



**Islamic University of Technology**

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Section : A-(02)

Department :EEE

Course No : EEE-4416

Course Title : Power System II Lab

Experiment No : 5

Date of Submission : 06/09/2025

## Bus-1:

*Current:*

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
1	Faulted Bus ->													
2														
3	B1		69.00	0.00	LLL	1245	10413.9521	-87.0049	10413.9520	152.9951	10413.9520	32.9951	0.0000	0.0000
4	B1		69.00	0.00	LG	813	6804.5927	-81.5906	0.0000	0.0000	0.0000	0.0000	6804.5927	-81.5906
5	B1		69.00	0.00	LL	1078	0.0002	180.0000	9018.7476	-177.0049	9018.7478	2.9951	0.0000	0.0000
6	B1		69.00	0.00	LLG	1159	0.0011	47.8156	9696.7386	168.0921	9018.5762	19.0477	5037.0372	101.0252
7														
8	First Ring Contributions													
9														
10	G1	Generator	69.00	0.00	LLL	1219	10195.9830	-87.1376	10195.9830	152.8624	10195.9830	32.8624	0.0000	0.0000
11		Generator	69.00	0.00	LG	531	4441.3867	-81.7231	2220.7017	98.2784	2220.6850	98.2754	0.0000	0.0000
12		Generator	69.00	0.00	LL	1055	0.0670	-90.0000	8829.9134	-177.1378	8829.9167	2.8626	0.0000	0.0000
13		Generator	69.00	0.00	LLG	1073	1643.9293	-79.1078	8891.6938	177.6633	8753.0271	8.1978	0.0000	0.0000
14	L14	Line	69.00	0.00	LLL	15	125.8250	-80.7738	125.8250	159.2282	125.8250	39.2262	0.0000	0.0000
15		Line	69.00	0.00	LG	136	1136.8415	-77.8897	1054.7092	-78.0935	1054.7092	-78.0935	3246.2554	-78.0242
16		Line	69.00	0.00	LL	13	0.0000	0.0000	108.9737	-170.7782	108.9737	9.2218	0.0000	0.0000
17		Line	69.00	0.00	LLG	99	780.7471	104.5225	828.5242	112.1468	808.2004	96.9109	2403.0238	104.5916
18	L16	Line	69.00	0.00	LLL	11	93.4457	-80.8911	93.4457	159.1089	93.4457	39.1088	0.0000	0.0000
19		Line	69.00	0.00	LG	147	1230.2983	-84.5249	1170.0308	-84.9951	1170.0308	-84.9951	3570.3327	-84.8331
20		Line	69.00	0.00	LL	9.7	0.0000	0.0000	80.9335	-170.8919	80.9335	9.1081	0.0000	0.0000
21		Line	69.00	0.00	LLG	107	866.1039	97.6213	890.3260	103.0757	893.8341	92.6688	2642.9058	97.7630

### *Voltage:*

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]
<b>1</b>	<b>Faulted Bus -&gt;</b>										
<b>2</b>											
<b>3</b>	B1		69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>4</b>	B1		69.00	0.00	LG	0.0000	0.0000	1.2869	-136.5625	1.3836	132.4818
<b>5</b>	B1		69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>6</b>	B1		69.00	0.00	LLG	1.3871	-1.5368	0.0000	0.0000	0.0000	0.0000
<b>7</b>											
<b>8</b>	<b>First Ring Contributions</b>										
<b>9</b>											
<b>10</b>	L14 (@ Bus : B1)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>11</b>		Line	69.00	0.00	LG	0.0000	0.0000	1.2869	-136.5625	1.3836	132.4818
<b>12</b>		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>13</b>		Line	69.00	0.00	LLG	1.3871	-1.5368	0.0000	0.0000	0.0000	0.0000
<b>14</b>	L16 (@ Bus : B1)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>15</b>		Line	69.00	0.00	LG	0.0000	0.0000	1.2869	-136.5625	1.3836	132.4818
<b>16</b>		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>17</b>		Line	69.00	0.00	LLG	1.3871	-1.5368	0.0000	0.0000	0.0000	0.0000

## **Bus-2:**

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***Current:***

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1</b>	<b>Faulted Bus -&gt;</b>													
<b>2</b>														
<b>3</b>	B2		13.80	0.00	LLL	692	28945.0128	-84.1558	28945.0127	155.8442	28945.0127	35.8442	0.0000	0.0000
<b>4</b>	B2		13.80	0.00	LG	0.3	10.9195	0.0000	0.0000	0.0000	0.0000	0.0000	10.9195	0.0000
<b>5</b>	B2		13.80	0.00	LL	599	0.0006	180.0000	25067.1160	-174.1558	25067.1160	5.8442	0.0000	0.0000
<b>6</b>	B2		13.80	0.00	LLG	599	3.6478	0.0313	25066.2152	-174.1558	25068.0175	5.8440	5.4597	0.0000
<b>7</b>														
<b>8</b>	<b>First Ring Contributions</b>													
<b>9</b>														
<b>10</b>	G2	Generator	13.80	0.00	LLL	665	27830.5981	-84.2894	27830.5980	155.7106	27830.5980	35.7106	0.0000	0.0000
<b>11</b>		Generator	13.80	0.00	LG	0.3	10.6684	-0.0000	0.1255	0.0000	0.0000	0.0000	10.9195	-0.0000
<b>12</b>		Generator	13.80	0.00	LL	576	0.2933	-90.0000	24101.7411	-174.2896	24101.7703	5.7111	0.0000	0.0000
<b>13</b>		Generator	13.80	0.00	LLG	576	0.2962	-98.1159	24104.4054	-174.2903	24099.1060	5.7117	5.3970	-180.0000
<b>14</b>	L2a	Line	13.80	0.00	LLL	15	640.6115	-80.7739	640.6115	159.2261	640.6115	39.2261	0.0000	0.0000
<b>15</b>		Line	13.80	0.00	LG	0.0	0.1673	0.0000	0.0837	0.0000	0.0000	0.0000	180.0000	0.0000
<b>16</b>		Line	13.80	0.00	LL	13	0.0000	0.0000	554.7916	-170.7702	554.7916	9.2298	0.0000	0.0000
<b>17</b>		Line	13.80	0.00	LLG	13	0.0418	0.0000	554.8065	-170.7742	554.7652	9.2264	0.0000	0.0000
<b>18</b>	L52	Line	13.80	0.00	LLL	11	475.7849	-80.8593	475.7849	159.1070	475.7849	39.1070	0.0000	0.0000
<b>19</b>		Line	13.80	0.00	LG	0.0	0.0837	0.0000	0.0418	0.0000	0.0000	0.0418	180.0000	0.0000
<b>20</b>		Line	13.80	0.00	LL	9.8	0.0000	0.0000	412.0060	-170.6922	412.0060	9.1078	0.0000	0.0000
<b>21</b>		Line	13.80	0.00	LLG	9.8	0.0418	0.0000	412.0324	-170.8877	411.9911	9.1132	0.0000	0.0000

### *Voltage:*

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]
1	Faulted Bus ->										
2											
3	B2		13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	B2		13.80	0.00	LG	0.0001	90.0301	1.9050	-150.0098	1.9054	149.9890
5	B2		13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
6	B2		13.80	0.00	LLG	1.6500	0.0000	0.0000	0.0000	0.0000	0.0000
7											
8	First Ring Contributions										
9											
10	L32 (@ Bus : B2)	Line	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11		Line	13.80	0.00	LG	0.0001	90.0301	1.9050	-150.0098	1.9054	149.9890
12		Line	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
13		Line	13.80	0.00	LLG	1.6500	0.0000	0.0000	0.0000	0.0000	0.0000
14	L52 (@ Bus : B2)	Line	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15		Line	13.80	0.00	LG	0.0001	90.0301	1.9050	-150.0098	1.9054	149.9890
16		Line	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
17		Line	13.80	0.00	LLG	1.6500	0.0000	0.0000	0.0000	0.0000	0.0000

