National Fire Protection Association

1 Batterymarch Park, Quincy, MA 02169-7471
Phone: 617-770-3000 • Fax: 617-770-0700 • www.nfpa.org

AGENDA

NEC Code-Making Panel 2

Report on Comment Meeting

November 28-December 1, 2012

Redondo Beach, CA

Item No.	Subject
12-11-1	Call to Order
12-11-2	Introduction of Members and Guests
12-11-3	Review of Meeting Procedures and Revision Schedule
12-11-4	Approval of ROP Meeting Minutes
12-11-5	Task Group Reports (if any)
12-11-6	Processing of Comments
12-11-7	Fire Protection Research Foundation Requests
12-11-8	Old Business
12-11-9	New Business
12-11-10	Adjournment

NATIONAL ELECTRICAL CODE
CODE-MAKING PANEL ___2____

Report on Proposals Meeting

Minutes

1. List date(s) and location of meeting:

CMP-2 met from January 16 - 19, 2009 at the Crowne Plaza Hilton Head, SC Task Groups 1, 2 & 3 met on Monday, January 16, 2012 and the full panel met from Tuesday, January 17 - Thursday January 19, 2012.

2. List names of guests in attendance:

See the attached attendance sheet.

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3. List names of guests addressing the Panel, the subject of their address, and the length of time they spoke:

January 17, 2012:

Paul Hamer spoke on Three-Phase Ground-Fault Circuit-Interrupter System Protection for Personnel. This presentation was regarding Proposals 2-7, 2-59 and 2-216. Mr. Hamer spoke for 10 minutes and there was an additional 5 minutes for a total of 15 minutes.

Michael Anthony and Jim Harvey spoke on their proposed revisions to the calculations required by Article 220. This presentation was on Proposals 2-218, 222, 224, 227, 228, 231, 235, 249, 250, 255 and 256. Mr. Anthony and Mr. Harvey spoke for 12 minutes and there was an additional 15 minutes of questions from the panel. The total time was 28 minutes.

January 18, 2012:

Travers Lindsey spoke on his proposals, 2-133, 212 and 213, regarding voltage drop in branch circuits and feeders. Mr. Lindsey spoke for 5 minutes and there was an additional 5 minutes of questions from the panel members. The total time was 10 minutes.

Paul Brazis, from Underwriters Laboratories presented an overview of the UL Report on the Effectiveness of Circuit Breakers in Mitigating Parallel Arcing Faults in the Home Run. Mr. Brazis spoke for 10 minutes and there was an additional 15 minutes of questions from the panel members. The total time was 25 minutes.

Thomas Domitrovich also spoke on the UL Report on the Effectiveness of Circuit Breakers in Mitigating Parallel Arcing Faults in the Home Run. Mr. Domitrovich spoke for 10 minutes and there was an additional 5 minutes of questions from the panel members. Total time was 15 minutes.

Jay Broniak spoke on proposals 2-47, 58, 80, regarding expanding the AFCI and GFCI requirements to circuits supplying laundry areas and dishwashers. Mr. Broniak spoke for 5 minutes and there was an additional 5 minutes of questions from the panel members. The total time was 10 minutes.

January 19, 2012:

Edoardo Roncone and Alain Lancereau spoke on Proposal 2-126 regarding GCI Technology. Mr. Roncone and Mr. Lancereau spoke for 10 minutes and there was an additional 2 minutes of questions from the panel members. The total time was 12 minutes.

4. Number of Proposals or Comments acted upon: 274

5. Number of Panel generated Proposals or Comments: 13 panel proposals

6. Appointments of any Task Groups that will be working on any Panel subject, subsequent to the Panel Meeting, along with the names of members of the Task Group(s):

N/A

7. List any request contained In a Panel Statement that requires Technical Correlating Committee attention:

8. List any Panel actions that, in your opinion, need to be referred to another Panel(s) for correlation:

The Panel requests that Proposal 2-60 is forwarded to Panel 9 for comment.

9. List any Proposals or Comments that should be referred to the Toxicity Advisory Committee:

N/A

10. List all Proposals or Comments related to combustibles in plenums or other air handling spaces:

N/A

11. List any general Panel requests for information or assistance from the Technical Correlating Committee:

N/A

12. List any additional information that you feel would be helpful to the Technical Correlating Committee, staff, or to the process in general:

N/A

13. Were any units of measure "Accepted" by the panel that are not listed in Annex C of the NEC Style Manual? If so, please list the section number(s) and proposal/comment number(s) below:

N/A

14. Identify any issues that should be brought to the attention of the NFPA Research Foundation for their input and assistance:

The Panel requested the information in Proposals 2-218, 222, 224, 227, 228, 231, 235, 249, 250, 255 and 256 is forwarded to the NFPA Research Foundation for consideration as a project. The panel has received numerous proposals and comments over the last few NEC cycles regarding the use and application of Article 220. This was the case again this cycle. Submitters are alleging Article 220 requirements do not align with energy codes and require significantly larger equipment than is actually necessary. They indicate this is especially true when you look at how large campus style and commercial electrical installations operate.

Sign-In Sheet
Code-Making Panel 2

NEC ROP Meeting
Hilton Head, SC
January 16-21, 2012

Name	Office	Organization	Signature	Staying at hotel	Days 1	2	3	4	5
Hilbert, Mark	Chair	International Association of Electrical	Mark R. Hilbert	Yes	✓	✓	✓	✓	
Boynton, Charles	Principal	American Chemistry Council	Charles Boynton	Yes		✓	✓	✓	✓
Coluccio, Frank	Principal	New York City Department of Buildings	Frank Coluccio	YES	✓	✓	✓	✓	
Duren, Ronald	Principal	Electric Light & Power Group/EEI	Ronald E Duren	Yes	✓	✓	✓	✓	✓
Harman, Thomas	Principal	University of Houston-Clear Lake	T Harman	YES	✓	✓	✓	✓	✓
King, Donald	Principal	International Brotherhood of Electrical	Donald King	yes	✓	✓	✓	✓	✓
LaRocca, Robert	Principal	Underwriters Laboratories Inc.	Robert LaRocca	yes	✓	✓	✓	✓	✓
Orlowski, Steven	Principal	National Association of Home Builders	Steven Orlowski	yes	✓		✓	✓	✓
Pauley, Jim	Principal	National Electrical Manufacturers	James Pauley	Yes	✓	✓	✓	✓	✓
Wilkinson, Robert	Principal	Independent Electrical Contractors, Inc.	Robert Wilkinson	yes	✓	✓	✓	✓	
Wood, Thomas	Principal	National Electrical Contractors Association	T. H. Wood	yes	✓	✓	✓	✓	✓
Benninger, Jacob	Alternate	International Brotherhood of Electrical	Jacob Benninger	Yes	✓	✓	✓	✓	✓
Brown, Lawrence	Alternate	National Association of Home Builders	Lawrence Brown	No	✓	✓	✓	✓	✓
Dini, David	Alternate	Underwriters Laboratories Inc.	David Dini	yes	✓	✓	✓	✓	✓
Kissane, Daniel	Alternate	National Electrical Manufacturers	Daniel Kissane	YES	✓	✓	✓	✓	✓
McCorcle, William	Alternate	Electric Light & Power Group/EEI	William McCorcle	yes		✓	✓	✓	✓
McGovern, William	Alternate	International Association of Electrical	Bill McGovern	Yes	✓	✓	✓	✓	✓
Thorwegen, Stephen	Alternate	Independent Electrical Contractors, Inc.	Stephen J. Thorwegen	Yes	✓	✓	✓	✓	✓
Burr, William	Nonvoting Member	Canadian Standards Association						✓	
Lee, Douglas	Nonvoting Member	US Consumer Product Safety Commission	Doug Lee	Yes	✓	✓	✓	✓	✓
Trotta, Andrew	Alt. to Nonvoting	US Consumer Product Safety Commission	Andrew Trotta	Yes	✓	✓	✓	✓	

