SYSTEM PROTECTION FUSE COORDINATION AND TRANSFORMER FUSING

INTRODUCTION

1. The purpose of protective coordination is to provide isolation of a fault as close to the fault as possible so that a minimum of customers will be affected. The workhorse of the JEA protection scheme is the fuse. By following the fuse tables given in this section, the fuse closest to a fault will melt first providing proper coordination and fault isolation.

2. The fuse tables are divided into three major groups:

   GROUP A: LATERAL FUSING presents the required fuses for the fusing of laterals and sub-laterals. Tables for overhead and underground laterals behind substation breakers and reclosers are given for each system voltage.

   GROUP B: EQUIPMENT PROTECTION FUSING gives the fuse sizes for the protection of transformers and capacitors.

   GROUP C: FUSE-FUSE COORDINATION presents various tables for coordinating one type of fuse link behind another type of fuse link.

3. In order to maintain a properly functioning fuse coordination system, the fuse tables presented in this section must be followed in both system design and maintenance.

4. If an installed fuse will not hold the connected load and a larger fuse is installed, the party installing the larger size fuse shall notify the System Analysis section of Technical Support Engineering of (1) the location, (2) the old fuse size, and (3) the new fuse size.

5. If a fuse is replaced with a different size fuse because the required size was not available, the party installing the different size fuse shall notify the Systems Operation Control Center so the proper size fuse can be reinstalled.

6. Do not install Sectionalizers on multiphase laterals (See System Analysis).

GROUP A: LATERAL FUSING

1. OVERHEAD LATERALS ON PRIVATE PROPERTY:
   - A. Fuse the lateral at the road with the correct size lateral fuse if the lateral meets ANY of the following conditions:
     - i. More than one transformer is served.
     - ii. The lateral is longer than two spans.
     - iii. The transformer pole cannot be seen from the cutout at the road.
     - iv. Trees could cause outage problems.
   - B. Fuse the lateral at the road with the correct size transformer fuse if the lateral meets ALL of the following conditions:
     - i. Only one transformer is served.
     - ii. The lateral is two spans or less in length.
     - iii. The transformer pole can be seen from the cutout at the road.
     - iv. Trees will not cause any outage problems.
2. UNDERGROUND LATERALS:
   - A. Fuse the lateral at the tap with the correct size lateral fuse if the lateral meets ANY of the following conditions:
     - i. The tap occurs in an underground fusing cabinet.
     - ii. The transformer served is equipped with bay-o-net fuses.
     - iii. More than one transformer is served.
     - iv. There are provisions for extending the lateral.
   - B. Fuse the lateral at the tap with the correct size transformer fuse if the lateral meets ALL of the following conditions:
     - i. The fused tap consists of overhead cutout(s).
     - ii. The transformer served is not equipped with bay-o-net fuses.
     - iii. Only one transformer is served.
     - iv. The lateral is a radial without provisions for extension.
3. FUSING BEHIND SECTIONALIZERS:

   Sectionalizers do not have time-current characteristics and therefore do not affect coordination between a fuse and an upstream breaker or recloser. When selecting fuses behind a sectionalizer, the presence of the sectionalizer should be ignored.
4. FUSING BEHIND SINGLE PHASE RECLOSERS:

   The largest fuse that can be used behind a 200A single phase recloser is a 65T. The largest fuse that can be used behind a 70A single phase recloser is a 25T. These fuse values allow for maximum coordination.

GROUP A: LATERAL FUSING (CONTINUED)

15.2/26.4KV DISTRIBUTION SYSTEM

Notes:

1) In the event that the tap off the main line fuse or sublateral fuse does not provide adequate current carrying capacity, notify the System Analysis section of Technical Support Engineering.
2) TABLE 3:

   The fuse size listed in this table is only for a tap off the main line feeder. The first sublateral fuse (Overhead) will be half or the next smaller standard size that JEA has in stock. For example: If a tap off the main line is a 65T fuse, then the first sublateral fuse will be a 30T, and the second sublateral fuse will be a 15T. See Table 1, Group C, for the first sublateral and second sublateral fuse off a cable pole.