### **Bus-3:**

*Current:*

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
1	Faulted Bus ->													
2														
3	B3		13.80	0.00	LLL	168	7017.0195	-82.0923	7017.0195	157.9077	7017.0195	37.9077	0.0000	0.0000
4	B3		13.80	0.00	LG	0.3	10.8943	0.0000	0.0000	0.0000	0.0000	0.0000	10.8943	0.0000
5	B2		13.80	0.00	LL	145	0.0002	180.0000	6076.9131	-172.0923	6076.9133	7.9077	0.0000	0.0000
6	B3		13.80	0.00	LLG	145	3.6341	-0.0766	6076.0184	-172.0911	6077.6150	7.9065	5.4472	0.0000
7														
8	First Ring Contributions													
9														
10	TF1	Fixed-Tap Xmer	13.80	0.00	LLL	151	6316.1682	-82.2529	6316.1682	157.7471	6316.1682	37.7471	0.0000	0.0000
11		Fixed-Tap Xmer	13.80	0.00	LG	0.2	6.5271	-0.7345	3.2636	179.2655	3.2636	179.2655	0.0000	0.0000
12		Fixed-Tap Xmer	13.80	0.00	LL	131	0.0000	0.0000	5469.9310	-172.2525	5469.9310	7.7475	0.0000	0.0000
13		Fixed-Tap Xmer	13.80	0.00	LLG	131	1.6322	-1.4708	5470.7677	-172.2543	5469.1566	7.7485	0.0000	0.0000
14	L32	Line	13.80	0.00	LLL	17	701.0989	-80.6450	701.0989	159.3550	701.0989	39.3550	0.0000	0.0000
15		Line	13.80	0.00	LG	0.1	4.3929	0.0000	3.2633	0.0000	3.2633	0.0000	10.9195	0.0000
16		Line	13.80	0.00	LL	15	0.0000	0.0000	607.2052	-170.6456	607.2052	9.3544	0.0000	0.0000
17		Line	13.80	0.00	LLG	15	1.6316	180.0000	609.0629	-170.6744	605.3476	9.3834	5.3970	180.0000

### **Voltage:**

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]
<b>1</b>	<b>Faulted Bus -&gt;</b>										
<b>2</b>											
<b>3</b>	B3		13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>4</b>	B3		13.80	0.00	LG	0.0001	-90.0326	1.9042	-150.0406	1.9059	149.9521
<b>5</b>	B3		13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>6</b>	B3		13.80	0.00	LLG	1.6499	-0.0104	0.0000	0.0000	0.0000	0.0000
<b>7</b>											
<b>8</b>	<b>First Ring Contributions</b>										
<b>9</b>											
<b>10</b>	TF1 (@ Bus : B3)	Fixed-Tap Xmer	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>11</b>		Fixed-Tap Xmer	13.80	0.00	LG	0.0001	-90.0326	1.9042	-150.0406	1.9059	149.9521
<b>12</b>		Fixed-Tap Xmer	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>13</b>		Fixed-Tap Xmer	13.80	0.00	LLG	1.6499	-0.0104	0.0000	0.0000	0.0000	0.0000
<b>14</b>	L32 (@ Bus : B3)	Line	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>15</b>		Line	13.80	0.00	LG	0.0001	-90.0326	1.9042	-150.0406	1.9059	149.9521
<b>16</b>		Line	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>17</b>		Line	13.80	0.00	LLG	1.6499	-0.0104	0.0000	0.0000	0.0000	0.0000

## Bus-4:

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***Current:***

ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]	
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
<b>3</b>	B4	69.00	0.00	LLL	200	1671.1512	-81.4502	1671.1512	158.5498	1671.1512	38.5498	0.0000	0.0000	
<b>4</b>	B4	69.00	0.00	LG	272	2277.5438	-81.7120	0.0000	0.0000	0.0000	0.0000	0.0000	2277.5438	
<b>5</b>	B4	69.00	0.00	LL	173	0.0000	180.0000	1447.2594	-171.4502	1447.2594	8.5498	0.0000	0.0000	
<b>6</b>	B4	69.00	0.00	LLG	277	0.0012	-173.7798	2283.5081	137.0532	2315.7773	59.0536	3574.3854	97.7279	
<b>7</b>														
<b>8 First Ring Contributions</b>														
<b>9</b>														
<b>10</b>	TF1	Fixed-Tap Xmer	69.00	0.00	LLL	16	137.4651	-80.7492	137.4651	159.2508	137.4651	39.2508	0.0000	0.0000
<b>11</b>		Fixed-Tap Xmer	69.00	0.00	LG	93	779.2175	-82.7651	591.9792	-83.3198	591.9792	-83.3198	1963.1538	-83.0996
<b>12</b>		Fixed-Tap Xmer	69.00	0.00	LL	14	0.0000	0.0000	119.0543	-170.7532	119.0543	9.2468	0.0000	0.0000
<b>13</b>		Fixed-Tap Xmer	69.00	0.00	LLG	130	929.0550	96.1198	1076.7074	102.7756	1088.3329	90.1629	3080.9840	96.3401
<b>14</b>	L14	Line	69.00	0.00	LLL	183	153.8955	-81.5128	153.6955	158.4872	153.6955	38.4872	0.0000	0.0000
<b>15</b>		Line	69.00	0.00	LG	179	1496.5363	-81.1643	591.9874	96.6801	591.9874	96.6801	318.5276	-73.1273
<b>16</b>		Line	69.00	0.00	LL	159	0.0000	0.0000	1328.2265	-171.5129	1328.2265	8.4871	0.0000	0.0000
<b>17</b>		Line	69.00	0.00	LLG	182	929.0541	-83.8807	1520.0507	160.5565	1493.8366	36.9417	499.9052	106.3137

Voltage:

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]
1	Faulted Bus ->										
2											
3	B4		69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	B4		69.00	0.00	LG	0.0000	0.0000	0.9713	-98.9357	0.9577	99.0639
5	B4		69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
6	B4		69.00	0.00	LLG	0.4740	2.0310	0.0000	0.0000	0.0000	0.0000
7											
8	First Ring Contributions										
9											
10	TF1 (@ Bus : B4)	Fixed-Tap Xmer	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11		Fixed-Tap Xmer	69.00	0.00	LG	0.0000	0.0000	0.9713	-98.9357	0.9577	99.0639
12		Fixed-Tap Xmer	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
13		Fixed-Tap Xmer	69.00	0.00	LLG	0.4740	2.0310	0.0000	0.0000	0.0000	0.0000
14	L14 (@ Bus : B4)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15		Line	69.00	0.00	LG	0.0000	0.0000	0.9713	-98.9357	0.9577	99.0639
16		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
17		Line	69.00	0.00	LLG	0.4740	2.0310	0.0000	0.0000	0.0000	0.0000

## Bus-5:

Current:

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
<b>3 BS</b>														
3			13.80	0.00	LLL	193	8055.5006	-84.5211	8055.5006	155.4789	8055.5006	35.4789	0.0000	0.0000
4			13.80	0.00	LG	0.3	10.8943	0.0000	0.0000	0.0000	0.0000	0.0000	10.8943	0.0000
5			13.80	0.00	LL	167	0.0068	6.3112	6976.2716	-174.5212	6976.2648	5.4768	0.0000	0.0000
6			13.80	0.00	LLG	167	3.6312	-0.1731	6975.3637	-174.5205	6977.1724	5.4762	5.4472	0.0000
<b>7</b>														
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	TF2	Fixed-Tap Xmer	13.80	0.00	LLL	181	7552.9741	-84.7809	7552.9741	155.2191	7552.9741	35.2191	0.0000	0.0000
11		Fixed-Tap Xmer	13.80	0.00	LG	0.2	6.7781	-0.7073	3.3891	179.2927	3.3891	179.2927	0.0000	0.0000
12		Fixed-Tap Xmer	13.80	0.00	LL	156	0.0000	0.0000	6541.1036	-174.7810	6541.1036	5.2190	0.0000	0.0000
13		Fixed-Tap Xmer	13.80	0.00	LLG	156	1.6740	-1.4340	6541.8988	-174.7818	6540.2361	5.2199	0.0000	0.0000
14	L52	Line	13.80	0.00	LLL	12	503.7559	-80.6222	503.7559	159.3778	503.7559	39.3778	0.0000	0.0000
15		Line	13.80	0.00	LG	0.1	4.0562	0.0000	3.4306	0.0000	3.4306	0.0000	10.9195	0.0000
16		Line	13.80	0.00	LL	10	0.0000	436.2654	436.2654	9.3778	0.0000	0.0000	0.0000	0.0000
17		Line	13.80	0.00	LLG	10	1.7153	180.0000	438.0817	-170.6614	434.4492	9.4174	5.3970	180.0000

Voltage:

