

# INSPECTION FORM: Series Rated Combination

ISSUED BY: \_\_\_\_\_

This form provides documentation to assure compliance with the following National Electrical Code®, NFPA 70, sections on the use of Series Rated Combinations: **110.9, 110.22 & 240.86**

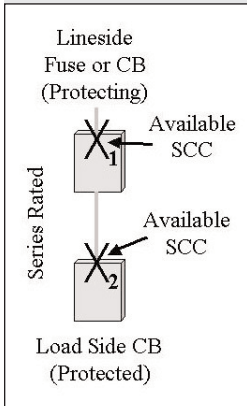
JOB # \_\_\_\_\_

NAME: \_\_\_\_\_

LOCATION: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

## ESSENTIAL INFORMATION:



**Line Side Panel Designation (If applicable)** \_\_\_\_\_

Line Side Overcurrent Protective Device Part Number \_\_\_\_\_

Line Side Overcurrent Protective Device Interrupting Rating \_\_\_\_\_

**X<sub>1</sub>** Available Short Circuit Current at Line side OCP Device \_\_\_\_\_

**Load Side Panel Designation** \_\_\_\_\_

Load Side Circuit Breaker Part Number \_\_\_\_\_

Load Side Circuit Breaker Individual Interrupting Rating \_\_\_\_\_

Series Combination Interrupting Rating \_\_\_\_\_

**X<sub>2</sub>** Available Short Circuit Current at Load side Circuit Breaker \_\_\_\_\_

## Compliance Checklist

*(For further information see discussion on reverse side for each item)*

### 1. Short-Circuit Currents

Is the interrupting rating of the line side fuse or circuit breaker greater than the available short-circuit current (**X<sub>1</sub>**) at its lineside (110.9)  YES  NO

Is the series combination interrupting rating greater than the available short-circuit current (**X<sub>2</sub>**) at the load side circuit breaker (permitted per 240.86)?  YES  NO

### 2. Manufacturer's Label

Are both devices in use for the series rated combination marked on the end use equipment in which the load side circuit breaker is installed (or contained in a booklet affixed to the equipment) as required in 240.86(A)?  YES  NO

### 3. Field Installed Label

Are field labels, as required by 110.22, that indicate "CAUTION – Series Rated Combination", along with the required replacement parts, panel designations, and series combination interrupting rating, installed on all end use equipment that contain the series combination rating devices?  YES  NO

### 4. Motor Contribution

If motors are connected between the series rated devices, is the combined full load current from these motors less than 1% of the downstream circuit breakers' interrupting rating (individual or stand alone interrupting rating) per 240.86(B)?  YES  NO

### 5. Selective Coordination

Is this series rated combination being installed in something other than a health care facility (see NEC® 517.17)?  YES  NO

Elevator circuits only: Is this series rated combination being installed on an elevator circuit with only one elevator in the building (see NEC® 620.62)?  YES  NO

**AN ANSWER OF "NO" TO ANY OF THESE QUESTIONS MAY INDICATE A LACK OF COMPLIANCE. LACK OF SUBMITTAL IS CONSIDERED AS EVIDENCE OF LACK OF COMPLIANCE.**

# Series Rated Combination

## What is a Series Rated Combination?

A combination of two devices, that have been tested under specific test conditions that work together to clear a fault. The allowed combinations are limited to those that have been selected by the circuit breaker manufacturer for testing. Only tested combinations can be used.

**CAUTION: A series rated combination allows a load side circuit breaker to be applied where the available short circuit current exceeds the interrupting rating marked on that circuit breaker.**

## BACKGROUND TO CHECKLIST ITEM

### 1) Short-Circuit Currents

The series combination interrupting rating must be greater than the available short-circuit current at the load side circuit breaker (240.86) and the interrupting rating of the line side fuse or circuit breaker must be greater than the available short-circuit current at its line terminals (110.9).