Sign-In Sheet
Code-Making Panel 2

NEC ROP Meeting
Hilton Head, SC
January 16-21, 2012

Name	Office	Organization	Signature	Staying at hotel	Days 1	2	3	4	5
Earley, Mark	Staff Liaison	National Fire Protection Association			✓	✓	✓	✓	

Guests:

Name	Office	Organization	Signature	Staying at hotel	Days 1	2	3	4	5
Jean Blanc	NFPA / Electrical	NFPA		✓	✓	✓	✓	✓	✓
Jeff Sargent	NFPA Staff	NFPA				X	✓	✓	
John Maddrick		IEC		✓		✓	✓	✓	
George Ockerlly		Cooper		✓		✓	✓	✓	
Bill Grande		Leviton		✓		✓	✓	✓	
Jay Broniak		GE		✓	✓	✓	✓	✓	✓
Joseph DeBartolo	Shelton, CT	Hubbell Inc.		✓	✓	✓	✓	✓	✓
Bob Simon	Shelton, CT	Hubbell Inc.		✓	✓	✓	✓	✓	✓
Lanson Relyea	Pittsburgh, PA	Eaton			✓	✓	✓	✓	
Thomas Domitrovich	Pittsburgh, PA	Eaton		✓	✓	✓	✓	✓	
Fernando Pacheco	PA, Chile	Methanex.		✓	X	X	X	X	X
Darron Lacey	Peachtree City GA	Cooper Wiring Devices		✓	X	X	X	✓	
Keith Lofland		IAEI		Yes	X	X	X	X	X
Joe Andre		NEMA		Y		X	✓	✓	

Sign-In Sheet

Name	Office	Organization	Signature	Staying at hotel	Days 1	2	3	4	5
Earley, Mark	Staff Liaison	National Fire Protection Association							

Guests:

Name	Office	Organization	Signature	Staying at hotel	Days 1	2	3	4	5
Stephen Rood	Syracuse, NY	Legrand / Pass + Seymour		X	X	X	X	X	X
John Young	Norcross GA	Siemens Industry		✓	✓	✓	✓	✓	
VINCE SAPORITA	ST. LOUIS	COOPER BUSSMANN		X		X	✓	✓	
BRIAN E. ROCK	SHELTON CT	HUBBELL INCORPORATED				✓	✓	✓	
						✓	✓	✓	
Palmer Hickman		IBEW		X		✓	✓	✓	
THOMAS PACKARD	SYRACUSE, NY	LEGRAND/ PASS & SEYMOUR		X		✓		✓	
David Hewitt	Norcross, GA	Siemens Industry Inc.		X			X	✓	
KEN KEMPE	NORCROSS, GA	SIEMENS INDUSTRY		X			X	✓	
Steve CAMPOLO	Melville, NY	LEVITON					X	✓	
PAUL HAMER	Richmond, CA	CHEVRON ENERGY TECHN. CO.		X			X	✓	
Matt Norlander	Richmond, CA	Chevron U.S.A.		X			X	✓	
Christel Hunter	Las Vegas NV	Alcan Cable					X	✓	✓
RANDY HUNTER	" " "	Bussman					X	✓	

Sign-In Sheet

Name	Office	Organization	Signature	Staying at hotel	Days 1	2	3	4	5
Earley, Mark	Staff Liaison	National Fire Protection Association							

Guests:

Name	Office	Organization	Signature	Staying at hotel	Days 1	2	3	4	5
TRAVIS LINDSEY	GUEST	TLCS, INC					✓	✓	
Bobby Gray	Guest	H-B, INC					✓	✓	
Dennis Addison	GUEST	ITW/DEVCON						✓	
Chuck Kurten	Guest	UL					✓	✓	
PAUL BRADY	GUEST	UL LLC					✓	✓	
E Trent	GUEST	NECA		YES			✓	✓	
Patrick Salas	Guest	GE		Y			✓	✓	✓
Donny Cook	Shelby County								
MIKE Holt	Guest	Self		Ys	✓	✓	✓	✓	✓
JODY GREENWOOD	~~ATTENDEE~~	NCC							
Rob Foster		IDAHO		—				✓	✓
Alain LANCEREAU	GUEST	C-JOULE Effect		Yes				✓	
EDOARDO RONCONE	GUEST	C JOULE EFFECT INC		YES				✓	
MIKE JOHNSTON	GUEST	NFPA		YES				✓	

2-1 Log #1339 NEC-P02 Final Action:
(100.Demand Factor)

Submitter: James E. Degnan, Sparling
Comment on Proposal No: 2-6
Recommendation: Add text to read as follows:
Demand Factor. The ratio of maximum demand of a system , or part of a system, to the total connected load of a system or the part of the system under consideration. Since demand load cannot be greater than the connected load, the demand factor cannot be greater than unity.
Substantiation: If CMP 2 chooses to reject this proposal the submitter would be appreciative if the panel would answer the following question in their substantiation statement: "Can a demand factor be greater than 1.0?" On the other hand the submitter would also be entirely gracious if the proposal is accepted.
The Panel is requested to consider two documents: The NEC Style manual and the definition of "demand factor" in the IEEE Standard Dictionary of Electrical and Electronic Terms.
From the NEC Style manual: "3.3.4 Word Clarity. Words and terms used in the NEC shall be specific and clear in meaning, and shall avoid jargon, trade terminology, industry-specific terms, or colloquial language that is difficult to understand. "
From IEEE Standard Dictionary of Electrical and Electronic Terms (IEEE 100-2000, 7th Edition):
"demand factor (1) (power operations) The ratio of the maximum coincident demand of a system, or part of a system, to the total connected load of the system , or part of the system under consideration. (PE/PSE)
(2) (electric power systems in commercial buildings) The ratio of the maximum demand of a system to the total connected load of the system. Notes: 1. Since demand load cannot be greater than the connected load, the demand factor cannot be greater than unity. 2. Those demand factors permitted by the NEC (for example services and feeders) must be considered in sizing the electric system (with few exceptions this is 100%); otherwise the circuit may be sized to support the anticipated load. (IA/PSE)
(3) The ratio of the maximum coincident demand of a system or part of a system, to the total connected load of the system, or part of the system, under consideration. The resultant is always 1 or less and can range from 0.8 to 1 to as low as 0.15 to 0.25 for some plants with very low diversity.(IA/PSE)
(4) The ratio of operating load demand of a system , or part of a system, to the total connected load of the system, or part of the system, under consideration. (IA/MT)."
In the above IEEE 100 text the parenthetic acronyms at the end of the definition help identify the source or usage of the definition, with PE denoting Power Engineering, which is typically a utility environment, and IA denoting Industrial Applications, which is typically a customer environment addressed by the suggested application of the NEC.
In substantiation for rejecting the original proposal CMP2 noted that the NEC definition is consistent with the IEEE definition, which it is, except two of the three (IA) sources in the IEEE definition also makes it clear that the demand factor is less than unity. This was the same intent of the original proposal which added the definition of a "demand load " as a load less than the connected load, which would result in the demand factor being less than unity.
Without further clarification as offered by IEEE, "demand" or "demand factor" could be interpreted in different ways. For example , some industry participants will say that the requirement in NEC-210.19 for branch circuits to be rated at 125% of the continuous load is a "demand factor" resulting in a demand factor greater than unity. Others will say that it is not, and that "Demand or Demand Factor" should be used consistent with the usage of the term by IEEE. The use of "demand" when "demand load" is intended constitutes jargon. Accordingly "demand factor" needs clarification per the style manual.