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]			
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
<b>3 BS</b>														
3			13.80	0.00	LLL		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4			13.80	0.00	LG		0.0000	0.0000	1.9044	-150.0368	1.9059	149.9587		
5			13.80	0.00	LL		1.1000	0.0000	0.5500	180.0000	0.5500	180.0000		
6			13.80	0.00	LLG		1.6500	-0.0104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	TF2 (@ Bus - BS)	Fixed-Tap Xmer	13.80	0.00	LLL		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11		Fixed-Tap Xmer	13.80	0.00	LG		0.0000	0.0000	1.9044	-150.0368	1.9059	149.9587		
12		Fixed-Tap Xmer	13.80	0.00	LL		1.1000	0.0000	0.5500	180.0000	0.5500	180.0000		
13		Fixed-Tap Xmer	13.80	0.00	LLG		1.6500	-0.0104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14	L52 (@ Bus - BS)	Line	13.80	0.00	LLL		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15		Line	13.80	0.00	LG		0.0000	0.0000	1.9044	-150.0368	1.9059	149.9587		
16		Line	13.80	0.00	LL		1.1000	0.0000	0.5500	180.0000	0.5500	180.0000		
17		Line	13.80	0.00	LLG		1.6500	-0.0104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

## Bus-6:

Current:

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
<b>3 BS</b>														
3			69.00	0.00	LLL	331	2770.6955	-82.1772	2770.6955	157.8228	2770.6955	37.8228	0.0000	0.0000
4			69.00	0.00	LG	386	3228.3968	-82.5184	0.0000	0.0000	0.0000	0.0000	3228.3568	-82.5184
5			69.00	0.00	LL	287	0.0001	180.0000	2399.4926	-172.1772	2399.4927	7.8228	0.0000	0.0000
6			69.00	0.00	LLG	371	0.0012	-170.4399	3059.9692	148.6406	3102.9293	46.3613	3866.8987	97.0053
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	TF2	Fixed-Tap Xmer	69.00	0.00	LLL	12	97.6727	-80.8661	97.6727	159.1339	97.6727	39.1339	0.0000	0.0000
11		Fixed-Tap Xmer	69.00	0.00	LG	101	848.9703	-86.3954	735.7133	-87.1969	735.7133	-87.1969	2320.3443	-86.9036
12		Fixed-Tap Xmer	69.00	0.00	LL	10	0.0000	0.0000	84.5810	-170.8605	84.5810	9.1395	0.0000	0.0000
13		Fixed-Tap Xmer	69.00	0.00	LLG	115	881.2279	92.3275	943.3932	97.8867	962.1113	87.7439	2779.2832	92.6204
14	L16	Line	69.00	0.00	LLL	319	2673.0541	-82.2261	2673.0541	157.7749	2673.0541	37.7749	0.0000	0.0000
15		Line	69.00	0.00	LG	285	2382.0121	-81.1374	735.7050	92.8632	735.7050	92.8032	931.8587	-71.5426
16		Line	69.00	0.00	LL	277	0.0000	0.0000	2314.9317	-172.2253	2314.9317	7.7747	0.0000	0.0000
17		Line	69.00	0.00	LLG	307	881.2276	-87.6731	2569.4682	165.1641	2464.5242	31.4052	1116.1587	107.9806

Voltage:

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]			
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
<b>3 BS</b>														
3			69.00	0.00	LLL		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4			69.00	0.00	LG		0.0001	-90.0171	1.0284	-110.9859	1.0143	111.2934		
5			69.00	0.00	LL		1.1000	0.0000	0.5500	180.0000	0.5500	180.0000		
6			69.00	0.00	LLG		0.8825	0.7206	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	TF2 (@ Bus - BS)	Fixed-Tap Xmer	69.00	0.00	LLL		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11		Fixed-Tap Xmer	69.00	0.00	LG		0.0001	-90.0171	1.0284	-110.9859	1.0143	111.2934		
12		Fixed-Tap Xmer	69.00	0.00	LL		1.1000	0.0000	0.5500	180.0000	0.5500	180.0000		
13		Fixed-Tap Xmer	69.00	0.00	LLG		0.8825	0.7206	0.0000					

BUS-1:

$$V_B = 69 \text{ kV}$$

$$I_{L1-4}(\text{min}) = 0.10897 \text{ kA}$$

$$I_{B21-4} = \sqrt{3} \times 69 \times 0.10897 = 13.026 \text{ mVA}$$

Again,  $I_{L1G}(\text{min}) = 80.9335 \text{ A}$

$$I_{B21G} = \sqrt{3} \times 69 \times 80.9335 \times 10^{-3} = 9.672 \text{ mVA}$$

$$I_{G11} = 2220.7017 \text{ A}$$

$$I_{BG1} = \sqrt{3} \times 69 \times I_{G11} = 265.4 \text{ mA}$$

BUS-2:

$$V = 13.8 \text{ kV}$$

$$\text{minimum current} = 10.9195 \text{ A} [\text{L-G fault}]$$

1st ring current:

generator-2:

$$\text{minimum current} = 10.6884 \text{ A} [\text{L-G fault}]$$

$$I_{B \text{ rating}} = \sqrt{3} \times 13.8 \times 10^3 \\ = 0.255 \text{ mVA}$$

L52:

$$\text{minimum current} = 0.0837 \text{ A} [\text{L-G fault}]$$

$$I_{B \text{ rating}} = \sqrt{3} \times 13.8 \times 10^3 \\ = 2.0067 \times 10^3 \text{ mVA}$$

L32:

$$\text{minimum current} = 0.1673 \text{ A} [\text{L-G fault}]$$

$$I_{B \text{ rating}} = \sqrt{3} \times 13.8 \times 0.1673 \times 10^3 \\ = 3.90 \times 10^{-4} \text{ mVA}$$

BUS-3:

$$\text{minimum current} = 10.8043 \text{ A} [\text{LG fault}]$$

1st ring contribution:

$$\text{TRF-1: minimum current} = 6.5271 \text{ A} [\text{LG fault}]$$

$$I_{B \text{ rating}} = \sqrt{3} \times 13.8 \times 6.527 \times 10^3 \\ = 0.156 \text{ mVA}$$

L35: minimum current = 4.3929 A [LG fault]

$$I_{B \text{ rating}} = \sqrt{3} \times 13.8 \times 4.3929 \times 10^3 \\ = 0.105 \text{ mVA}$$

BUS-4:

$$\text{minimum current} = 1447.2394 \text{ A} [\text{LL fault}] \quad V = 69 \text{ kV}$$

1st ring contribution:

$$\text{TRF-1: } I_{B \text{ rating}} = \sqrt{3} \times 69 \times 119.0543 \times 10^{-3} \\ = 14.228 \text{ mVA}$$

$$\text{minimum current} = 119.0543 \text{ A} [\text{LL fault}]$$

L14:

$$\text{minimum current} = 1328.7265 \text{ A} [\text{LL fault}]$$

$$I_{B \text{ rating}} = \sqrt{3} \times 69 \times 1328.7265 \times 10^{-3} \text{ mVA} \\ = 158.736 \text{ mVA}$$

BUS-5:

$$V = 13.8 \text{ kV}$$

$$\text{minimum current} = 10.8043 \text{ A} [\text{LG fault}]$$

1st ring contribution:

$$\text{minimum current} = 10.8043 \text{ A} [\text{LG fault}]$$

$$I_{B \text{ rating}} = \sqrt{3} \times 13.8 \times 6.778 \times 10^{-3} \text{ mVA} \\ = 0.16201 \text{ mVA}$$

L52:

$$\text{minimum current} = 10.8043 \text{ A} [\text{LG fault}]$$

$$I_{B \text{ rating}} = \sqrt{3} \times 13.8 \times 4.6582 \times 10^{-3} \text{ mVA} \\ = 0.097 \text{ mVA}$$

BUS-6:

$$V = 69 \text{ kV}$$

$$\text{minimum current} = 2399.4926 \text{ A} [\text{LL fault}]$$

1st ring contribution:

$$\text{TRF-2: minimum current} = 84.5810 \text{ A} [\text{LL fault}]$$

2nd ring contribution:

L16: minimum current = 2314.9317 A [LL fault]

$$I_{B \text{ rating}} = \sqrt{3} \times 69 \times 2314.9317 \text{ mVA} \\ = 276.66 \text{ mVA}$$

## Line 1-4:

### Current:

Length 5%:

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
3	L14FL		69.00	0.00	LLL	973	8137.8834	-85.5534	8137.8834	154.4466	8137.8834	34.4466	0.0000	0.0000
4	L14FL		69.00	0.00	LG	724	6058.4048	-81.3207	0.0000	0.0000	0.0000	0.0000	6058.4048	-81.3207
5	L14FL		69.00	0.00	LL	842	0.0002	180.0000	7047.6144	-175.5534	7047.6145	4.4466	0.0000	0.0000
6	L14FL		69.00	0.00	LLG	921	0.0015	164.1886	7709.5935	-166.3880	7175.1188	23.9025	4812.9925	101.1811
7														
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	L14	Line	69.00	0.00	LLL	957	8011.5646	-85.6288	8011.5645	154.3712	8011.5645	34.3712	0.0000	0.0000
11		Line	69.00	0.00	LG	597	4995.5714	-82.0096	970.5535	101.7627	970.5535	101.7636	3061.3338	-84.4008
12		Line	69.00	0.00	LL	829	0.0000	0.0000	6938.2247	-175.6268	6938.2247	4.3712	0.0000	0.0000
13		Line	69.00	0.00	LLG	868	771.0410	-75.7350	7260.5255	171.6953	6977.2115	17.5710	2432.0205	98.1011
14	L14RL	Line	69.00	0.00	LLL	15	126.7633	-80.7814	126.7633	159.2186	126.7633	39.2186	0.0000	0.0000
15		Line	69.00	0.00	LG	127	1064.8769	-78.0869	970.5492	-78.2373	970.5492	-78.2373	3005.9730	-78.1840
16		Line	69.00	0.00	LL	13	0.0000	0.0000	109.7814	-170.7777	109.7814	9.2223	0.0000	0.0000
17		Line	69.00	0.00	LLG	99	771.0328	104.2652	825.5868	111.9541	806.1513	96.5482	2388.0482	104.3182

Length 50%:

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
3	L14FL		69.00	0.00	LLL	335	2803.0203	-82.1648	2803.0203	157.8352	2803.0203	37.8352	0.0000	0.0000
4	L14FL		69.00	0.00	LG	384	3211.0715	-80.8783	0.0000	0.0000	0.0000	0.0000	3211.0715	-80.8783
5	L14FL		69.00	0.00	LL	290	0.0001	180.0000	2427.4868	-172.1648	2427.4868	7.8352	0.0000	0.0000
6	L14FL		69.00	0.00	LLG	376	0.0018	-7.9618	3145.9149	151.2502	2989.8794	46.6731	3755.2013	100.8454
7														
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	L14	Line	69.00	0.00	LLL	319	2670.9090	-82.2344	2670.9090	157.7656	2670.9090	37.7656	0.0000	0.0000
11		Line	69.00	0.00	LG	286	2394.1914	-81.0505	665.5566	99.4203	665.5566	99.4203	1063.1794	-81.6399
12		Line	69.00	0.00	LL	276	0.0000	0.0000	2313.0813	-172.2346	2313.0813	7.7654	0.0000	0.0000
13		Line	69.00	0.00	LLG	307	778.3337	-78.8583	2567.9757	164.6133	2479.8395	31.7915	1243.3671	100.0844
14	L14RL	Line	69.00	0.00	LLL	16	132.1554	-80.7586	132.1554	159.2434	132.1554	39.2434	0.0000	0.0000
15		Line	69.00	0.00	LG	98	816.9133	-80.3742	665.5566	-80.5797	665.5566	-80.5797	2148.0234	-80.5016
16		Line	69.00	0.00	LL	14	0.0000	0.0000	114.4416	-170.7596	114.4416	9.2404	0.0000	0.0000
17		Line	69.00	0.00	LLG	105	778.3354	101.1443	878.3392	108.7397	870.3657	93.7068	2512.0137	101.2226

Length 95%:

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
3	L14FL		69.00	0.00	LLL	208	1738.8241	-81.4927	1738.8241	158.5073	1738.8241	38.5073	0.0000	0.0000
4	L14FL		69.00	0.00	LG	279	2336.6897	-81.5986	0.0000	0.0000	0.0000	0.0000	2336.6897	-81.5986
5	L14FL		69.00	0.00	LL	180	0.0000	180.0000	1505.8651	-171.4927	1505.8652	8.5073	0.0000	0.0000
6	L14FL		69.00	0.00	LLG	279	0.0011	3.8785	2325.4554	138.5413	2338.4125	58.0967	3561.0815	98.1844
7														
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	L14	Line	69.00	0.00	LLL	191	1601.9063	-81.5581	1601.9063	158.4439	1601.9063	38.4439	0.0000	0.0000
11		Line	69.00	0.00	LG	186	1557.9174	-81.1313	595.0248	96.9485	595.0248	96.9485	370.6871	-74.9559
12		Line	69.00	0.00	LL	166	0.0000	0.0000	1387.2987	-171.5562	1387.2987	8.4438	0.0000	0.0000
13		Line	69.00	0.00	LLG	189	906.8169	-83.2687	1585.2618	160.8657	1553.6998	36.6316	564.9085	104.8273
14	L14RL	Line	69.00	0.00	LLL	16	136.9301	-80.7518	136.9301	159.2482	136.9301	39.2482	0.0000	0.0000
15		Line	69.00	0.00	LG	93	778.9248	-82.5327	595.0247	-83.0515	595.0247	-83.0515	1968.9550	-82.8463
16		Line	69.00	0.00	LL	14	0.0000	0.0000	118.5849	-170.7518	118.5849	9.2482	0.0000	0.0000
17		Line	69.00	0.00	LLG	126	906.8086	96.7314	1049.0475	103.5114	1058.1868	90.5962	3000.6651	96.9367

### Voltage:

Length 5%:

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]	In	In	[deg]
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
3	L14FL		69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	L14FL		69.00	0.00	LG	0.0001	90.5464	1.2209	-133.0447	1.3117	129.4407			
5	L14FL		69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000			
6	L14FL		69.00	0.00	LLG	1.3275	-1.6446	0.0000	0.0000	0.0000	0.0000			
7														
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	L14 (@ Bus : L14FL)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11		Line	69.00	0.00	LG	0.0001	90.5464	1.2209	-133.0447	1.3117	129.4407			
12		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000			
13		Line	69.00	0.00	LLG	1.3275	-1.6446	0.0000	0.0000	0.0000	0.0000			
14	L14RL (@ Bus : L14FL)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000					

Length 50%:

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]
<b>1</b>	<b>Faulted Bus -&gt;</b>										
<b>2</b>											
<b>3</b>	L14FL		69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>4</b>	L14FL		69.00	0.00	LG	0.0001	90.0171	1.0033	-112.8859	1.0557	111.6912
<b>5</b>	L14FL		69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>6</b>	L14FL		69.00	0.00	LLG	0.9150	-2.4240	0.0000	0.0000	0.0000	0.0000
<b>7</b>											
<b>8</b>	<b>First Ring Contributions</b>										
<b>9</b>											
<b>10</b>	L14 (@ Bus : L14FL)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>11</b>		Line	69.00	0.00	LG	0.0001	90.0171	1.0033	-112.8859	1.0557	111.6912
<b>12</b>		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>13</b>		Line	69.00	0.00	LLG	0.9150	-2.4240	0.0000	0.0000	0.0000	0.0000
<b>14</b>	L14RL (@ Bus : L14FL)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>15</b>		Line	69.00	0.00	LG	0.0001	90.0171	1.0033	-112.8859	1.0557	111.6912
<b>16</b>		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>17</b>		Line	69.00	0.00	LLG	0.9150	-2.4240	0.0000	0.0000	0.0000	0.0000

Length 95%:

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]
<b>1</b>	<b>Faulted Bus -&gt;</b>										
<b>2</b>											
<b>3</b>	L14FL		69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>4</b>	L14FL		69.00	0.00	LG	0.0000	0.0000	0.9707	-100.1939	0.9653	100.2506
<b>5</b>	L14FL		69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>6</b>	L14FL		69.00	0.00	LLG	0.5237	0.6893	0.0000	0.0000	0.0000	0.0000
<b>7</b>											
<b>8</b>	<b>First Ring Contributions</b>										
<b>9</b>											
<b>10</b>	L14 (@ Bus : L14FL)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>11</b>		Line	69.00	0.00	LG	0.0000	0.0000	0.9707	-100.1939	0.9653	100.2506
<b>12</b>		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>13</b>		Line	69.00	0.00	LLG	0.5237	0.6893	0.0000	0.0000	0.0000	0.0000
<b>14</b>	L14RL (@ Bus : L14FL)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>15</b>		Line	69.00	0.00	LG	0.0000	0.0000	0.9707	-100.1939	0.9653	100.2506
<b>16</b>		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>17</b>		Line	69.00	0.00	LLG	0.5237	0.6893	0.0000	0.0000	0.0000	0.0000