TABLE 1: OVERHEAD LATERAL & CABLE POLE FUSING (T-LINK)
26.4kV System Behind Station Breaker

CONDUCTOR SIZE	TAP OFF MAIN LINE	1ST SUB-LATERAL FUSE	2ND SUB-LATERAL FUSE
1/0 AL. OR 2 CU. OR 2 AL.	100T	50T	25T
4 CU.	80T	40T	20T
4 AL. OR 6 CU. OR SMALLER	65T	30T	15T
CABLE POLE 1/0 AL. CABLE OR SMALLER	100T	SIZE PER TABLE 1 GROUP C - (1)	SIZE PER TABLE 1 GROUP C - (1)

TABLE 2: UNDERGROUND LATERAL FUSING (E-LINK)
26.4kV System Behind Station Breaker

CABLE SIZE	TAP OFF MAIN LINE	1ST SUB-LATERAL FUSE	2ND SUB-LATERAL FUSE
1/0 AL. OR SMALLER	150E	100E	50E

GROUP B: EQUIPMENT PROTECTION FUSING

TABLE 5: LINE CAPACITOR BANK FUSING

3 - PHASE BANK KVAR	SYSTEM VOLTAGE 2.4/4.16kV	SYSTEM VOLTAGE 7.62/13.2kV	SYSTEM VOLTAGE 15.2/26.4kV
150	25T	–	–
300	50T	15T	–
600	100T	25T	15T
1200	–	–	25T

TABLE 6: TRANSFORMER FUSING – 15.2/26.4kV

TRANSFORMER			FUSE LINKS – OVERHEAD				FUSE LINKS – UNDERGROUND	
KVA 1 PHASE	KVA 3 PHASE PADS	FULL LOAD AMPS	JEA ITEM ID	CHANC E TYPE	KEARNEY TYPE	COOPER TYPE	JEA ITEM ID WYE	RTE TYPE
5	–	0.33	FUSOH019	0.4 SF	1/2 X	–	–	–
10	–	0.66	FUSOH020	0.7 SF	1 X	–	–	–
15	–	0.98	FUSOH021	1.0 SF	1-1/2 X	–	–	–
25	–	1.64	FUSOH022	1.6 SF	2-1/2 X	–	FUSUG021	4000358C03B
37.5	–	2.46	FUSOH023	2.1 SF	3-1/2 X	–	–	–
50	–	3.28	FUSOH024	3.1 SF	4 X	–	FUSUG022	4000358C05B
75	–	4.92	FUSOH026	5.2 SF	7 X	–	FUSUG022	4000358C05B
100	–	6.56	FUSOH027	7.0 SF	10 X	–	FUSUG023	4000358C08B
167	–	10.96	FUSOH028	10.4 SF	15 X	–	FUSUG023	4000358C08B
250	–	16.40	FUSOH029	14 SF	25 KS	25 S	FUSUG024	4000358C10B
–	75	1.64	–	–	–	–	FUSUG021	4000358C03B
–	150	3.28	–	–	–	–	FUSUG022	4000358C05B
–	225	4.92	–	–	–	–	FUSUG022	4000358C05B
–	300	6.56	–	–	–	–	FUSUG023	4000358C08B
–	500	10.96	–	–	–	–	FUSUG024	4000358C10B
BALDWIN	500	10.96	–	–	–	–	FUSUG025	4000358C12B
–	750	16.40	–	–	–	–	FUSUG025	4000358C12B
BALDWIN	750	16.40	–	–	–	–	FUSUG024	4000358C10B
–	1,000	21.87	–	–	–	–	FUSUG025	4000358C12B
–	1,500	32.80	–	–	–	–	FUSUG026	4000358C14B

GROUP B: EQUIPMENT PROTECTION FUSING – (CONTINUED)

TABLE 6: TRANSFORMER FUSING – 15.2/26.4kV - (CONTINUED)