The proposed text is in keeping with the concept of the original proposal, and is not new material, it just rewords the proposal to align with IEEE, for which the panel indicated an affiliation. Acceptance of this wording or the original proposal meets my intent.
Appendix: IEEE's web site notes that IEEE-100 has been superseded, the document is no longer available, I believe the 7th edition was the last version of IEEE-100 published. IEEE had the various working groups that make up the organization create their individual definitions and terms, because many terms had meanings that were dependent on specific applications. From the perspective of the power/industrial/commercial users, the closest replacement document is IEEE SA 1459-2010 "IEEE Standard Definitions for the Measurement of Electric Power Quantities Under Sinusoidal, Nonsinusoidal, Balanced, or Unbalanced Conditions" but this new document has no definitions for demand, demand factor, connected load, etc., it mostly focuses on the math associated with the terms used in the title. Without IEEE publishing a current document defining these terms the NEC must stand alone on its content.

2-2 Log #264 NEC-P02 **Final Action:**

(100.Uninfinished Basement (New) and 210.8(A)(5))

Submitter: Code-Making Panel 3,
Comment on Proposal No: 2-10
Recommendation: Continue to Reject Proposal 2-10.
Substantiation: Code-Making Panel 3 agrees with the action taken by Code-Making Panel 2 on Proposal 2-10.

This comment was developed by a CMP-3 Task Group and balloted through the entire panel with the following ballot results:
15 Eligible to Vote
13 Affirmative
2 Ballots Not Returned (A.D. Corbin and D.T. Mills)
No Comments on Vote were received

2-3 Log #978 NEC-P02 **Final Action:**

(210.2 (New))

Submitter: Charles J. Palmieri, Town of Norwell
Comment on Proposal No: 2-11
Recommendation: The panel should reconsider this opportunity to provide clarity to installers and inspectors alike by providing a definition of when renovations constitute a circuit modification that compels the installer to install AFCI Protection. I continue to suggest the following language. From the previous proposal. Re-locate and re-number the existing language of 210.2 and install the following definition. New Definition as 210.02 Definitions.
Modifications (Circuits). For the purpose of this article the term modifications shall include changes to an existing structures branch circuit wiring installation, which results in the replacement, relocation or extension for the purpose of serving outlets or utilization equipment. The term modifications in this section shall not apply to short sections of spliced conductors consistent with panelboard, device or luminaire replecement.
Substantiation: I am submitting this comment on proposal 2-11 70-A2013 ROP to provide CMP 2 with another opportunity to clarify, under what conditions manipulation of existing circuitry during panel board and device replacement is it intended to require the addition of AFCI Protection.

2-4 Log #1047 NEC-P02 Final Action:
(210.4)

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 2-13
Recommendation: Accept the proposal in principle as follows:
Exception: Simultaneous disconnection of ungrounded conductors of a dedicated multiwire branch circuit supplying a combination pump controller and alarm may be omitted if all supply conductors are contained within the same wiring method at the controller. A warning label shall be placed on the panelboard that clearly states that both phases supplying the pump and alarm require disconnection prior to maintenance or repair.
Substantiation: A pump controller featuring a 120V pump on the first line and a 120V alarm on the second line of a multiwire branch circuit with no stops in between should not pose a surprise to qualified personnel if all conductors are present and terminate within the same enclosure. A pump that trips the OCPD and inadvertently also trips the supply to the alarm defeats the entire purpose of having the alarm. The label was added as an afterthought to protect these wildly underqualified people we're so concerned about.

2-5 Log #21 NEC-P02 Final Action:
(210.4(C))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-17a
Recommendation: The Correlating Committee directs that the panel provide further clarification for the exact location of the Informational Note.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-6 Log #1202 NEC-P02 Final Action:
(210.4(D))

Submitter: Michael L. Last, Na'Alehu, HI
Comment on Proposal No: 2-18
Recommendation: Revise text to read as follows:
(D) Grouping. The ungrounded and grounded circuit conductors of each multiwire branch circuit shall be grouped by cable ties or similar means and indicated as such in at least one location within the panelboard or other point of origination. The means of identification shall be permanent by tagging or similar methods.
Substantiation: The proposal should be reconsidered and accepted based on the fact that the submitter's substantiation identifies a significant problem with the existing requirement. The requirement set forth in the 2011 NEC does not accurately offer identification fr multiwire branch circuits. The grouping of conductors does not indicate the reason for such bundling (grouping). Nor does the exception address this same concern. The fact that the ungrounded and grounded circuit conductors are in some way grouped (bundled) does not in and of itself indicate they constitute a multiwire branch circuit. This proposal will quickly and easily indicate the reason for such grouping; as well as reduce the possibility of unintentional consequences caused by compromising the integrity of the grounded circuit conductor.

2-7 Log #1305 NEC-P02 Final Action:
(210.4(D))

Submitter: James M. Imlah, Hillsboro, OR
Comment on Proposal No: 2-19
Recommendation: Delete text to read as follows:
210.4 Multiwire Branch Circuits.
A. Unchanged
B. Unchanged
C. Unchanged
D. Grouping. The ungrounded and grounded circuit conductors of each multiwire branch circuit shall be grouped by cable ties or similar means in at least one location within the panel board or other point of origination. ~~Or if the conductors are identified at their terminations with numbered wire markers corresponding to the appropriate circuit number:~~
Substantiation: Please reject this proposal as it does not enhance or add clarity to the existing exception. Numbered wire markers work well for a period of time, but over time and due to environmental conditions tags are usually found inside the bottom of the panel, un-readable, or altogether missing. The submitter has not provided clarity as to how a multiwire branch circuit with a common neutral (grounded conductor) shall be identified such as a circuit 2 & 4 and then you identify the neutral is it actually 2 & 4 or is that 24, grouping does provide one of the methods for assuring circuit groups. If this exception is allowed to be added, grouping by cable ties or other similar means is not done, only number marking would be acceptable which could be considered as overly restrictive. This would be an enforcement nightmare if a deficiency is cited for numbering only when the exception is applied. Identification is already allowed in the charging statement (similar means) and does not belong as another condition to the exception.

