

October 15, 2012
ELECTRICAL SECTION

SERIES RATED COMBINATIONS

The following information has been compiled from various equipment manufacture literature and the 22nd Edition of the BCEC for educational purpose only. This guide is not intended as a design specification or instruction manual.

Introduction

CSA requires that all CSA listed panel boards and switchboards are marked with a maximum short circuit current rating. This rating represents the maximum fault current, which the bus structure and overcurrent devices can withstand during a bolted fault situation. There are two systems of short circuit current protection available:

- A fully rated system; or
- A series rated system

Fully Rated System

The interrupting rating of all devices matches or exceeds the system available fault level at every point in the distribution system. The main advantage of this type of system is that it provides the most robust form of protection and its straightforward application. The only disadvantage is that it is the more expensive of the two alternatives.

Series Rated System.

This type of system permits the use of downstream devices having lower interrupting ratings than the available fault current when protected by specific upstream devices. The upstream device must have an interrupting rating equal to or greater than the available fault current. In addition, each specific combination of upstream and downstream devices must be tested and approved by CSA at the fault level in question.

The principal advantage of this type of system is that it can lower the overall equipment cost. The main disadvantage is that its application can be confusing for the engineer, the installer and the contractor resulting in a higher probability of error when compared to the fully rated system.

Note that there is no difference with regard to circuit protection and continuity when comparing series rated and fully rated systems. Although the upstream and downstream devices have different interrupting ratings, they both have the same time-current trip characteristic. Whether the downstream device is fully rated or series rated, coordination and selectivity remain the same.

Series Rated System - How It Works

Series ratings work on the principle of adding impedance into the faulted circuit. In a major fault situation, both the upstream and the downstream devices will open. The simultaneous opening of both devices introduces impedance into the circuit, which reduces the let-through energy to a value that can be safely cleared. It is this added impedance that allows a lower rated device to be safely used in situations where a higher fault current is available. However, the let-through energy cannot be accurately calculated by theory. Therefore, the manufacturer must specifically test each combination. Each of these tests must be witnessed by a CSA representative and each safe combination must be clearly identified on the end use, downstream equipment to help prevent misapplication of an added device later on by the end user.

It must be emphasized that great care must be taken by the designer, the installer and later on by the end user to confirm that the correct devices have been chosen to ensure the equipment can safely withstand a bolted fault situation.

Series Rated Panelboard Labels

Downstream panelboards installed with branch circuit breakers that are used in series rating applications must be clearly labelled to indicate the following:

- panelboard type
- operating voltage
- fully rated integral main or upstream device type
- approved lower rated branch breaker type

Replacement of breakers in series rated panelboards must be based on breakers listed on the panelboard series rating label. These specific breaker combinations are based on approved test results. Careful attention must be given to these labels.

Examples of various manufacture series rating labels:

Max. Fault Level Available (ka sym.)		Tenant/Remote/ Panel Main Breakers	Suite Panel Breakers	Main or Upstream Breaker Type			
				400A	600A	800A	1200A
22	BR/BQL (15-100)	DNPL/ CHNT, BR/CH, GFGB/CH_GF, BR_AF/BR_GF/CH_AF/CH_AFGF	DK, KD, HKD	-----	-----	-----	-----
	BRH, HBQL, CHH-H2, ED	DNPL/ CHNT, BR/CH, GFGB/CH_GF, BR_AF/BR_GF/CH_AF/CH_AFGF	-----	-----	-----	-----	-----
42	BR/BQL (15-70)	DNPL/ CHNT, BR/CH, GFGB/CH_GF, BR_AF/BR_GF/CH_AF/CH_AFGF	DK, KD, HKD	-----	-----	-----	-----
	BRH, HBQL, CHH-H2, ED	DNPL/ CHNT, BR/CH, GFGB/CH_GF, BR_AF/BR_GF/CH_AF/CH_AFGF	DK, KD, HKD	LD	-----	-----	-----
	BRHH, CHH-H4, ED	DNPL/ CHNT, BR/CH, GFGB/CH_GF, BR_AF/BR_GF/CH_AF/CH_AFGF	DK, KD, HKD	LD	MC, MDL	ND, HND, NDC	-----
65	BRHH, ED	DNPL/ CHNT, BR/CH, GFGB/CH_GF, BR_AF/BR_GF/CH_AF/CH_AFGF	DK, KD, HKD	LD	MC, MDL	ND, HND, NDC	-----

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Max. Fault Level Available (kA Sym.)		Branch Breakers	Poles/ Amps	Integral Main or Upstream Breaker Type			
				125A	200A	225A	400A
22	NC	1P 15-50A 2P 15-50A	1C (60-125A) NAH, NBH	2C, FKD	FKD	FKD	CJL-E
	NA, NAGF	1P 15-50A 2P 15-125A 3P 15-100A					
25	NC	1P 15-50A 2P 15-50A	FKD, CE-E	FKD	FKD	FKD	CJL-E
	NA, NAGF	1P 15-50A 2P 15-125A 3P 15-100A					
65	NC	1P 15-50A 2P 15-50A	FKG, CE-E	FKG	FKG	FKG	CJL-E
	NA, NAGF	1P 15-50A 2P 15-125A 3P 15-100A					
100	NC	1P 15-50A 2P 15-50A	CE-N	CJL-H	CJL-H	CJL-H	CJL-H
	NA, NAGF	1P 15-50A 2P 15-100A 3P 15-100A					
200	NC	1P 15-50A 2P 15-50A	n/a	CJL-H	CJL-H	CJL-H	CJL-H
	NA, NAGF	1P 15-50A 2P 15-125A 3P 15-100A					