TRANSFORMER			FUSE LINKS – OVERHEAD				FUSE LINKS – UNDERGROUND	
KVA 1 PHASE	KVA 3 PHASE PADS	FULL LOAD AMPS	JEA ITEM ID	CHANCE TYPE	KEARNEY TYPE	COOPER TYPE	JEA ITEM ID WYE	RTE TYPE
–	2,000	43.74	–	–	–	–	NO ITEM ID *	4038361C04CB
–	2,500	54.67	–	–	–	–	NO ITEM ID *	4038361C04CB
–	3,750	82.01	–	–	–	–	FUSUG048	4000353C17B
	500kVA DELTA	–	–	–	–	–	NO ITEM ID	FA9H18

* These transformers can be fused with FUSUG026 until the 4038361C04CB is in stock. Then the new fuse should then be used. *This fuse comes with a new fuse cartridge. The complete unit should be used to replace the old fuse and cartridge.*

- FUSE LINKS - Overhead applies to pole mounted transformers as well as padmounted transformers not equipped with BAY-O-NET fuses that are fused at the cable pole. See Group A, General Comments on underground laterals.

TABLE 7: TRANSFORMER FUSING – 7.6/13.2kV

TRANSFORMER			FUSE LINKS – OVERHEAD				FUSE LINKS – UNDERGROUND	
KVA 1 PHASE	KVA 3 PHASE PADS	FULL LOAD AMPS	JEA ITEM ID	CHANCE TYPE	KEARNEY TYPE	COOPER TYPE	JEA ITEM ID WYE	RTE TYPE
5	–	0.66	FUSOH020	0.7 SF	1 X	–	–	–
10	–	1.31	FUSOH022	1.6 SF	2-1/2 X	–	–	–
15	–	1.97	FUSOH023	2.1 SF	3-1/2 X	–	–	–
25	–	3.28	FUSOH024	3.1 SF	4 X	–	FUSUG022	4000358C05B
37.5	–	4.92	FUSOH026	5.2 SF	7 X	–	–	–
50	–	6.56	FUSOH027	7.0 SF	10 X	–	FUSUG023	4000358C08B
75	–	9.84	FUSOH028	10.4 SF	15 X	–	FUSUG023	4000358C08B
100	–	13.12	FUSOH029	14 SF	25 KS	25 S	FUSUG024	4000358C10B
167	–	21.91	FUSOH030	21 SF	30 KS	30 S	FUSUG024	4000358C10B
250	–	32.80	FUSOH031	32 SF	50 KS	50 S	FUSUG025	4000358C12B
333	–	43.69	FUSOH032	46 SF	65 KS	65 S	FUSUG025	4000358C12B
500	–	65.61	FUSOH033	100 MS	100 KS	100 S	FUSUG026	4000358C14B
–	75	3.28	–	–	–	–	FUSUG022	4000358C05B
–	150	6.56	–	–	–	–	FUSUG022	4000358C05B
–	300	13.12	–	–	–	–	FUSUG025	4000358C12B
–	500	21.91	–	–	–	–	FUSUG025	4000358C12B
–	750	32.80	–	–	–	–	FUSUG026	4000358C14B
–	1,000	43.69	–	–	–	–	FUSUG026	4000358C14B

GROUP B: EQUIPMENT PROTECTION FUSING – (CONTINUED)

TABLE 7: TRANSFORMER FUSING – 7.6/13.2kV – (CONTINUED)

TRANSFORMER			FUSE LINKS – OVERHEAD				FUSE LINKS – UNDERGROUND	
KVA 1 PHASE	KVA 3 PHASE PADS	FULL LOAD AMPS	JEA ITEM ID	CHANCE TYPE	KEARNEY TYPE	COOPER TYPE	JEA ITEM ID WYE	RTE TYPE
–	1,500	65.61	–	–	–	–	NO ITEM ID **	4000353C18B
–	2,000	87.48	–	–	–	–	NO ITEM ID *	4038361C05CB
–	2,500	109.3	–	–	–	–	NO ITEM ID *	4038361C05CB

* These transformers can be fused with FUSUG026 until the 353c17 is in stock. Then the new fuse should be used.