2-8 Log #1203 NEC-P02 Final Action:
(210.4(E))

Submitter: Michael L. Last, Na'Alehu, HI
Comment on Proposal No: 2-20
Recommendation: Accept the proposal and add new text to read as follows:
(E) Identification of Ungrounded and Associated Grounded Conductors. At the locations indicated in 210.4(D), and at all other locations where it is permissible to interrupt the integrity of the grounded (neutral) conductor of a multiwire branch circuit, all the ungrounded (phase or line) and grounded circuit conductors of each multiwire branch circuit shall be individually grouped by cable ties or similar means and identified as such. At all locations where more than one multiwire branch circuit is present, each separate multiwire branch circuit shall be uniquely identified whereby each grounded conductor is readily identified with the corresponding ungrounded conductors of that particular multiwire branch circuit. The means of identification shall be permanent by tagging or similar methods.
Substantiation: The proposal should be reconsidered and accepted based on the fact that the submitter's substantiation identifies a significant problem with the existing requirement. The requirement set forth in the 2011 NEC® does not accurately offer identification of multiwire branch circuits. While 210.4(D) does provide some indication that a multiwire branch circuit possibly could exist, it is possible that the bundling of conductors could have been provided for some other reason. A readily identified tag (or other means) will definitely indicate the actual purpose of bundling, i.e. that of a multiwire branch circuit. The complete and proper identification of multiwire branch circuit(s) as proposed could not be considered overly excessive when it increases the margin of safety.

2-9 Log #1274 NEC-P02 Final Action:
(210.5(B), 215.6, and 215.12)

Submitter: Elliot Rappaport, Electro Technology Consultants
Comment on Proposal No: 2-21
Recommendation: Accept proposal
Substantiation: The term “equipment grounding conductor” does not have a unique meaning since the words themselves do not express the purpose of that conductor. The term “equipment grounding conductor” has a definite purpose that is not uniquely expressed in the term, i.e. “bond the equipment to a terminal at the source of voltage”. As a result, there is a misconception that “grounding”, without bonding to the source, will make a system safe. On the contrary, connecting equipment to ground without providing the bonding connection back to the source can make equipment less safe by increasing the time to clear the fault.

The Panel statement that the equipment grounding conductor serves a dual purpose of providing a path to ground as well as a path for fault current does not place sufficient significance on the importance of bonding over grounding. Bonding provides sufficient ground fault current back to the source of voltage to operate an overcurrent device and clear the fault quickly. Connection to ground limits the voltage to ground on normally non-current-carrying parts during non-fault conditions. During fault conditions, the value of grounding is minimal since the primary safety concern is to remove the fault voltage as quickly as possible. A path to ground for fault current is not necessary since ground fault current must return to the source of voltage, not to ground.

Renaming this conductor as an “Equipment Bonding Conductor (EBC)” will clarify that the primary purpose of this conductor is to bond to the source in order to provide a known path for ground fault current that will facilitate rapid fault clearing.

It is recognized that the term “EGC” has been in use for a long time and that changing it to EBC will cause some concerns including changing written literature that uses the EGC term. After the initial period of understanding, users will correctly understand the purpose of this conductor and this will enhance the safety of personnel.

The fundamental purpose of this and companion proposals is to clearly state that “systems” are “grounded” and “equipment” is “bonded”. The fact that the bonding conductor may be grounded also is secondary to the primary function of bonding.

2-10 Log #22 NEC-P02 Final Action:
(210.5(C))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-23
Recommendation: The Correlating Committee directs that this proposal be reconsidered and correlated with the actions taken on Proposals 2-217, 4-262, 4-234, 4-375, 5-220, 5-221 and 13-33 with regard to the 50 volt/60 volt nominal level.

The Correlating Committee also directs that the word "and" in 210.5(C) be reviewed to see if "or" would be more applicable.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-11 Log #511 NEC-P02 Final Action:
(210.7(C))

Submitter: Russel LeBlanc, The Peterson School of Engineering
Comment on Proposal No: 2-198
Recommendation: This proposal should have been accepted.
Substantiation: Presently illumination is not required for equipment in a dark utility room. That is simply not safe. The proposal will make it safer to service equipment needing servicing. While I agree with the panel statement "The determination of whether a space in buildings or structures other than a dwelling unit is used for a utility room or basement must be decided by the AHJ on a case-by-case basis", that statement does not explain why the panel feels the equipment in those spaces does not need illumination. Yes the AHJ needs to make the decision on what name to call the space (e.g. utility room or basement etc.), but no matter what name you give the space, the hazards at the equipment remain the same if there is no illumination provided. Dark is dark not matter whether it is in an attic, underfloor space, utility room or basement of a dwelling or a non-dwelling. Lighting is needed in all of these locations, regardless of what the name of the space is if there is equipment that needs servicing.

2-12 Log #24 NEC-P02 Final Action:
(210.8)

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-31
Recommendation: The Correlating Committee directs that the action on this proposal be correlated with the action taken on Proposal 1-131.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-13 Log #381 NEC-P02 Final Action:
(210.8)

Submitter: Keith M. Whitesel, Whitesel Electric
Comment on Proposal No: 2-28
Recommendation: Proposal 2-28 Log #533 NEC–P02.
Reconsider this exception to the GFCI requirement.
While a sump pump, refrigerator or freezer will operate correctly when correctly connected to a GFCI if the GCFI device nuisance trips, and they still do, the basement could flood or the contents of the refrigerator or freezer could be lost.
This came home to me recently when during a lightning storm one of my GFCI's tripped and I lost $500.00 worth of food from my freezer. I live in an area where lightning storms are frequent and at least one of my seven GFCI devices trips almost every storm. It can be any one of my GFCI's. I have both GFCI breakers installed on some circuits and GFCI receptacles on other circuits. Any of them can trip during any storm. My house is also in a flood prone area. If my sump pumps were connected to GFCI's and they were to nuisance trip, my basement would flood and the potential damage could be thousands of dollars.

Substantiation: 90.1 clearly states that the purpose of the NEC is to protect both people and PROPERTY. Protecting ones home from flooding and from lose of food certainly should fall into this category of protection. These receptacles were formerly except from the GFCI requirement in past codes.

2-14 Log #1161 NEC-P02 Final Action:
(210.8, Informational Note (New))

Submitter: Thomas A. Domitrovich, American Circuit Breaker Manufacturers Association (ACBMA)
Comment on Proposal No: 2-32
Recommendation: This proposal should have been accepted.
Substantiation: The Code panel rejected this proposal stating "The receptacle GFCI short circuit ratings are readily available from manufacturers of these devices if this information is necessary to comply with the requirements of 110.10."

However, the case of a GFCI receptacle is much different than most products in that many people are not even aware that these devices have a short circuit rating.

The UL 943 Standard requires a 2000A test for the typical device, and permits an Optional 10kA Short Circuit Current Test, but does NOT permit it to be marked 10kA. UL 943 States the following:

"SA3.1 A ground-fault circuit-interrupter that complies with SA2.1 and SA2.2 shall not be marked to indicate the ability to withstand a 10kA short circuit current as a result of these tests."

The rating information for these products, especially for the inspector reviewing the installation after these products have been installed, is often unchecked. This enables the misapplication of these life saving devices beyond their ratings. There are many areas where these devices are applied, especially in commercial and industrial environments, where the available fault currents may exceed the rating of the device.