## Line 1-6:

Current:

Length 50%:

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1</b>	<b>Faulted Bus -&gt;</b>													
<b>2</b>														
<b>3</b>	L16FL		69.00	0.00	LLL	1091	9127.2869	-86.1892	9127.2869	153.8108	9127.2869	33.8108	0.0000	0.0000
<b>4</b>	L16FL		69.00	0.00	LG	767	6414.6405	-81.6076	0.0000	0.0000	0.0000	0.0000	6414.6405	-81.6076
<b>5</b>	L16FL		69.00	0.00	LL	945	0.0002	180.0000	7904.4622	-176.1892	7904.4624	3.8108	0.0000	0.0000
<b>6</b>	L16FL		69.00	0.00	LLG	1024	0.0024	-9.5110	8564.4352	167.2074	7985.8007	21.8562	4931.8363	100.8661
<b>7</b>														
<b>8</b>	<b>First Ring Contributions</b>													
<b>9</b>														
<b>10</b>	L16	Line	69.00	0.00	LLL	1080	9033.8492	-86.2441	9033.8492	153.7559	9033.8492	33.7559	0.0000	0.0000
<b>11</b>		Line	69.00	0.00	LG	625	5230.5056	-80.9273	1120.9095	94.9049	1120.9095	94.9049	2999.0441	-77.8131
<b>12</b>		Line	69.00	0.00	LL	935	0.0000	0.0000	7823.5429	-176.2441	7823.5429	3.7559	0.0000	0.0000
<b>13</b>		Line	69.00	0.00	LLG	982	861.8080	-82.6210	8218.6902	172.7992	7737.5409	15.4033	2305.7772	104.6606
<b>14</b>	L16RL	Line	69.00	0.00	LLL	11	93.841	-80.8988	93.8419	159.1012	93.8419	39.1012	0.0000	0.0000
<b>15</b>		Line	69.00	0.00	LG	142	1186.1383	-84.6083	1120.9094	-85.0951	1120.9094	-85.0951	3427.8291	-84.9267
<b>16</b>		Line	69.00	0.00	LL	9.7	0.0000	0.0000	81.2695	-170.8988	81.2695	9.1012	0.0000	0.0000
<b>17</b>		Line	69.00	0.00	LLG	107	861.7987	97.3785	888.4939	102.8748	892.6540	92.4066	2635.5142	97.5467

Length 50%:

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1</b>	<b>Faulted Bus -&gt;</b>													
<b>2</b>														
<b>3</b>	L16FL		69.00	0.00	LLL	519	4344.7589	-83.1676	4344.7589	156.8324	4344.7589	36.8324	0.0000	0.0000
<b>4</b>	L16FL		69.00	0.00	LG	514	4300.5137	-81.9433	0.0000	0.0000	0.0000	0.0000	4300.5137	-81.9433
<b>5</b>	L16FL		69.00	0.00	LL	450	0.0001	180.0000	3762.6709	-173.1676	3762.6710	6.8324	0.0000	0.0000
<b>6</b>	L16FL		69.00	0.00	LLG	526	0.0008	46.8476	4400.1724	157.9442	4243.5332	36.8944	4255.2771	99.2557
<b>7</b>														
<b>8</b>	<b>First Ring Contributions</b>													
<b>9</b>														
<b>10</b>	L16	Line	69.00	0.00	LLL	508	4248.8196	-83.2193	4248.8195	156.7807	4248.8195	36.7807	0.0000	0.0000
<b>11</b>		Line	69.00	0.00	LG	400	3348.5917	-80.9487	859.7007	93.9262	859.7007	93.9262	1643.2583	-75.5855
<b>12</b>		Line	69.00	0.00	LL	440	0.0002	96.0000	3679.5860	-173.2192	3679.5850	6.7807	0.0000	0.0000
<b>13</b>		Line	69.00	0.00	LLG	476	850.6585	-84.8747	3986.1634	168.8305	3772.6577	25.7846	1625.9760	105.6137
<b>14</b>	L16RL	Line	69.00	0.00	LLL	11	96.0166	-80.8792	96.0166	159.1208	96.0166	39.1208	0.0000	0.0000
<b>15</b>		Line	69.00	0.00	LG	114	954.2149	-85.4357	859.7008	-86.0738	859.7008	-86.0738	2673.5784	-85.8461
<b>16</b>		Line	69.00	0.00	LL	9.9	0.0000	0.0000	83.1517	-170.8841	83.1517	9.1159	0.0000	0.0000
<b>17</b>		Line	69.00	0.00	LLG	108	850.6861	95.1247	895.9507	100.7749	906.5081	90.2083	2645.4577	95.3526

**Length 95%:**

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
3	L16FL		69.00	0.00	LLL	519	4344.7589	-83.1676	4344.7589	156.8324	4344.7589	36.8324	0.0000	0.0000
4	L16FL		69.00	0.00	LG	514	4300.5137	-81.9433	0.0000	0.0000	0.0000	0.0000	4300.5137	-81.9433
5	L16FL		69.00	0.00	LL	450	0.0001	180.0000	3762.6709	-173.1676	3762.6710	6.8324	0.0000	0.0000
6	L16FL		69.00	0.00	LLG	526	0.0008	46.8476	4400.1724	157.9442	4243.5332	36.8944	4255.2771	99.2557
7														
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	L16	Line	69.00	0.00	LLL	508	4248.8196	-83.2193	4248.8195	156.7807	4248.8195	36.7807	0.0000	0.0000
11		Line	69.00	0.00	LG	400	3348.5917	-80.9487	859.7007	93.9262	859.7007	93.9262	1643.2583	-75.5855
12		Line	69.00	0.00	LL	440	0.0082	96.0000	3679.5860	-173.2192	3679.5850	6.7807	0.0000	0.0000
13		Line	69.00	0.00	LLG	476	850.6585	-84.8747	3986.1638	168.8305	3772.6577	25.7846	1625.9760	105.6137
14	L16RL	Line	69.00	0.00	LLL	11	96.0166	-80.8792	96.0166	159.1206	96.0166	39.1206	0.0000	0.0000
15		Line	69.00	0.00	LG	114	954.2149	-85.4357	859.7008	-86.0738	859.7008	-86.0738	2673.5784	-85.8461
16		Line	69.00	0.00	LL	9.9	0.0000	0.0000	83.1517	-170.8841	83.1517	9.1159	0.0000	0.0000
17		Line	69.00	0.00	LLG	108	850.6661	95.1247	895.9507	100.7749	906.5081	90.2083	2645.4577	95.3526

**Voltage:**

**Length 5%:**

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]
<b>1 Faulted Bus -&gt;</b>											
<b>2</b>											
3	L16FL		69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	L16FL		69.00	0.00	LG	0.0000	0.0000	1.2518	-134.6299	1.3425	130.9215
5	L16FL		69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
6	L16FL		69.00	0.00	LLG	1.3556	-1.5472	0.0000	0.0000	0.0000	0.0000
7											
<b>8 First Ring Contributions</b>											
<b>9</b>											
10	L16 (@ Bus : L16FL)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11		Line	69.00	0.00	LG	0.0000	0.0000	1.2518	-134.6299	1.3425	130.9215
12		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
13		Line	69.00	0.00	LLG	1.3556	-1.5472	0.0000	0.0000	0.0000	0.0000
14	L16RL (@ Bus : L16FL)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15		Line	69.00	0.00	LG	0.0000	0.0000	1.2518	-134.6299	1.3425	130.9215
16		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
17		Line	69.00	0.00	LLG	1.3556	-1.5472	0.0000	0.0000	0.0000	0.0000

