

# FORM FOR PROPOSALS FOR 2011 NATIONAL ELECTRICAL CODE®

## INSTRUCTIONS — PLEASE READ CAREFULLY

Type or print **legibly** in **black ink**. Use a separate copy for each proposal. Limit each proposal to a **SINGLE** section. All proposals **must be received by NFPA by 5 p.m., EST, Friday, November 7, 2008**, to be considered for the 2011 National Electrical Code. Proposals received after 5:00 p.m., EST, Friday, November 7, 2008, will be returned to the submitter. If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

**For technical assistance, please call NFPA at 1-800-344-3555.**

## FOR OFFICE USE ONLY

Log #: \_\_\_\_\_

Date Rec'd: \_\_\_\_\_

Please indicate in which format you wish to receive your ROP/ROC  electronic  paper  download  
(Note: If choosing the download option, you must view the ROP/ROC from our website; no copy will be sent to you.)

Date 11/3/08 Name Paul A. Keleher Tel. No. 978-838-2457  
Company Paul Keleher Electrical Services Email pakeleher@gmail.com  
Street Address 35 Barnes Hill Road City Berlin State MA Zip 01503

Please indicate organization represented (if any) \_\_\_\_\_

1. Section/Paragraph Proposed new paragraph (5) Permissible Voltage Drop added to 210.19(A) Conductors- Minimum ampacity and Size.

2. Proposal Recommends (check one):  new text  revised text  deleted text

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted): [Note: Proposed text should be in legislative format; i.e., use underscore to denote wording to be inserted (inserted wording) and strike-through to denote wording to be deleted (~~deleted wording~~).]

### **210.19 Conductors- Minimum Ampacity and size (A) Branch Circuits Not More Than 600 Volts.**

(5) **Permissible Voltage-Drop.** The circuit conductors of a 15 or 20-ampere/120-volt branch circuit shall be sized such that voltage-drop measured at the rated ampacity of the circuit shall be 5% or less at any outlet.

*Exception No. 1: Use of non-standardized circuit breakers in compliance with 240.4 shall be permitted on circuits supplying dedicated loads with high inrush or motor starting current where a circuit breaker meeting the requirements of this section can be shown to nuisance trip.*

*Exception No. 2: Where 240.3 or 240.4(G) applies.*

**FPN:** Standard 120/240V circuit breakers rated from 15-50A that are listed to meet the overcurrent protection requirements of 240.4 contain a nonadjustable, instantaneous trip mechanism whose current setting will open the circuit within 1 cycle of being subjected to an overcurrent equal to or greater than 20 times their rated current. A full-load voltage drop measurement of 5% on a 120V branch circuit allows the system to deliver at least 20 times the rated current of the circuit to a short-circuit or bolted fault, ensuring that the circuit breaker's instantaneous mechanism will respond in compliance with other requirements of this Code.

4. **Statement of Problem and Substantiation for Proposal:** (Note: State the problem that would be resolved by your recommendation; give the specific reason for your Proposal, including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

CMP-2 rejected a proposal in the last cycle to make 210.19(A), FPN 4 mandatory with the statement, "it is not clear from the substantiation that making the fine print note mandatory will reduce electrical fires". The present proposal is substantiated by a sample of >1000 in-situ short-circuit tests conducted at 15-20A/120V receptacle outlets selected at random in dwelling units across the US.<sup>1</sup> This data substantiates the claim of the previous submitter and this proposal that limiting voltage drop at outlets is necessary to provide effective protection against branch circuit fault current.

Analysis of the test data shows that:

1. At more than 1/2 of the outlets in the sample, the breaker failed to trip instantaneously.
2. In nearly 20% of those tests where the instantaneous trip failed, the value of I<sup>2</sup>T conductor heating recorded by the test exceeded the maximum safe limit according to accepted industry standards for conductor heating in insulated cables<sup>2</sup>, potentially compromising the insulation when power to the circuit is restored.

3. In ALL tests where the breaker did respond instantaneously, conductor heating was limited to levels far below the safe threshold, safely preventing conductor overheating during fault conditions.