This informational note is important for safety as it raises the awareness to installers and inspectors alike who are not aware of the short circuit capabilities of these devices. This will go a long way for ensuring these devices are applied within their rating.

2-15 Log #25 NEC-P02 Final Action:
(210.8(A) Exception to (5))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-36
Recommendation: The Correlating Committee requests that Panel 2 review the text contained in the Informational Note following the "Exception to (5)" and clarify if changes are warranted since the term "fire alarm" was removed in this proposal.

The Correlating Committee also directs that this proposal be sent to Code-Making Panel 3 for comment as to whether the Informational Note in 760.41(B) will still be applicable.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-16 Log #265 NEC-P02 Final Action:
(210.8(A) Exception No. 5)

Submitter: Code-Making Panel 3,
Comment on Proposal No: 2-36
Recommendation: Reject Proposal 2-36.
Substantiation: The Panel rejects the action of CMP 2. The exact wording that is found in 760.41(B) and 760.121(B) is provided below. This proposal should be an Accept. The allowance is that the power for fire alarm equipment not be supplied through either a ground-fault circuit interrupter or arc-fault circuit interrupters. The proposed text makes it clear that this is a requirement and not an option.

While burglar alarm systems are not addressed within Article 760, most if not all intrusion systems that are installed within single family dwellings do have at least one zone of protection connected to smoke detectors. The existing paragraph addressed both fire alarm and intrusion detection systems.

The existing language of 2108(A), Exception 5 should remain as follows:
760.41(B) This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit-interrupters.

760.121(B) This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit interrupters.

This comment was developed by a CMP-3 Task Group and balloted through the entire panel with the following ballot results:

15 Eligible to Vote
12 Affirmative
2 Ballots Not Returned (A.D. Corbin and D.T. Mills)
1 Negative (see comment below)

The following Negative Comment on Vote was received:

S.L. STENE: The action on Proposal 2-36 was the correct action to “accept in principle in part.” The Panel 3 Comment should not have been a reject, since a total reject of the proposal would keep the text as previously stated in the 2011 NEC. The Panel 2 action on the proposal eliminated the fire alarm text and left burglar alarm panels to not require GFCI protectionas a permissive statement. A burglar alarm without fire alarm function using Class 2 and 3 circuits is covered under Article 725. A dual function burglar/fire alarm is covered by 760.41(B) and 760.121(B). A burglar alarm panel with fire alarm capabilities is a combination fire and burglar alarm and could not be supplied by a GFCI protected circuit based on 760.41 and 760.121.

2-17 Log #1009 NEC-P02 Final Action:
(210.8(A) Exception No. 5)

Submitter: Mike Holt, Mike Hold Enterprises
Comment on Proposal No: 2-36
Recommendation: Accept the proposal in principal by deleting the exception (and its informational note) altogether.
Substantiation: Over the last several Code cycles exceptions to GFCI protection have been removed due to the fact that equipment should not interfere with the operation of a GFCI device. A burglar alarm should work just fine with GFCI protection.

2-18 Log #773 NEC-P02 Final Action:
(210.8(A)(2))

Submitter: Richard H. Murray, S. Easton, MA
Comment on Proposal No: 2-37
Recommendation: Revise the second sentence in 210.8 to read as follows:
The ground-fault circuit-interruptor test equipment shall be installed in a readily accessible location.
Substantiation: I believe this will help solve some of the issues that evolved when this change was added to the 2011 NEC.

2-19 Log #1094 NEC-P02 Final Action:
(210.8(A)(6))

Submitter: Ron B. Chilton, Rep. NC Code Clearing Committee
Comment on Proposal No: 2-39
Recommendation: The Code Panel should have "Accepted" this proposal.
Substantiation: This omission still leaves a gap, which seems unintentional by the previous Code Making Panels, where the kitchen sink is within 2 ft., of the end of the countertop and a receptacle may be less than a foot from the edge, on the wall adjacent to the countertop, or more often, directly on the opposite wall of a pass-through opening, not serving the countertop. This allows appliances to be set on the ledge of a pass-through directly over the sink and plugged into a receptacle not provided with GPCI protection. The Proposal only closes the gap to clarify that all receptacles located near sinks as close as 6 ft be GFCI protected. Surely all countertop receptacles in the kitchen are required to have GPCI protection, this evolved from the original 6 ft. rule. In the last few Code cycles emphasis has been placed on deleting the exceptions to requirements for GFCI protection in loose proximity, 6 ft., of all sinks in a dwelling. The Proposal is identical to other past proposals for sinks in a dwelling addressing the need for GFCI protection for receptacles near sinks. When the requirement for GFCI protection in bathrooms became effective, there was no reference to the countertop only, and the emphasis was placed on the receptacle being located in the proximity of all those potential water hazards.
This is not original material; its reference/source is as follows:
NC Code Clearing Committee.

2-20 Log #769 NEC-P02 Final Action:
(210.8(A)(7))

Submitter: James Dorsey, Douglas County Electrical Inspector
Comment on Proposal No: 2-40
Recommendation: Delete the words “located in areas other than kitchens”
In the 2011 NEC:
(7) Sinks - ~~Located in areas other than kitchens~~ where receptacles are located within 1.8 m (6 ft) of the outside edge of the sink.
Proposed text should read:
(7) Sinks - **W**here receptacles are installed within 1.8 m (6 ft) of the outside edge of the sink.

Substantiation: Consistency; There is no difference in the ground-fault shock hazard between any appliances (especially with the trend of stainless steel) that are plugged into a 120v receptacle (refrigerators, dishwashers, trash compactors or garbage disposals) that is within 6’ of a wet bar sink to the same type of appliance plugged into a 120v receptacle within 6’ of the sink in a residential kitchen. The NEC has indicated that the presence of water and grounded or conductive surfaces can contribute to a hazardous environment. Since the NEC mandates that all receptacles within 6' of a wet bar sink must be gfci protected how can the panel not agree with the proposal to protect the same type of appliances in a residential kitchen where there is a ground-fault shock hazard because of the presence of water and grounded surfaces? The 6’ rule with consistency would be a good start.
Many residences are built slab on grade so the kitchen is in contact with the earth just like wet bar sinks in basements. It is awkward, confusing and even embarrassing as an inspector (who must enforce the code by what is written in the code) to tell a homeowner or contractor that one area must be gfci protected while the other area does not. Furthermore, it creates inconsistency among inspectors on how to enforce this article while also using common sense. Common sense would say, if it is ok not to require gfci protection in a kitchen for cord connected appliances within 6' of the sink than it should be ok not to enforce GFCI protection for the same type of appliances by a wet bar. Please reconsider your rejection or add an exception to the general 6’ rule for consistency.

2-21 Log #803 NEC-P02 Final Action:
(210.8(A)(7))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 2-44
Recommendation: Proposal 2-44 should be accepted.
Substantiation: The submitter is correct when he stated that the means of measurement needs to be defined and that it is not clearly understood. The shortest distance would be horizontal from the edge of the sink. We receive questions from the field pertaining to whether the measurement is horizontal or a combination of horizontal and vertical.