** These transformers can be fused with FUSUG048 until the 4038361C05CB is in stock. Then the new fuse should be used. . *This fuse comes with a new fuse cartridge. The complete unit should be used to replace the old fuse and cartridge.*

- FUSE LINKS - Overhead applies to pole mounted transformers as well as padmounted transformers not equipped with BAY-O-NET fuses that are fused at the cable pole. See Group A, General Comments on underground laterals.

TABLE 8: TRANSFORMER FUSING – 13.2kV DELTA

TRANSFORMER			FUSE LINKS – OVERHEAD				FUSE LINKS – UNDERGROUND	
KVA 1 PHASE	KVA 3 PHASE PADS	FULL LOAD AMPS	JEA ITEM ID	CHANCE TYPE	KEARNEY TYPE	COOPER TYPE	JEA ITEM ID WYE	RTE TYPE
–	500kVA DELTA		–	–	–	_	FUSUG025	4000358C12B
–	750kVA DELTA		–	–	–	_	FUSUG026 *	4000358C14B
	1500kVA DELTA		–	–	–	–	NO ITEM ID *	4038361C04CB
	2500kVA DELTA		–	–	–	–	NO ITEM ID **	4038361C05CB

* These transformers can be fused with FUSUG048 until the 4038361C04CB is in stock. Then the new fuse should be used.

** These transformers can be fused with FUSUG048 until the 4038361C05CB is in stock. Then the new fuse should be used. *This fuse comes with a new fuse cartridge. The complete unit should be used to replace the old fuse and cartridge.*

- FUSE LINKS - Overhead applies to pole mounted transformers as well as padmounted transformers not equipped with BAY-O-NET fuses that are fused at the cable pole. See Group A, General Comments on underground laterals.

GROUP B: EQUIPMENT PROTECTION FUSING – (CONTINUED)

TABLE 9: TRANSFORMER FUSING – 2.4/4.16kV

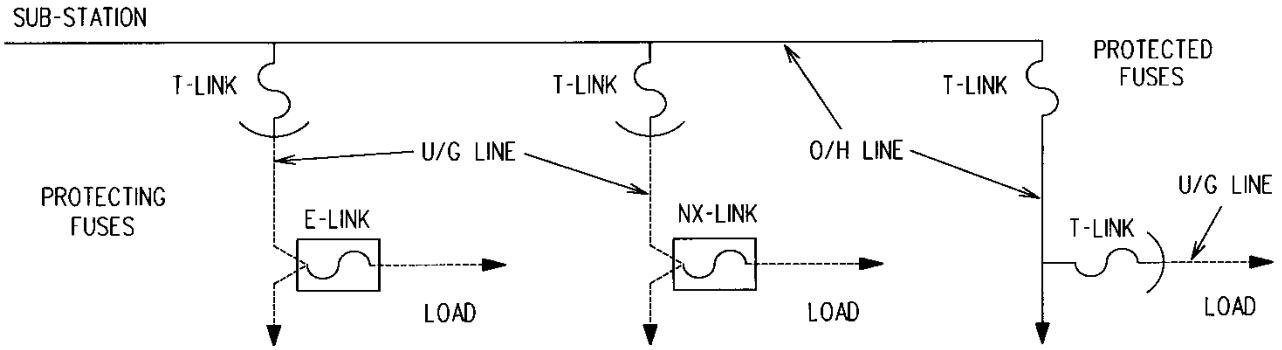
TRANSFORMER			FUSE LINKS – OVERHEAD				FUSE LINKS – UNDERGROUND	
KVA 1 PHASE	KVA 3 PHASE PADS	FULL LOAD AMPS	JEA ITEM ID	CHANCE TYPE	KEARNEY TYPE	COOPER TYPE	JEA ITEM ID WYE	RTE TYPE
3	–	1.25	FUSOH022	1.6 SF	2-1/2 X	–	–	–
5	–	2.08	FUSOH023	2.1 SF	3-1/2 X	–	–	–
7.5	–	3.12	FUSOH024	3.1 SF	5-1/2 X	–	–	–
10	–	4.16	FUSOH025	4.2 SF	7 X	–	–	–
15	–	6.25	FUSOH027	7.0 SF	10 X	–	–	–
25	–	10.41	FUSOH028	10.4 SF	15 X	–	FUSUG023	4000358C10B
37.5	–	15.61	FUSOH029	14 SF	25 KS	25 S	–	–
50	–	20.82	FUSOH030	21 SF	30 KS	30 S	FUSUG024	4000358C12B
75	–	31.23	FUSOH031	32 SF	50 KS	50 S	FUSUG025	4000358C12B
100	–	41.64	FUSOH032	46 SF	65 KS	65 S	FUSUG025	4000358C12B
167	–	69.53	FUSOH033	100 MS	100 KS	100 S	FUSUG025	4000358C14B
250	–	104.09	FUSOH034	125 MS	125 KS	125 S	–	–
333	–	138.65	FUSOH035	150 MS	150 KS	150 S	–	–
500	–	208.18	FUSOH036	200 MS	200 KS	200 S	–	–
	75	10.41	–	–	–	–	FUSUG023	4000358C10B
	150	20.82	–	–	–	–	FUSUG024	4000358C12B
	300	41.64	–	–	–	–	FUSUG025	4000358C12B
	500	69.53	–	–	–	–	NO ITEM ID	4000358C18B
	750	104.09	–	–	–	–	NO ITEM ID	4000358C18B
	1000kVA DELTA		–	–	–	–	NO ITEM ID	4000358C18B