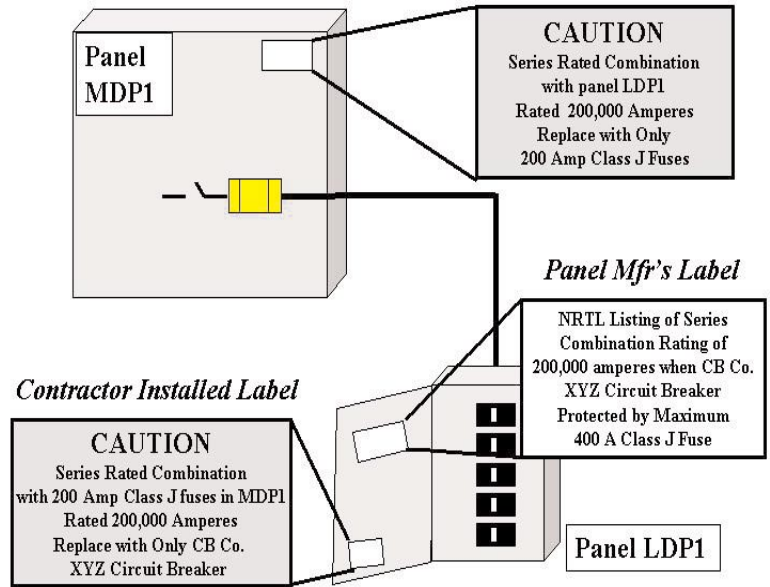
### 2) Manufacturer's Label

Since the use of series rated combinations are limited to specific combinations that have been tested, the end use equipment is required to be marked, by the **manufacturer**, per 240.86(A) of the 2002 NEC®. Since there are hundreds of combinations, this marking may be in a book that is affixed to the end use equipment, as allowed in UL67. The manufacturer's marking is used to verify that both devices are part of a recognized series rated combination, the panelboard is listed for use with the combination, and that the series combination interrupting rating is sufficient for the available short circuit current. This label also provides guidance for future upgrades as to the specific replacement devices that are allowed.

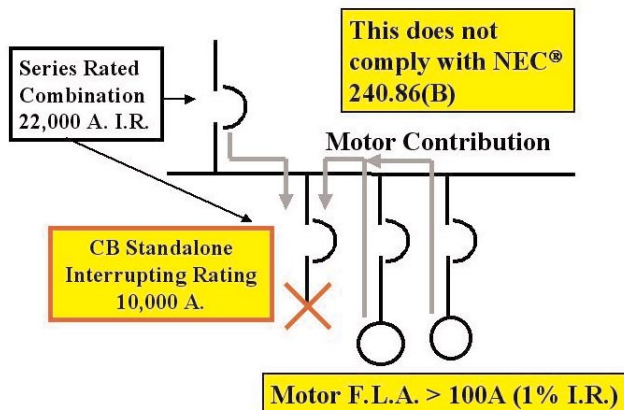
### 3) Field Installed Label

110.22 of the 2002 NEC® requires the **installer** to apply a field caution label warning that a series rated combination is being used. This label must be applied on the panel containing the series rated combination or on both pieces of electrical equipment if the line side device is located separate from the load side circuit breaker to assure that the proper devices have been installed and that proper future replacements are made. The inspector can check the devices noted on the field label required by 110.22 against the tested and listed series rated combinations marked on the panelboard or switchboard by the manufacturer per 240.86.

### 110.22 & 240.86(A) Labeling



## Series Rated Combination



### 4) Motor Contribution

A series rated combination is evaluated under specific testing conditions of which motor contribution is not a part of the criteria. If a motor(s) were connected in the middle of the combination, it would supply extra fault current that did not exist when the combination was tested. 240.86(B) of the 2002 NEC® addresses this by prohibiting the use of series rated combinations when the sum of the full load current of the motors exceeds 1% of the interrupting rating marked on the **LOAD SIDE** circuit breaker. For example, if the load side circuit breaker is rated 10,000 A.I.R., with motor loads exceeding 100 amps, then a series rated combination could not be used. For other than lighting panels, it is necessary to investigate the protected circuit breaker of a series combination to insure that the protected circuit breaker's individual interrupting rating complies with 240.86(B). For other than lighting panels, it is advisable not to utilize series rated combinations for building spaces where the loads may change during the life of the electrical system. If more motor loads are added, the series combination rating for that application could be negated.

### 5) Selective Coordination

A disadvantage of a series rated combination is that, by definition, for fault conditions the line side (protecting) device must open at the same time, and in conjunction with, the load side (protected) circuit breaker. This means that the entire panel loses power because the device feeding the panel must open under medium to high level short-circuit conditions. For life and safety reasons, the NEC® requires selective coordination in some applications. Main to feeder series rated combinations do not meet the requirements of 517.17 in health care facilities. Series rated combinations do not meet 620.62 for elevator circuits that contain more than one elevator. Series rated combinations would reduce the overall system reliability of emergency circuits as presented in 700.25 FPN because of their inherent lack of fault current coordination.