2-22 Log #1544 NEC-P02 Final Action:
(210.8(A)(7))

Submitter: Frederic P. Hartwell, Rep. Massachusetts Electrical Code Advisory Committee
Comment on Proposal No: 2-44
Recommendation: Accept the proposal in principle. Revise text to read as follows:
(7) Sinks — located in areas other than kitchens where receptacles are installed within the zone 1.8 m (6 ft) measured horizontally from ~~of~~ the outside edge of the sink and extending from the floor to 1.8 m (6 ft) above the floor.
Substantiation: The Advisory Committee agrees that the requirement should reach all receptacles within 6 ft of a sink. The proposal was always intended to do exactly that. If the rule is applied literally based on the current text, a receptacle at baseboard height and 6 ft 2 in. from the sink, measured in a straight line, is excluded because it would be over 6 ft from the outside edge of a sink that might well be perhaps two feet higher. This wording agrees with the proposal concept and more clearly conveys the intent. It is now apparent that both CMP 2 and the Advisory Committee are in agreement as to the intended scope of the requirement.

2-23 Log #865 NEC-P02 Final Action:
(210.8(A)(9))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 2-47
Recommendation: Reject proposal 2-47.
Substantiation: The substantiation does not provide sufficient technical information to conclude that additional GFCI protection is required for all laundry area 125 volt, 15 and 20 ampere receptacles. The necessity of providing GFCI protection for the laundry area circuit was not quantified. There is no data provided in the substantiation regarding the number or frequency of electric shock incidents involving laundry area circuits. The substantiation is anecdotal at best. GFCI protection has been a requirement of the NEC for many years. The requirement has never existed for all laundry area circuits until proposal 2-47 was made for the 2014 NEC. If the proposal is an attempted resolution with a particular appliance problem, the manufacturers of the product have other avenues that may yield the desired result such as installing GFCI protection within their equipment.

2-24 Log #1048 NEC-P02 Final Action:
(210.8(A)(9))

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 2-47
Recommendation: Reject the proposal.
Substantiation: There was no substantiation provided to require GFCI in Laundry Areas, at all. As written, the substantiation should have been to a proposal to add "(9) Everywhere Else"! If the submitter has evidence that GE appliances are failing and killing people I would invite them to offer up this data. Also, this proposal could conflict with the beneficial change accepted to change required circuits to refer to the equipment, rather than an undefined area, in 210.11 and 210.52. With the 2011 change to require GFCI protection around all sinks, and then the 2014 proposal to require GFCI protection on all bathtubs, that about covers every laundry area/equipment receptacles. It is unnecessary, and in most cases will require an extra line-side GFCI receptacle to protect the washer receptacle, based on the "readily accessible" requirement added in 2011.

2-25 Log #804 NEC-P02 Final Action:
(210.8(B)(5))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 2-55
Recommendation: Proposal 2-55 should be accepted.
Substantiation: The submitter is correct when he stated that the means of measurement needs to be defined and that it is not clearly understood. The shortest distance would be horizontal from the edge of the sink. We receive questions from the field pertaining to whether the measurement is horizontal or a combination of horizontal and vertical.

2-26 Log #1545 NEC-P02 Final Action:
(210.8(B)(5))

Submitter: Frederic P. Hartwell, Rep. Massachusetts Electrical Code Advisory Committee
Comment on Proposal No: 2-55
Recommendation: Accept the proposal in principle. Revise text to read as follows:
(5) Sinks — where receptacles are installed within the zone 1.8 m (6 ft) measured horizontally from ~~of~~ the outside edge of the sink and extending from the floor to 1.8 m (6 ft) above the floor.
Substantiation: The Advisory Committee agrees that the requirement should reach all receptacles within 6 ft of a sink. The proposal was always intended to do exactly that. If the rule is applied literally based on the current text, a receptacle at baseboard height and 6 ft 2 in. from the sink, measured in a straight line, is excluded because it would be over 6 ft from the outside edge of a sink that might well be perhaps two feet higher. This wording agrees with the proposal concept and more clearly conveys the intent. It is now apparent that both CMP 2 and the Advisory Committee are in agreement as to the intended scope of the requirement.

2-27 Log #1 NEC-P02 Final Action:
(210.8(B)(8))

Submitter: Mike Weaver, C&M Enterprises
Comment on Proposal No: 2-49
Recommendation: Do not accept Proposal 2-49.
Substantiation: While the proposal, in and of itself has significant merit (as noted in the submitter's substantiation), for application to commercial garages and similar areas and occupancies, this subsection item (8), which was new for the 2011 cycle, currently has the ability to impact a broader range of occupancy areas than the language of 210.8(B)(8) infers on the surface. Existing text, which will be removed by the acceptance of Proposals 2-49 or 2-50, affords effective limitation to expanded, potentially unintended, application of 210.8(B)(8).

The text of 210.8(B)(8) incorporates the word "garag"' which is a defined term in Article 100. Careful review of this "garage" definition language reveals that the auto dealer showroom floor area (as just one example) meets the Article 100 definition of a garage. Potentially, the riding mower dealer showroom floor area also falls under the definition of "garage" (a vehicle is defined in Merriam-Webster's dictionary as a piece of mechanized equipment, and is undefined in the NEC). If the language modifications (deleted text) in Proposal 2-49 (or Proposal 2-50) are accepted into210.8(B)(8), then GFCI protection will be mandated for the receptacles noted within 210.8(B) for an automobile dealership's showroom floor area (as one example). This is NOT what the submitter was addressing in the proposal substantiation provided. This mandate for the (previous) example area, as well as other unintended "garage" occupancy areas become locations which are enforceable to the requirements of Section 210.8(B)(8). Encompassing other "garage" areas (such as the commercial-industrial facilities' fork-lift charging area. If the vehicles are staged there for other than during their charging process, which is quite typical for such areas) may have merit, while others (the dealer showroom floor area) may not. While the submitter's (CMP accepted) proposal has sound merit, it incorporates GFCI protection for areas where such protection may not be considered as necessary. Current 210.8(B)(8) language provides some limitations for such areas of question.

Limiting the board application of 210.8(B)(8) for areas which GFCI protection may not be considered necessary, requires new language, or carefully worded exceptions, or a revision to the Article 100 definition of "garage". Revisions which broaden the application of 210.8(B)(8) to encompass the submitter's noted (and CMP confirmed) concerns requires additional input from others who also recognize the added collateral damage from deletion of text noted in the original proposal. This comment submission, in conjunction with your rejection of Proposals 2-49 and 2-50, will allow the submitter and others to craft adequate language which addresses the submitter's concerns without producing potentially unwanted consequences. If this requires an additional revision cycle, it would be better than accepting the revisions as originally proposed, which paint 210.8(B)(8)'s requirements to areas and occupancies with quite a broad brush.

Please see my companion comment to Proposal 2-50.

2-28 Log #2 NEC-P02 Final Action:
(210.8(B)(8))

Submitter: Mike Weaver, C&M Enterprises
Comment on Proposal No: 2-50
Recommendation: Do not accept Proposal 2-50.
Substantiation: Please see substantiation to my comment on Proposal 2-49.

This is a companion comment to a previous comment addressed to Proposal 2-49.

2-29 Log #566 NEC-P02 Final Action:
(210.8(D))

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.