**Length 50%:**

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]
<b>1 Faulted Bus -&gt;</b>											
<b>2</b>											
3	L16FL		69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	L16FL		69.00	0.00	LG	0.0001	-90.0000	1.0858	-121.1381	1.1259	119.9118
5	L16FL		69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
6	L16FL		69.00	0.00	LLG	1.1120	-1.1748	0.0000	0.0000	0.0000	0.0000
7											
<b>8 First Ring Contributions</b>											
<b>9</b>											
10	L16 (@ Bus : L16FL)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11		Line	69.00	0.00	LG	0.0001	-90.0000	1.0858	-121.1381	1.1259	119.9118
12		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
13		Line	69.00	0.00	LLG	1.1120	-1.1748	0.0000	0.0000	0.0000	0.0000
14	L16RL (@ Bus : L16FL)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15		Line	69.00	0.00	LG	0.0001	90.0000	1.0858	-121.1381	1.1259	119.9118
16		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
17		Line	69.00	0.00	LLG	1.1120	-1.1748	0.0000	0.0000	0.0000	0.0000

**Length 95%:**

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]
<b>1 Faulted Bus -&gt;</b>											
<b>2</b>											
3	L16FL		69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	L16FL		69.00	0.00	LG	0.0001	90.0000	1.0315	-111.8640	1.0228	112.0601
5	L16FL		69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
6	L16FL		69.00	0.00	LLG	0.9048	0.4180	0.0000	0.0000	0.0000	0.0000
7											
<b>8 First Ring Contributions</b>											
<b>9</b>											
10	L16 (@ Bus : L16FL)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11		Line	69.00	0.00	LG	0.0001	90.0000	1.0315	-111.8640	1.0228	112.0601
12		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
13		Line	69.00	0.00	LLG	0.9048	0.4180	0.0000	0.0000	0.0000	0.0000
14	L16RL (@ Bus : L16FL)	Line	69.00	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15		Line	69.00	0.00	LG	0.0001	90.0000	1.0315	-111.8640	1.0228	112.0601
16		Line	69.00	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
17		Line	69.00	0.00	LLG	0.9048	0.4180	0.0000	0.0000	0.0000	0.0000

### Line 3-2:

**Current:**

### Length 5%:

Length 50%:

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
<b>3</b>	L32FL		13.80	0.00	LLL	61	2543.4456	-80.7847	2543.4456	159.2153	2543.4456	39.2153	0.0000	0.0000
<b>4</b>	L32FL		13.80	0.00	LG	0.3	10.9069	0.0000	0.0000	0.0000	0.0000	0.0000	10.9069	0.0000
<b>5</b>	L32FL		13.80	0.00	LL	53	0.0021	6.7098	2202.6895	-170.7847	2202.6874	9.2153	0.0000	0.0000
<b>6</b>	L32FL		13.80	0.00	LLG	53	3.6351	-0.0236	2201.7935	-170.7810	2203.5825	9.2115	5.4472	0.0000
<b>7</b>														
<b>8 First Ring Contributions</b>														
<b>9</b>														
<b>10</b>	L32	Line	13.80	0.00	LLL	28	1172.8133	-80.8599	1172.8133	159.1401	1172.8133	39.1401	0.0000	0.0000
<b>11</b>		Line	13.80	0.00	LG	0.1	3.3470	0.0000	1.6735	180.0000	1.6735	180.0000	0.0000	0.0000
<b>12</b>		Line	13.80	0.00	LL	24	0.0000	0.0000	1015.6447	-170.8616	1015.6447	9.1384	0.0000	0.0000
<b>13</b>		Line	13.80	0.00	LLG	24	0.8367	0.0000	1016.0577	-170.8654	1015.2316	9.1421	0.0000	0.0000
<b>14</b>	L32RL	Line	13.80	0.00	LLL	33	1370.6530	-88.7202	1370.6530	159.2798	1370.6530	39.2798	0.0000	0.0000
<b>15</b>		Line	13.80	0.00	LG	0.2	7.5725	0.0000	1.6735	0.0000	1.6735	0.0000	10.9195	0.0000
<b>16</b>		Line	13.80	0.00	LL	28	0.0000	0.0000	1186.9904	-170.7182	1186.9904	9.2818	0.0000	0.0000
<b>17</b>		Line	13.80	0.00	LLG	28	0.8367	180.0000	1189.2349	-170.7377	1184.7344	9.2978	5.3970	180.0000

Length 95%:

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
3	L32FL		13.80	0.00	LLL	244	10225.8736	-81.7167	10225.8736	158.2833	10225.8738	38.2833	0.0000	0.0000
4	L32FL		13.80	0.00	LG	0.3	10.9195	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	10.9195
5	L32FL		13.80	0.00	LL	212	0.0002	180.0000	8855.8897	-171.7167	8855.8899	8.2833	0.0000	0.0000
6	L32FL		13.80	0.00	LLG	212	3.6417	-0.0235	8854.9662	-171.7159	8856.7655	8.2825	5.4597	0.0000
7														
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	L32	Line	13.80	0.00	LLL	16	674.9454	-80.7508	674.9454	159.2492	674.9454	39.2492	0.0000	0.0000
11		Line	13.80	0.00	LG	0	0.5020	0.0000	0.2510	180.0000	0.2510	180.0000	0.0000	0.0000
12		Line	13.80	0.00	LL	14	0.0000	0.0000	584.5615	-170.7479	584.5615	9.2521	0.0000	0.0000
13		Line	13.80	0.00	LLG	14	0.1255	0.0000	584.6176	-170.7523	584.4937	9.2496	0.0000	0.0000
14	L32RL	Line	13.80	0.00	LLL	228	9551.0270	-81.7850	9551.0269	158.2150	9551.0269	38.2150	0.0000	0.0000
15		Line	13.80	0.00	LG	0.2	10.4174	0.0000	0.2510	0.0000	0.2510	0.0000	10.9195	0.0000
16		Line	13.80	0.00	LL	198	0.0000	0.0000	8271.4679	-171.7851	8271.4679	8.2149	0.0000	0.0000
17		Line	13.80	0.00	LLG	198	0.1324	-161.5464	8274.0376	-171.7878	8268.8283	8.2177	5.3970	180.0000

### *Voltage:*

Length 5%:

Length 50%:

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]
<b>1 Faulted Bus -&gt;</b>											
<b>2</b>											
<b>3 L32FL</b>											
<b>4 L32FL</b>											
<b>5 L32FL</b>			13.80	0.00	LL	1.0000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>6 L32FL</b>			13.80	0.00	LLG	1.6498	-0.0417	0.0000	0.0000	0.0000	0.0000
<b>7</b>											
<b>8 First Ring Contributions</b>											
<b>9</b>											
<b>10 L32 (@ Bus : L32FL)</b>	Line	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>11</b>	Line	13.80	0.00	LG	0.0001	-90.0444	1.9022	-150.1109	1.9069	149.8660	
<b>12</b>	Line	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000	
<b>13</b>	Line	13.80	0.00	LLG	1.6498	-0.0417	0.0000	0.0000	0.0000	0.0000	
<b>14 L32RL (@ Bus : L32FL)</b>	Line	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>15</b>	Line	13.80	0.00	LG	0.0001	-90.0444	1.9022	-150.1109	1.9069	149.8660	
<b>16</b>	Line	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000	
<b>17</b>	Line	13.80	0.00	LLG	1.6498	-0.0417	0.0000	0.0000	0.0000	0.0000	0.0000

Length 95%:

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]
<b>1 Faulted Bus -&gt;</b>											
<b>2</b>											
<b>3 L32FL</b>											
<b>4 L32FL</b>											
<b>5 L32FL</b>			13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000
<b>6 L32FL</b>			13.80	0.00	LLG	1.6500	-0.0104	0.0000	0.0000	0.0000	0.0000
<b>7</b>											
<b>8 First Ring Contributions</b>											
<b>9</b>											
<b>10 L32 (@ Bus : L32FL)</b>	Line	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>11</b>	Line	13.80	0.00	LG	0.0000	0.0000	1.9045	-150.0287	1.9057	149.9662	
<b>12</b>	Line	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000	
<b>13</b>	Line	13.80	0.00	LLG	1.6500	-0.0104	0.0000	0.0000	0.0000	0.0000	
<b>14 L32RL (@ Bus : L32FL)</b>	Line	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>15</b>	Line	13.80	0.00	LG	0.0000	0.0000	1.9045	-150.0287	1.9057	149.9662	
<b>16</b>	Line	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000	
<b>17</b>	Line	13.80	0.00	LLG	1.6500	-0.0104	0.0000	0.0000	0.0000	0.0000	0.0000

## Line 5-2:

Current:

Length 5%:

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
<b>3 L52FL</b>														
<b>4 L52FL</b>														
<b>5 L52FL</b>			13.80	0.00	LL	101	0.0001	180.0000	4233.7102	-172.7293	4233.7103	7.2707	0.0000	0.0000
<b>6 L52FL</b>			13.80	0.00	LLG	101	3.6316	-0.1416	4232.8127	-172.7278	4234.6149	7.2692	5.4472	0.0000
<b>7</b>														
<b>8 First Ring Contributions</b>														
<b>9</b>														
<b>10 L52</b>	Line	13.80	0.00	LLL	104	4358.5222	-82.9857	4358.5222	157.2707	4888.6675	37.2707	0.0000	0.0000	0.0000
<b>11</b>	Line	13.80	0.00	LG	0.2	6.4434	-0.7441	3.2217	179.2559	3.2217	179.2559	0.0000	0.0000	0.0000
<b>12</b>	Line	13.80	0.00	LL	90	0.0000	0.0000	3774.6270	-172.9858	3774.6270	7.0142	0.0000	0.0000	0.0000
<b>13</b>	Line	13.80	0.00	LLG	90	1.6322	-1.4708	3775.3937	-172.9881	3773.7794	7.0156	0.0000	0.0000	0.0000
<b>14 L52RL</b>	Line	13.80	0.00	LLL	13	530.5592	-80.6194	530.5592	159.3806	530.5592	39.3806	0.0000	0.0000	0.0000
<b>15</b>	Line	13.80	0.00	LG	0.1	4.3931	-0.5457	3.2636	-0.7345	3.2636	-0.7345	10.9202	-0.6585	
<b>16</b>	Line	13.80	0.00	LL	11	0.0000	0.0000	459.4719	-170.6238	459.4719	9.3762	0.0000	0.0000	0.0000
<b>17</b>	Line	13.80	0.00	LLG	11	1.5688	180.0000	461.3560	-170.6579	457.5998	9.4195	5.3970	180.0000	

Length 50%:

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
<b>3 L52FL</b>														
<b>4 L52FL</b>														
<b>5 L52FL</b>			13.80	0.00	LL	39	0.0000	180.0000	1644.2029	-170.8511	1644.2029	9.1489	0.0000	0.0000
<b>6 L52FL</b>			13.80	0.00	LLG	39	3.6328	-0.1298	1643.3023	-170.8462	1645.0949	9.1440	5.4472	0.0000
<b>7</b>														
<b>8 First Ring Contributions</b>														
<b>9</b>														
<b>10 L52</b>	Line	13.80	0.00	LLL	22	905.6291	-81.0490	905.6291	158.9510	905.6291	38.9510	0.0000	0.0000	0.0000
<b>11</b>	Line	13.80	0.00	LG	0.1	3.4306	0.0000	1.7153	180.0000	1.7153	180.0000	0.0000	0.0000	0.0000
<b>12</b>	Line	13.80	0.00	LL	19	0.0000	0.0000	784.3336	-171.0494	784.3336	8.9506	0.0000	0.0000	0.0000
<b>13</b>	Line	13.80	0.00	LLG	19	0.8786	0.0000	784.7619	-171.0570	783.8940	8.9530	0.0000	0.0000	0.0000
<b>14 L52RL</b>	Line	13.80	0.00	LLL	24	992.9182	-80.6690	992.9182	159.3310	992.9182	39.3310	0.0000	0.0000	0.0000
<b>15</b>	Line	13.80	0.00	LG	0.2	7.4053	-0.3237	1.7577	-1.3639	1.7577	-1.3639	10.9202	-0.6585	
<b>16</b>	Line	13.80	0.00	LL	21	0.0000	0.0000	859.9281	-170.6694	859.9281	9.3306	0.0000	0.0000	0.0000
<b>17</b>	Line	13.80	0.00	LLG	21	0.8786	180.0000	862.1575	-170.6938	857.6969	9.3550	5.3970	180.0000	

### Length 95%:

	ID	Type	Prefault kV	Angle	Fault type	Fault S [MVA]	IL1 [A]	IL1 [deg]	IL2 [A]	IL2 [deg]	IL3 [A]	IL3 [deg]	In [A]	In [deg]
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
3	L52FL		13.80	0.00	LLL	193	8064.6379	-81.4727	8064.6379	158.5273	8064.6379	38.5273	0.0000	0.0000
4	L52FL		13.80	0.00	LG	0.3	10.9069	0.0000	0.0000	0.0000	0.0000	0.0000	10.9069	0.0000
5	L52FL		13.80	0.00	LL	167	0.0002	180.0000	6984.1812	-171.4727	6984.1814	8.5273	0.0000	0.0000
6	L52FL		13.80	0.00	LLG	167	3.6416	-0.0314	6983.2857	-171.4716	6985.0841	8.5262	5.4597	0.0000
7														
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	L52	Line	13.80	0.00	LLL	12	503.8522	-80.8505	503.8522	159.1495	503.8522	39.1495	0.0000	0.0000
11		Line	13.80	0.00	LG	0.0	0.4184	0.0000	0.2092	180.0000	0.2092	180.0000	0.0000	0.0000
12		Line	13.80	0.00	LL	10	0.0000	0.0000	436.3431	-170.8552	436.3431	9.1448	0.0000	0.0000
13		Line	13.80	0.00	LLG	10	0.1255	0.0000	436.4108	-170.8518	436.2869	9.1508	0.0000	0.0000
14	L52RL	Line	13.80	0.00	LLL	181	7560.8394	-81.5142	7560.8394	158.4858	7560.8394	38.4858	0.0000	0.0000
15		Line	13.80	0.00	LG	0.3	10.5011	0.0000	0.2092	0.0000	0.2092	0.0000	10.9195	0.0000
16		Line	13.80	0.00	LL	157	0.0000	0.0000	6547.8431	-171.5142	6547.8431	8.4858	0.0000	0.0000
17		Line	13.80	0.00	LLG	157	0.0934	-153.5343	6550.5086	-171.5175	6545.2596	8.4897	5.3970	180.0000

### Voltage:

#### Length 5%:

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]			
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
3	L52FL		13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	L52FL		13.80	0.00	LG	0.0000	0.0000	1.9038	-150.0577	1.9062	149.9327			
5	L52FL		13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000			
6	L52FL		13.80	0.00	LLG	1.6499	-0.0208	0.0000	0.0000	0.0000	0.0000			
7														
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	L52 (@ Bus : L52FL)	Line	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11		Line	13.80	0.00	LG	0.0000	0.0000	1.9038	-150.0577	1.9062	149.9327			
12		Line	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000			
13		Line	13.80	0.00	LLG	1.6499	-0.0208	0.0000	0.0000	0.0000	0.0000			
14	L52RL (@ Bus : L52FL)	Line	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			
15		Line	13.80	0.00	LG	0.0000	0.0000	1.9038	-150.0577	1.9062	149.9327			
16		Line	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000			
17		Line	13.80	0.00	LLG	1.6499	-0.0208	0.0000	0.0000	0.0000	0.0000			

#### Length 50%:

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]			
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
3	L52FL		13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	L52FL		13.80	0.00	LG	0.0000	0.0000	1.9012	-150.1487	1.9075	149.8204			
5	L52FL		13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000			
6	L52FL		13.80	0.00	LLG	1.6497	-0.0521	0.0000	0.0000	0.0000	0.0000			
7														
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	L52 (@ Bus : L52FL)	Line	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11		Line	13.80	0.00	LG	0.0000	0.0000	1.9012	-150.1487	1.9075	149.8204			
12		Line	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000			
13		Line	13.80	0.00	LLG	1.6497	-0.0521	0.0000	0.0000	0.0000	0.0000			
14	L52RL (@ Bus : L52FL)	Line	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15		Line	13.80	0.00	LG	0.0000	0.0000	1.9012	-150.1487	1.9075	149.8204			
16		Line	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000			
17		Line	13.80	0.00	LLG	1.6497	-0.0521	0.0000	0.0000	0.0000	0.0000			