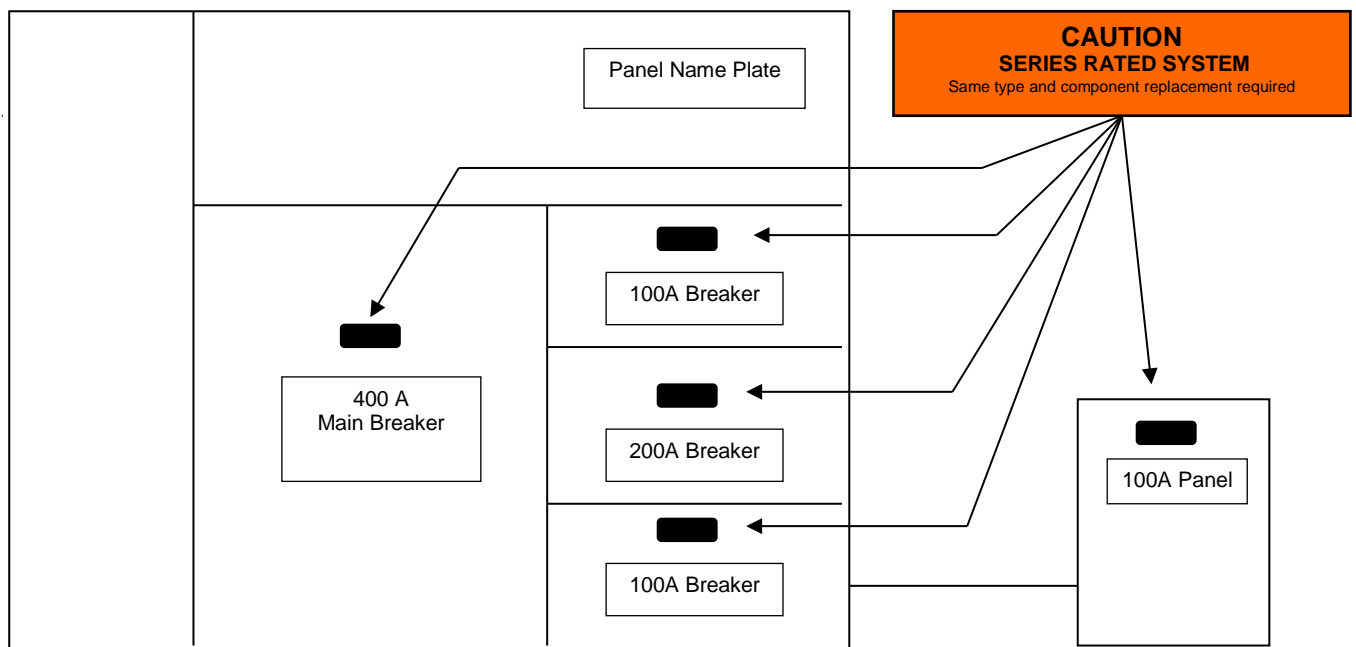
City of Surrey Requirements

Prior to requesting service connection approval from the City of Surrey the Electrical Contractor is responsible for the following:

- Provide the Electrical Safety Officer with the maximum available fault current level. A one line drawing sealed by a professional engineer indicating available fault current levels at all distribution points will be required. The electrical safety officer may request calculations to be submitted as proof of fault current ratings.
- For a Fully Rated System, be prepared to provide evidence all breakers have a rating equal to or greater than the maximum available fault current.
- For a Series Rated System, indicate which manufacture approved series rated combination is being used. This can be accomplished by submitting a copy of the manufacture series rating label and simply circling or high lighting which o/c combination is to be used. This will facilitate the Electrical Safety Officer in verifying the installation is compliant with all applicable regulations. Please note above example.
- For Series Rated Systems, ensure the equipment manufactures supplied "Caution" labels have been applied beside each breaker type as required by BCEC rule 14-0014 (e). See below for an example:



Label Location for Series Rated System:



22nd Edition of the BCEC States:

14-012 Ratings of protective and control equipment (see Appendix B)

In circuits of 750 V and less,

- (a) electrical equipment required to interrupt fault currents shall have ratings sufficient for the voltage employed and for the fault current that is available at the terminals; and
- (b) electrical equipment required to interrupt current at other than fault levels shall have ratings sufficient for the voltage employed and for the current it must interrupt.

14-014 Series rated combinations (see Appendix B)

Notwithstanding Rule 14-012(a), a moulded case circuit breaker shall be permitted to be installed in a circuit having an available fault current higher than its rating, provided that

- (a) the circuit breaker is a recognized component of an approved series rated combination;
- (b) it is installed on the load side of an overcurrent device that has an interrupting rating at least equal to the available fault current;
- (c) the overcurrent device on the line side of the lower rated circuit breaker is as specified on the equipment in which the lower rated circuit breaker is installed;
- (d) the equipment in which the lower rated circuit breaker is installed is marked with a series combination interrupting rating at least equal to the available fault current; and
- (e) the overcurrent devices installed in a series rated combination are marked at the time of installation in a conspicuous and legible manner to indicate that they must be replaced only with components of the same type and rating.