Submitter: Jay A. Broniak, GE Appliances & Lighting
Comment on Proposal No: 2-58
Recommendation: Revise text to read as follows:

This form proposal is for requiring ground-fault circuit-interrupt (GFCI) protection on the dishwasher circuit.

Section 210.8

(D) Kitchen Dishwasher branch circuit. GFCI protection shall be provided for outlets that supply dishwashers installed in dwelling unit locations.

Substantiation: As the requirement for ground-fault circuit-interrupters (GFCIs) has been expanded throughout the NEC code, the amount of electrical shock incidents related to consumer products have continued to decline over time. Increased usage of GFCIs within branch circuits of residential homes is a highly effective means of further reducing the potential for electrical shocks. CMP-2 should require GFCI protection on the dishwasher circuit.

2-30 Log #866 NEC-P02 Final Action:
(210.8(D))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 2-58
Recommendation: Continue to reject proposal 2-58.
Substantiation: The substantiation does not provide sufficient technical information to conclude that additional GFCI protection is required for a dishwasher outlet. The necessity of providing GFCI protection for the dishwasher outlet was not quantified in the substantiation. There is no data provided in the substantiation regarding the number or frequency of electric shock incidents involving the dishwasher. Rather, the substantiation presented is anecdotal. Furthermore, manufacturers of dishwashers have the capability of installing added protection within the internal wiring of their equipment.

2-31 Log #27 NEC-P02 Final Action:
(210.9 Exception No. 3 (New))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-60
Recommendation: The Correlating Committee directs that Panel 2 reconsider this proposal and consider breaking the text into more than one sentence for the purpose of clarity.

It was the action of the Correlating Committee that this proposal be referred to Code-Making Panels 5 and 9 for comment.

This action will be considered as a public comment.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-32 Log #275 NEC-P02 Final Action:
(210.9 Exception No. 3 (New))

Submitter: Code-Making Panel 5,
Comment on Proposal No: 2-60
Recommendation: Code-Making Panel 5 recommends revising the text to read as follows:
"The grounded conductor of a branch circuit supplied from a grounding autotransformer shall not be required to be connected to the grounded conductor of the system supplying the autotransformer if the autotransformer has less than 1.0% zero phase sequence on its load side and more than 30% zero phase sequence impedance on its line side."

Substantiation: The revised text is edited for clarity and compliance with the NEC Style Manual.
This comment was developed by a CMP-5 Task Group and balloted through the entire panel with the following ballot results:
16 Eligible to Vote
15 Affirmative
1 Ballot Note Returned (W.J. Helfrich)
The following AFFIRMATIVE comments on Vote were received:
T.N. BOWMER: I agree with the proposal to include the exemption and generally reword as suggested. However, it is unclear to me how an inspector can determine if the autotransformer meets the <1% zero phase sequence on its load side and > 30% zero phase sequence impedance on its load side. Should the 1st "zero phase sequence" be "zero phase sequence impedance".
D. MOHLA: Add in Informational Note to 210.9, Exception 3 to read as follows:
"Informational Note: Inversion of the neutral may occur under abnormal conditions in Y-connected autotransformers with ungrounded neutrals resulting in high voltage on the neutral. Inversion of neutral can occur on power frequency voltage or on the transient voltage. Grounding the autotransformer neutral, use of a delta tertiary, and use of three-leg 3-phase cores all help to prevent inversion of neutral. See IEEE Standard 142-2007, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems, for additional information."

2-33 Log #281 NEC-P02 Final Action:
(210.9 Exception No. 3 (New))

Submitter: Code-Making Panel 9,
Comment on Proposal No: 2-60
Recommendation: This proposal should be Rejected to correlate with panel action on Proposal 9-142.
Substantiation: CMP 9 requested additional information to evaluate the technical merits of the proposal. If the submitter provides data as part of a public comment, CMP 9 committed to create a task group to further review the available information prior to the meeting on public comments. The panel is concerned that this requirement may create an opportunity for a proprietary product and the panel is concerned this may violate the NFPA Patent Policy. The submitter should provide information to NFPA that indicates that the NFPA Patent Policy is not violated.
This comment was developed by a CMP-9 Task Group and balloted through the entire panel with the following ballot results:
12 Eligible to vote
11 Affirmative
1 Ballot Not Returned (J.M. Ferrara, Voting Alternate)
No Comments on Vote were received.

2-34 Log #1275 NEC-P02 Final Action:
(210.9 Exception No. 3)

Submitter: Elliot Rappaport, Electro Technology Consultants
Comment on Proposal No: 2-60
Recommendation: Reject the proposal
Substantiation: Although the proposal may be appropriate, the substantiation is inadequate. The purpose of providing the grounded conductor from the grounded system supplying the autotransformer is to assure that the neutral point of the autotransformer will remain at (or near) ground potential during fault conditions. If that condition is not satisfied, then failure of equipment connected to the unfaulted phases can occur. The supporting material does not provide justification for why these specific phase sequence impedances provide for the desired voltage conditions during a fault.

2-35 Log #1596 NEC-P02 Final Action:
(210.11(C)(1), (2), and (3))

Submitter: Scott Cline, Monterey Park, CA
Comment on Proposal No: 2-61
Recommendation: Add 120-volt, in front of “20-ampere” in (1), (2), and (3),
-OR-
Add a reference to 210.52(D) in 210.11(C)(3).
Substantiation: 210.11, 220.10, and 210.11(C)(3), include circuits which are not 120-volt.
As now worded, a 20-amp, 240-volt circuit to a bathroom receptacle would satisfy the words of 210.11(C)(3), but this certainly is not the intent.
If adding "120-volt" to remove possible ambiguity seems inappropriate, then a reference in 210.11(C)(3) to 210.52(D) seem to be in order.

2-36 Log #28 NEC-P02 Final Action:
(210.11(C)(3) Exception, Informational Note)

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-62b
Recommendation: The Correlating Committee directs that the panel reconsider the location of the Informational Note.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-37 Log #520 NEC-P02 Final Action:
(210.12)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 2-78
Recommendation: 210.12 Arc-Fault Circuit-Interrupter Protection.
(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas shall be protected as described by (1), (2), (3), or (4).[ROP 2–80, ROP 2–82a, ROP 2–85]
For the purpose of this section dormitory units shall be considered dwelling units.

Substantiation: The NFPA, Fire Marshals and the Electrical Industry are in a massive campaign to extend the protection of AFCIs to dwelling units. The last several editions of the *NEC* have expanded the usage of AFCIs to extend more protection in dwelling units.

The causes of fire in dwelling units and in dormitories are nearly the same. Compare the statistics in http://www.nfpa.org/itemDetail.asp?categoryID=953&itemID=23071&URL=Research/Fire%20statistics/The%20U.S.%20fire%20problem for dwelling units and http://www.nfpa.org/assets/files//MbrSecurePDF/OS.Campus.PDF for dormitories. Also note that the dormitory statistics under-represent the problem:

"Many students live at home or in off-campus housing not owned by the university or by any fraternal organization. These numbers are not reflected in the statistics in this analysis. Further complicating the picture is the change in dormitory properties themselves. In the past, dormitories did not have kitchens in the individual units. Many of today's dormitories more closely resemble apartment buildings with suite style apartments that include kitchens. The distinction between apartments and dormitory properties is now quite blurred."