#### Length 95%:

	ID	Type	Prefault kV	Angle	Fault type	VL1 [pu]	VL1 [deg]	VL2 [pu]	VL2 [deg]	VL3 [pu]	VL3 [deg]			
<b>1 Faulted Bus -&gt;</b>														
<b>2</b>														
3	L52FL		13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	L52FL		13.80	0.00	LG	0.0000	0.0000	1.9043	-150.0357	1.9058	149.9576			
5	L52FL		13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000			
6	L52FL		13.80	0.00	LLG	1.6499	-0.0104	0.0000	0.0000	0.0000	0.0000			
7														
<b>8 First Ring Contributions</b>														
<b>9</b>														
10	L52 (@ Bus : L52FL)	Line	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11		Line	13.80	0.00	LG	0.0000	0.0000	1.9043	-150.0357	1.9058	149.9576			
12		Line	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000			
13		Line	13.80	0.00	LLG	1.6499	-0.0104	0.0000	0.0000	0.0000	0.0000			
14	L52RL (@ Bus : L52FL)	Line	13.80	0.00	LLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15		Line	13.80	0.00	LG	0.0000	0.0000	1.9043	-150.0357	1.9058	149.9576			
16		Line	13.80	0.00	LL	1.1000	0.0000	0.5500	180.0000	0.5500	180.0000			
17		Line	13.80	0.00	LLG	1.6499	-0.0104	0.0000	0.0000	0.0000	0.0000			

Fault analysis in line # of Different location:

L14:  $V = 69 \text{ kV}$

5% length:

$$\text{minimum current} = 6058.4045 \text{ A} [\text{LG fault}]$$

50% length:

$$\text{minimum current} = 2427.4865 \text{ A} [\text{LL fault}]$$

95% length:

$$\text{minimum current} = 1505.8651 \text{ A} [\text{LL fault}]$$

current minimum for CB:

$$\begin{aligned} \text{CB rating} &= \sqrt{3} \times 69 \times 1505.8651 \times 10^{-3} \text{ MVA} \\ &= 179.061 \text{ MVA} \end{aligned}$$

L16:  $V = 69 \text{ kV}$

5% length:

$$\text{minimum current} = 6014.6405 \text{ A} [\text{LG fault}]$$

50% length:

$$\text{minimum current} = 3726.6710 \text{ A} [\text{LL fault}]$$

95% length:

$$\text{minimum current} = 2488.5375 \text{ A}$$

current minimum for CB = 2488.5375 A

$$\begin{aligned} \text{CB rating} &= \sqrt{3} \times 69 \times 2488.5375 \times 10^{-3} \text{ MVA} \\ &= 297.408 \text{ MVA} \end{aligned}$$

L32:  $V = 13.8 \text{ kV}$

5% length:

$$\text{minimum current} = 10.8043 \text{ A} [\text{LG fault}]$$

50% length:

$$\text{minimum current} = 10.9069 \text{ A} [\text{LG fault}]$$

95% length:

$$\text{minimum current} = 10.069 \text{ A} [\text{LG fault}]$$

$$\begin{aligned} \text{current minimum for CB} &= \sqrt{3} \times 13.8 \\ &= 0.2604 \text{ MVA} \end{aligned}$$

$$\text{CB} = 0.2604 \text{ MVA}$$

L52:  $V = 13.8 \text{ kV}$

5% length:

$$\text{minimum current} = 10.8043 \text{ A} [\text{LG fault}]$$

50% length:

$$\text{minimum current} = 10.8943 \text{ A} [\text{LG fault}]$$

95% length: minimum current = 10.9069 A [LG fault]

current minimum for CB = 10.8943

$$\begin{aligned} \text{CB rating} &= \sqrt{3} \times 13.8 \times 10.8943 \times 10^{-6} \\ &= 0.2604 \text{ MVA} \end{aligned}$$

Circuit Breaker for each position of power system:

Generator:

$$G_1: \text{Rating} = 530.79 \text{ MVA}$$

$$G_2: \text{Rating} = 0.255 \text{ MVA}$$

Line:

$$\begin{aligned} L14: \text{Rating} &= \min(\text{fault at bus-1, bus-2, L14}) \\ &= \min(13.023, 158.738, 179.068) \\ &= 13.023 \text{ MVA} \end{aligned}$$

L16: fault at:

$$\text{bus-1} = 9.67 \text{ MVA}$$

$$\text{bus-6} = 276.66 \text{ MVA}$$

$$L16 = 297.408 \text{ MVA}$$

$$\text{minimum rating} = 9.67 \text{ MVA}$$

L32: fault at,

$$\text{bus-3} = 0.105 \text{ MVA}$$

$$\text{bus-2} = 3.09 \times 10^{-4} \text{ MVA}$$

$$L32 = 0.2604 \text{ MVA}$$

$$\text{minimum rating} = 3.09 \times 10^{-4} \text{ MVA}$$

L52: fault at,

$$\text{bus-5} = 0.097 \text{ MVA}$$

$$\text{bus-2} = 2.0667 \times 10^{-3} \text{ MVA}$$

$$L52 = 0.2604 \text{ MVA}$$

$$\text{minimum Rating} = 2.0667 \times 10^{-3} \text{ MVA}$$

## Transformer

TRF - 1:

At Bus-3, rating = 0.156 mVA

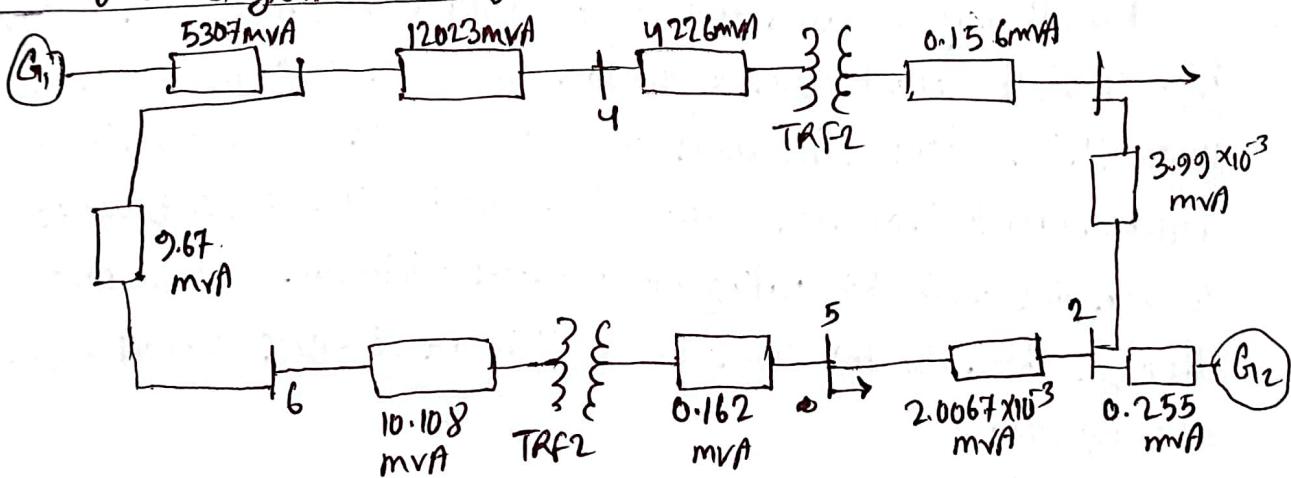
At Bus-4, rating = 14.228 mVA

TRF - 2:

At Bus-5, rating = 0.16201 mVA

At Bus-6, rating = 10.108 mVA

Power system Diagram with rating:



\* What if loads at the buses were removed?

⇒ If the loads at the buses are removed, the impact is negligible because the fault current is much larger than the load current. During a fault at the buses, the current bypasses the loads and flows through the short-circuit path, making the load current nearly zero. Therefore, removing the load has almost no effect on short-circuit fault analysis.

### Discussion:

In this experiment, we learned to use a software tool called PSAF for power system fault analysis. Using this software, we performed a detailed fault study on a given three-phase network. The provided system had 6 buses, 2 transformers, and 2 generators. We analyzed different equipment under four types of faults: LLL, LG<sub>i</sub>, LL and LG<sub>i</sub>. For each case, we considered bolted faults, both with and without load. For the transmission lines, sliding faults were examined at 5%, 50% and 95% of their length.

From theory, we found that the LLL fault is the most severe since it produces the highest fault current. Our observations confirmed that maximum current occurs under LLL faults. For bus faults, we also calculated the contribution of equipment to the fault current, known as first swing contribution. Circuit Breakers were then assigned to each line, with their rating based on the minimum fault current expected to pass through them. In the cases of LG<sub>i</sub>, LL and LG<sub>i</sub> faults, current from healthy buses were neglected.

Overall, this process allowed us to carry out a detailed fault analysis of a power system network.