* These transformers can be fused with FUSUG025 at a reduced load capability until the 4038361C04CB is in stock. Then the new fuse should be used. *This fuse comes with a new fuse cartridge. The complete unit should be used to replace the old fuse and cartridge.*

- FUSE LINKS - Overhead applies to pole mounted transformers as well as padmounted transformers not equipped with BAY-O-NET fuses that are fused at the cable pole. See Group A, General Comments on underground laterals.

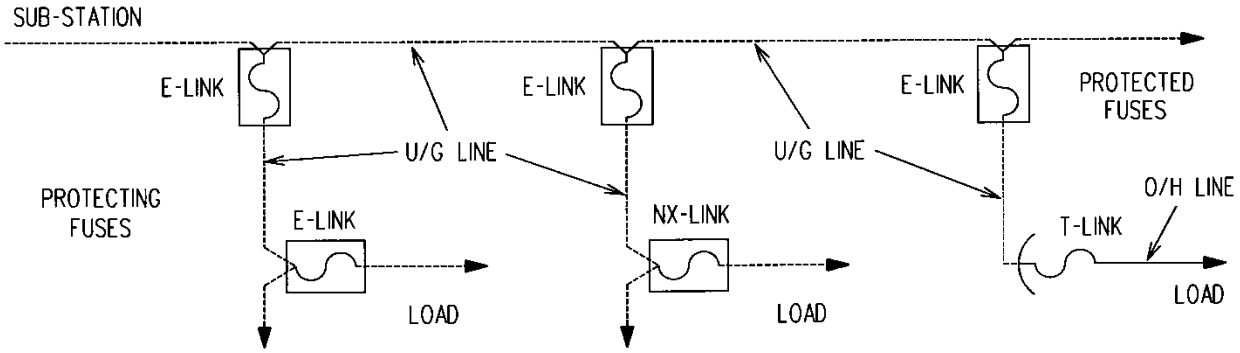
GROUP C: FUSE COORDINATION

TABLE 10: LATERAL FUSING OFF OF FUSED OVERHEAD LATERALS



PROTECTING FUSE	PROTECTED FUSE (T-LINK)							
	100T	80T	65T	50T	40T	30T	25T	20T
E-LINK (3-PHASE)	80	65	50	40	30	25	20	15
NX-LINK (1-PHASE)	50	40	30	25	20	12	12	10
T-LINK	50	40	30	25	20	12	12	10

TABLE 11: LATERAL FUSING OFF OF FUSED UNDERGROUND LATERALS



PROTECTING FUSE	PROTECTED FUSE (E-LINK)							
	150E	100E	80E	65E	50E	40E	30E	25E
E-LINK (3-PHASE)	100	50	50	40	25	20	20	15
NX-LINK (1-PHASE)	65	30	25	25	20	12	12	10
T-LINK	80	40	30	25	20	15	12	10