Furthermore, this failure in circuit breaker performance violates the requirements of section 250.4(A)(5) and other sections of the NEC.<sup>3</sup> In 2005 CMP- 5 added several new sections and notes to the NEC, all reinforcing the intent of the CMP regarding the purpose of the equipment-grounding conductor in a circuit. 250.4(A)(5) is an extraordinary requirement in that explanatory language usually reserved to a non-mandatory Fine Print Note is here made MANDATORY TEXT. The intent of these requirements and the extraordinary emphasis it has placed on them is to make clear to installers of electrical circuits that an equipment-grounding conductor must be a "...permanent, low impedance circuit facilitating the operation of the overcurrent device...". The Panel has indicated its intent in 250.4(A)(5) is for an OCPD to operate "as quickly as possible," which for a thermal/magnetic circuit breaker means it must respond magnetically. The published time/current curves of the 5 dominant lines of 120/240V, 15-50A standard circuit breakers used to meet the requirements of 240.4 all show the magnetic response mechanism in a circuit breaker, when engaged, will clear the circuit in 1-cycle (.167 seconds). Therefore, the intent of NEC Section 250.4(A)(5) is to assure that a fault to the equipment-grounding conductor will trigger the magnetic response of a thermal/magnetic circuit breaker. The data indicates that the intent of 250.4(A)(5) is not met at more than half of 15 and 20A/120V outlets.

NEC Section 240.9 (Thermal Devices) prohibits the use of thermal devices as protection from short circuits or ground faults. Although intended to clarify the proper use of thermal overload relays in motor applications, 240.9 says in part, "thermal relays and other devices not designed to open short circuits or ground faults shall not be used for the protection of conductors against overcurrent due to short circuits or ground faults." So, when the magnetic (instantaneous) trip mechanism in a thermal/magnetic circuit breaker fails to engage in response to a short circuit or ground fault at an outlet, leaving the thermal device as the sole response mechanism, this thermal device is being used as de facto protection of conductors against a short circuit or ground fault, in violation of 240.9.

Referring to the chart accompanying this proposal<sup>4</sup>, the system supplying any outlet on a 120V branch circuit that exhibits a voltage-drop of 5% or less when measured at the full rated load of the circuit as stipulated in the proposal, will deliver sufficient current to a short circuit or ground fault to trigger a magnetic (instantaneous) circuit breaker response, provided that response is set to trigger at 20X its current-rating or less, as products installed to meet the requirements of Section 240.4 presently do. A proposal presently under evaluation by UL/STP-489 will, if accepted, assure that the circuit breaker performance described in the proposed Fine Print Note is assured in the future for all OCPD devices installed to meet the overcurrent protection requirements of 240.4.

The result of this coordination is that all 15 and 20A/120V outlets are assured of an instantaneous breaker response to fault current, putting to rest the questions raised by the test data and assuring compliance with 250.4(A)(5) and 240.9 for 15-20A/120V outlets.

The data supporting this proposal shows how the failure of circuit breakers to respond instantaneously to fault-level overcurrent creates a safety issue based on accepted engineering standards that the NEC should address. Accordingly, the submitter urges the NEC to accept this proposal and put the safety questions raised by the test data to rest.

#### 5. Copyright Assignment

- (a)  I am the author of the text or other material (such as illustrations, graphs) proposed in this Proposal.
- (b)  Some or all of the text or other material proposed in this Proposal was not authored by me. Its source is as follows (please identify which material and provide complete information on its source):

---

*I agree that any material that I author, either individually or with others, in connection with work performed by an NFPA Technical Committee shall be considered to be works made for hire for the NFPA. To the extent that I retain any rights in copyright as to such material, or as to any other material authored by me that I submit for the use of an NFPA Technical Committee in the drafting of an NFPA code, standard, or other NFPA document, I hereby grant and assign all and full rights in copyright to the NFPA. I further agree and acknowledge that I acquire no rights in any publication of the NFPA and that copyright and all rights in materials produced by NFPA Technical Committees are owned by the NFPA and that the NFPA may register copyright in its own name.*

Signature (Required)

*Paul A. Keleher*

---

**PLEASE USE SEPARATE FORM FOR EACH PROPOSAL • email: [proposals\\_comments@nfpa.org](mailto:proposals_comments@nfpa.org) • NFPA Fax: (617) 770-3500**  
**Mail to:** Secretary, Standards Council, National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471

---

<sup>1</sup> See supporting document: RESIDENTIAL CIRCUIT BREAKER RESPONSE DATA-by I2T.pdf

<sup>2</sup> See supporting document: Soares Grounding and Bonding- pp. 203-207.pdf

<sup>3</sup>See supporting document: "NEC 250.4(A)(5) et al.pdf"

<sup>4</sup>See supporting document: "Branch Circuit VD-ASCC-I2T"