

# SHORT CIRCUIT PROTECTION

## Table of Contents - Section 800

PARAGRAPH		PAGE
800.0	SHORT CIRCUIT PROTECTION.....	1
800.1	GENERAL .....	1
800.2	MAXIMUM SERVICE EQUIPMENT SHORT CIRCUIT CAPABILITIES .....	2
800.3	FAULT CURRENT FOR RESIDENTIAL MULTI-FAMILY APARTMENT PROJECTS .....	3
800.4	MINIMUM CONDUCTOR LENGTH REQUIRED TO LIMIT FAULT CURRENT .....	3
800.5	MULTIPLE SERVICES FOR COMMERCIAL APPLICATIONS .....	4



## 800.0 SHORT CIRCUIT PROTECTION

### 800.1 GENERAL

The National Electric Code, State, County and Municipal Codes and/or Regulations require that service entrance equipment shall be suitable for the short-circuit current available at its supply terminals.

It is the responsibility of the Customer to install service entrance equipment and protective devices (fuses or circuit breakers) capable of interrupting and withstanding the available fault current.

In cases where multiple service entrance sections are served from one transformer the utility fault current contribution may exceed the values noted. Please consult your Service Representative before ordering or designing your equipment and refer to section 800.5.

The fault current values are based on a bolted phase-to-ground, phase-to-phase or three phase fault, whichever is greater.

**Arc Flash hazard calculations** should be performed by a Registered Professional Engineer. The dynamic electric utility system grid makes it impractical to provide any further information other than the fault current values noted, in Table 800.2. CRA-ES will provide only maximum fault current values at the service entrance section. Impedance values, X/R Ratios, primary fault current data and coordination information will not be provided.

See Section 1000.2-1 (MEDIUM VOLTAGE METERING AND SERVICE EQUIPMENT) for information, primary fault current and protection scheme data.

#### **Explanation of Short Circuit Transformer Size:**

The transformers listed in the short circuit table 800.2 are based upon 80% of the indicated SES size in Amps. This was established as a result of the NEC enforcement by the authority having jurisdiction. The NEC requires continuous and uniform load with an adder of 25% depending upon the type of load or building class. If established building occupant calculate and apply for a permit for any added load the existing and new load will be 80% or less of the SES size.



**800.2 MAXIMUM SERVICE EQUIPMENT SHORT CIRCUIT CAPABILITIES**

SES#	1 PH 120/240 POLE/PAD XFMR		3 PH 120/240- Closed Delta POLE TOP XFMR		3 PH 120/240- Open Delta POLE TOP XFMR		3 PH 120/240- Open Delta PAD XFMR (based upon a 167/75kva transformers)		3 PH 120/208 POLE TOP XFMR		3 PH 120/208 PAD XFMR		3 PH 277/480 POLE TOP XFMR		3 PH 277/480 PAD XFMR	
	AMPS	kVA	Isc	kVA	Isc	kVA	Isc	kVA	Isc	kVA	Isc	kVA	Isc	kVA	Isc	kVA
100	50	9,493	75	10,694	75	24,344	167	31,209	75	6,857	112.5	20,145	75	4,357	112.5	9,753
125	50	9,493	75	10,694	75	24,344	167	31,209	75	6,857	112.5	20,145	150	7,866	112.5	9,753
150	50	9,493	75	10,694	75	24,344	167	31,209	75	6,857	112.5	20,145	150	7,866	112.5	9,753
200	75	12,540	75	10,694	75	24,344	167	31,209	75	8,434	112.5	20,145	150	8,672	150	12,887
*400	100	18,757	150	19,929	75	24,344	167	31,209	150	16,867	150	25,079	300	17,343	300	24,883
600	167	31,094	225	31,021	100	35,876	167	37,900	225	27,779	225	40,289	500	26,831	500	25,773
800	167	40,481	300	39,858	167	44,951	167	37,900	300	34,962	300	51,502			750	25,773
1,000			500	50,704					300	34,962	300	51,502			750	25,773
1,200			500	54,904					500	52,020	500	54,501			1,000	25,773
1,600									500	55,084	500	56,135			1,500	30,973
2,000											750	56,135			1,500	31,107
2,500											750	56,135			2,000	41,510
3,000											1,000	56,135			2,000	41,720

\* 400 Amp, 120/240 V, Single Phase Panels: Second breaker is an CRA-ES requirement and needs to be minimum 22K AIC rated.

**Notes:**

- For service equipment designed for underground feed using overhead transformers use the highest fault current between the OH and Pad XFMR values. This provides for proper bracing, if future conversions occur.
- Please refer to the General Section 800.1 for additional information.
- Table 800.2 indicates the minimum interrupting requirements for service entrance equipment, and is based on an infinite buss located on the transformer primary and 20 ft. of service conductor sized to serve at least 80% of the service entrance section.
- Current values are symmetrical amperes of three-phase faults on three-phase transformers and either phase-to-phase or phase-to-neutral, whichever is larger for single-phase transformers.
- Values do not apply to primary services. Consult with CRA-ES, primary fault current value can be 26kA and spot network can be 200kA values.
- Arc Flash hazard calculations** should be performed by a Registered Professional Engineer. The dynamic electric utility system grid makes it impractical to provide any further information other than the fault current values noted in Table 800.2. CRA-ES will provide only maximum fault current values at the service entrance section. Impedance values, X/R Ratios, primary fault current data and coordination information will not be provided, except primary service see section 1000.2-1.
- The maximum size transformer for new installation is limited to 2,000kVA @ 480V plus 2000kVA @ 208V, for **MAINTENANCE PURPOSES:** only a 2,500kVA transformer rated at 480V with 20feet of service length can produce fault current value of 52,136, also this required 11-4" service conduits.



