28.00	Wye	Solid		7.00	1.000	7.00
Gen_8	Steam Turbo	17.400	1.000	1800	19.00	1.000	19.00	0.0	28.00	Wye	Solid		7.00	1.000	7.00

Total Connected Synchronous Generators (= 5): 344.304 MVA

Project: IEEE 14 BUS

Location:

Contract:

Engineer:

Filename: kkk

ETAP

19.0.1C

Study Case: SC

Page: 8

Date: 12-10-2022

SN:

Revision: Base

Config.: Normal

Lumped Load Input Data

Lumped Load					Motor Loads										
Lumped Load		Rating		% Load		Loading		X/R Ratio		Impedance			Grounding		
										(Machine Base)					
ID	kVA	kV	MTR	STAT	kW	kvar	X"/R	X'/R	% R	% X"	% X'	Conn.	Type	Amp.	
Load_2	25143.2	1.000	100	0	21700.0	12700.0	2.38	2.38	8.403	20.00	50.00	Delta			
Load_3	96097.0	1.000	100	0	94200.0	19000.0	2.38	2.38	8.403	20.00	50.00	Delta			
Load_4	47958.8	1.000	100	0	47800.0	-3900.0	2.38	2.38	8.403	20.00	50.00	Delta			
Load_5	7766.6	1.000	100	0	7600.0	1600.0	2.38	2.38	8.403	20.00	50.00	Delta			
Load_6	13479.2	1.000	100	0	11200.0	7500.0	2.38	2.38	8.403	20.00	50.00	Delta			
Load_9	33849.8	1.000	100	0	29500.0	16600.0	2.38	2.38	8.403	20.00	50.00	Delta			
Load_10	10707.0	1.000	100	0	9000.0	5800.0	2.38	2.38	8.403	20.00	50.00	Delta			
Load_11	3935.7	1.000	100	0	3500.0	1800.0	2.38	2.38	8.403	20.00	50.00	Delta			
Load_12	6306.3	1.000	100	0	6100.0	1600.0	2.38	2.38	8.403	20.00	50.00	Delta			
Load_13	14693.2	1.000	100	0	13500.0	5800.0	2.38	2.38	8.403	20.00	50.00	Delta			
Load_14	15716.6	1.000	100	0	14900.0	5000.0	2.38	2.38	8.403	20.00	50.00	Delta			

Total Connected Lumped Loads (= 11): 275653.6 kVA

Project: IEEE 14 BUS
Location:
Contract:
Engineer:
Filename: kkk

ETAP
19.0.1C

Study Case: SC

Page: 9
Date: 12-10-2022
SN:
Revision: Base
Config.: Normal

SHORT- CIRCUIT REPORT

Fault at bus: F1_1

Prefault voltage = 1.000 kV
= 100.00 % of nominal bus kV (1.000 kV)
= 100.00 % of base kV (1.000 kV)

Line-To-Line-To-Ground Fault

Contribution		% Voltage at From Bus						Current at From Bus (kA)						Sequence Current (kA)		
From Bus	To Bus	Va		Vb		Vc		Ia		Ib		Ic				
ID	ID	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	I1	I2	I0
F1_1	Total	91.22	-0.3	0.00	0.0	0.00	0.0	0.000	0.0	1063.193	158.4	1080.053	45.5	713.071	318.629	394.509
F1	F1_1	88.16	-1.2	47.26	-133.1	45.69	119.9	30.820	130.2	438.197	155.0	423.657	48.0	276.491	123.697	180.006
Gen_2	B2	100.00	0.0	100.00	-120.0	100.00	120.0	78.922	103.7	241.148	136.6	231.278	54.3	123.097	56.504	144.722
Load_2	B2	100.00	0.0	100.00	-120.0	100.00	120.0	26.223	-66.7	59.536	-169.9	59.294	35.6	46.569	20.347	0.000
F4_4	F4	100.90	-0.1	38.12	-113.4	38.98	110.4	30.108	-69.9	118.552	174.8	121.237	38.7	89.158	39.269	19.882
F3_3	F3	100.51	0.5	45.95	-113.9	47.96	115.1	26.646	-68.1	130.377	169.4	136.081	38.4	97.211	42.789	28.186
F2	F2_2	98.98	-0.3	35.68	-116.3	36.49	110.9	24.466	-71.2	112.588	171.8	115.129	39.0	83.575	36.894	22.294

Indicates fault current contribution is from three-winding transformers.

Project: IEEE 14 BUS
Location:
Contract:
Engineer:
Filename: kkk

ETAP
19.0.1C

Study Case: SC

Page: 10
Date: 12-10-2022
SN:
Revision: Base
Config.: Normal

Short-Circuit Summary Report

1/2 Cycle - 3-Phase, LG, LL, & LLG Fault Currents

Prefault Voltage = 100 % of the Bus Nominal Voltage

Bus		3-Phase Fault			Line-to-Ground Fault			Line-to-Line Fault			*Line-to-Line-to-Ground		
ID	kV	Real	Imag.	Mag.	Real	Imag.	Mag.	Real	Imag.	Mag.	Real	Imag.	Mag.
F1_1	1.000	209.887	-1002.901	1024.628	235.651	-1085.473	1110.758	876.087	194.255	897.365	757.538	769.839	1080.053

All fault currents are symmetrical (1/2 Cycle network) values in rms kA.
* LLG fault current is the larger of the two faulted line currents.

Project: IEEE 14 BUS
Location:
Contract:
Engineer:
Filename: kkk

ETAP
19.0.1C

Study Case: SC

Page: 11
Date: 12-10-2022
SN:
Revision: Base
Config.: Normal

Sequence Impedance Summary Report

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
F1_1	1.000	0.00012	0.00055	0.00056	0.00013	0.00054	0.00055	0.00009	0.00044	0.00045	0.00000	0.00000	0.00000