**ELECTRIC SERVICE REQUIREMENTS**

**800.2**

**800.3**

**FAULT CURRENT FOR RESIDENTIAL MULTI-FAMILY APARTMENT PROJECTS**

CRA-ES designs and builds the following minimum criteria as a method to limit fault current in residential multi-family apartment projects to 22,000 amps or less:

1. Transformer size does not exceed 100 KVA.
2. Service wire runs will not be less than the following distances:

UA 1/0	-	10 Ft.
UA 4/0	-	15 Ft.
UA 4/0-2	-	30 Ft.
UA 500	-	25 Ft.

**If the transformer size is larger or service length is shorter than shown, refer to Table 800.2 for available fault current.**

**800.4**

**MINIMUM CONDUCTOR LENGTH REQUIRED TO LIMIT FAULT CURRENT**

**MINIMUM CONDUCTOR LENGTH REQUIRED TO LIMIT FAULT CURRENT TO 22,000AMPS**

CONDUCTOR SIZE	TRANSFORMER SIZE - SINGLE PHASE, 120/240v				
	25kVA	50kVA	75kVA	100kVA	167kVA
Underground Conductor	Minimum Wire Length in Feet				
1/0 AL	0	0	0	10	15
4/0 AL	0	0	0	15	30
2 sets of 4/0 AL	0	0	0	30	55

**MINIMUM CONDUCTOR LENGTH REQUIRED TO LIMIT FAULT CURRENT TO 10,000AMPS**

CONDUCTOR SIZE	TRANSFORMER SIZE - SINGLE PHASE, 120/240v				
	25kVA	50kVA	75kVA	100kVA	167kVA
Underground Conductor	Minimum Length in Feet				
1/0 AL	0	16	32	36	55
4/0 AL	0	29	60	67	100
2 sets of 4/0 AL	0	57	120	133	200

**Note: The above charts are to be used for assistance with existing field situations. Distances validated from the transformer sizing program.**



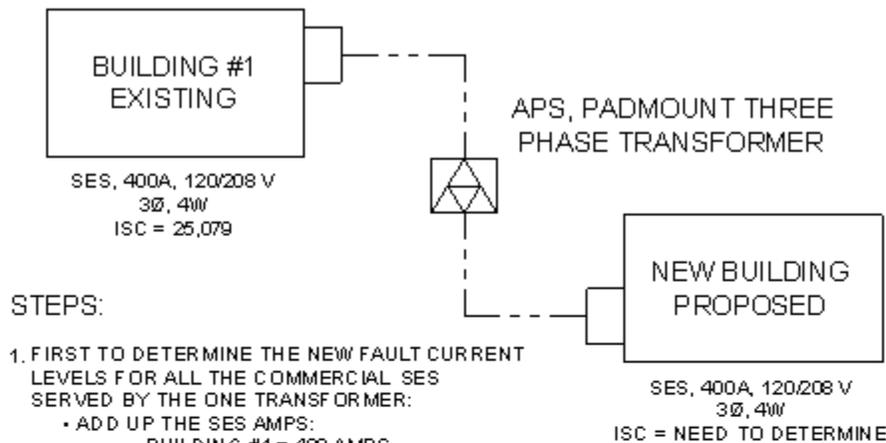
**MULTIPLE SERVICES FOR COMMERCIAL APPLICATIONS**

Use the following to determine the fault current for multiple services from one three phase transformer:

Add all of the existing and proposed service entrance (SES) ampere ratings. Then use this total SES amp figure to find the appropriate fault current using, Table 800.2. Each SES being served from this transformer needs to be braced for this fault current level. Also, ensure the new building plans indicate on the one-line the proper bracing or AIC rating for the equipment.

**NOTE:** The maximum value of all SES's added together cannot exceed a total of 3,000Amps for multi-SES's service from one three phase transformer.

**FAULT CURRENT FOR MULTIPLE COMMERCIAL SERVICES FROM ONE TRANSFORMER**



**STEPS:**

1. FIRST TO DETERMINE THE NEW FAULT CURRENT LEVELS FOR ALL THE COMMERCIAL SES SERVED BY THE ONE TRANSFORMER:
  - ADD UP THE SES AMPS:
    - BUILDING #1 = 400 AMPS
    - BUILDING #2 = 400 AMPS
    - TOTAL of all SES SIZE's = 800 AMPS
2. FIND FROM THE FAULT CURRENT TABLE 800.2  
 ISC FOR 800 AMPS = 51,502 AMPS
3. EACH SES SERVED BY THE ONE TRANSFORMER WILL NEED TO BE BRACED FOR 51,502 AMPS OF FAULT CURRENT.
4. VERIFY THE EXISTING SES BRACING.
5. IF THE EXISTING SES IS NOT ADEQUATELY BRACED FOR THE NEW AVAILABLE FAULT CURRENT LEVEL, APS WILL CONSIDER INSTALLING A SEPARATE TRANSFORMER FOR THE NEW BUILDING.