Surely our young men and women who live in dormitory settings should be afforded the same protection the *NEC* provisions for their home afford. Please support the addition of AFCI protection to dormitories and other congregate housing.

2-38 Log #526 NEC-P02 Final Action:
(210.12)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 2-92, 2-102, 2-103
Recommendation: 210.12 Arc-Fault Circuit-Interrupter Protection.
(A) Dwelling Units.
(1) A listed combination type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.
(2) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where all of the following conditions are met:
a. The branch circuit over current protection device shall be a listed circuit breaker having an instantaneous trip not exceeding {1}~~300~~ 20 amperes
b. The {2}branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.
c. The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor-.
~~d. The first outlet box in the branch circuit shall be~~ {3} ~~identified.~~
(3) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet is installed using RMC, IMC, EMT, Type MC, ~~or~~ steel armored Type AC cables meeting the requirements of 250.118 {4} , metal wireways, or metal auxiliary gutters and using metal outlet and junction boxes.
(4) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet is installed using a {5} ~~listed metal or~~ nonmetallic conduit or tubing encased in not less than 50 mm (2 in.) of concrete.
~~{6} Exception No. 1: If RMC, IMC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118, metal wireways, metal auxiliary gutters, and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device~~
~~and the first outlet, it shall be permitted to install an outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.~~
~~{7} Exception No. 2: Where a listed metal or nonmetallic conduit or tubing or Type MC Cable is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.~~
{8} Exception ~~No. 3:~~

Substantiation: The last “conductor-.” in 210.12(A)c. has a dash as a typo and should be removed. Legislative deletion format fails for deleting a dash.
{1} 210.12(A) applies to 15- and 20-ampere outlets and devices. Receptacles and lighting circuits would be required to have OCPDs of 15 or 20 ampere ratings. Not even the most extreme motor circuit would allow a 300A OCPD for a 20A FLA. I understand the 300A comes from the theoretical calculation for protection based on the #14 and #12 wire lengths. 90.1(A) Purpose. talks about the practical safeguarding, not the theoretical.
{2} 210.12(A)(2)b. requires “branch circuit wiring shall be continuous”. I presume, but do not know if that means that the circuit will be without splice. I also assume that *continuous* does allow pig tailing the grounding conductor in any metallic junction boxes the circuit passes through, but I'm not sure. Or it may mean that it must be in a *continuous* cable or even in a continuous raceway (ENT perhaps). This need to be clarified. Possible text could be “wiring shall be ~~continuous~~ unspliced from” or “ wiring shall be in a continuous sheath or wiring method from” depending on the meaning intended.
{3} 210.12(A)(2)d. requires the first outlet box to be *identified*. This is the only box in the entire text for 210.12 that has that requirement. Is this box somehow special? Is *identified* missing from the other box references?
Since 210.12(A)(2) specifies no wiring methods, I presume that all wiring methods are allowed.
It is my understanding that an exception alters the rule to which it applies AND imposes some additional condition(s).
{4} 210.12(A)(3) requires the use of RMC, IMC, EMT, Type MC, or steel armored type AC meeting the requirements of 250.118. Exception 1 merely adds “metal wireways, metal auxiliary gutters,” without imposing any additional requirements. Folding exception 1 into 210.12(A)(3) imposes the same rules without the added text.
{5} 210.12(A)(4) allows the use of nonmetallic conduit if encased in 2 in. of concrete. The listing “metallic or” is unnecessary since 210.12(A)(3) already allows that whether or not it is encased in concrete.

{6} With the addition of the phrase in {4} above Exception No. 1 is now completely redundant and can be eliminated.
{7} Exception No. 2: allows the use of metal or nonmetallic conduit or tubing encased in 2 in. of concrete. This is already allowed in 210.12(A)(3) and (A)(4), as amended. Exception No. 2: also allows MC cable to be used if encased in 2 in. of concrete, but 210.12(A)(3) already allows that. Thus Exception 2 is now completely redundant and can be eliminated.
{8} Exception No. 3: is now the only exception left standing and now can be renamed “Exception:”
The exception text appears to reflect the piling of ROPs on this section.

2-39 Log #824 NEC-P02 **Final Action:**
(210.12)

Submitter: Robert Huddleston, Jr., RLH Engineering Consulting
Comment on Proposal No: 2-76
Recommendation: Delete wording as shown in the original proposal.
Substantiation: This proposal should have been accepted by the Panel. It was shown in the CD video that was sent to all Panel 2 members that combination-type AFCIs do not trip under series arc fault conditions (loose connections, broken wires, damaged cord, or splice failures - all of which can burn a house down, and all of which are advertised as being protected against by combination-type AFCIs by the manufacturers). The panel's rejection statement does not address the submitter's concern - that the NEC should not mandate and require devices that do not work as advertised (advertising by the manufacturers was provided to the Panel that conclusively demonstrated that the devices are sold to the general public under the guise of tripping on series arc faults). The proposal asks that the wording "combination-type" be struck from the Code language, as well as adding the words "parallel arc fault" to describe the protection that standard AFCIs will indeed provide, generally because of differential ground fault detection techniques.

The panel statement of "Replication of the experiments shown in the video shows that there is minimal actual arcing occurring" implies that there was low energy in the arcs. However, as shown in the video, there was a 1500 Watt heater in series with the load, which would be typical of a large 120V load in a residence. How can the Panel accept the claim that combination-type AFCIs will trip when experiencing a series arc fault, when a real, live series arc fault (series because the load of the circuit - 1500W heater is in series with the arcing fault) will NOT trip the AFCI?

Recently, a representative of Cutler Hammer came to the city of Kingsport, Tennessee and met with the city officials. They showed them a magic "box" that supposedly demonstrated how well AFCIs will trip and protect a structure when a series arc fault is generated using carbon-arc rods in series with a load. The city of Kingsport and their inspectors shook their heads up and down and said that this is really great technology...members of panel 2, there is a serious credibility problem here. Testing done by the submitter of the proposal clearly showed that combination-type AFCI devices will never trip on series arc faults.

How can this Code Panel continue to support requiring technology that does not work as claimed? I look forward to the panel finally seeing the light on this issue and responding in a responsible manner by eliminating the requirement for combination-type AFCI devices.

Note: Supporting material is available for review at NFPA Headquarters.

2-40 Log #1160 NEC-P02 Final Action:
(210.12)

Submitter: Thomas A. Domitrovich, American Circuit Breaker Manufacturers Association (ACBMA)
Comment on Proposal No: 2-92
Recommendation: Revise text to read as follows:

210.12 Arc-Fault Circuit-Interrupter Protection. Arc-fault circuit-interrupter protection shall be provided as required in 210.12(A) and (B). The arc-fault circuit interrupter shall be installed in a readily accessible location.

(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas shall be protected by any of the means described in (1) through (6). ~~as described by (1), (2), (3), or (4).~~

(1) A listed combination type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.

~~(2) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where all of the following conditions are met:~~

~~a. The branch circuit over current protection device shall be a listed circuit breaker having an instantaneous trip not exceeding 300 amperes.~~

~~b. The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.~~

~~c. The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor~~

~~d. The first outlet box in the branch circuit shall be identified.~~

(2) A listed branch/feeder type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be identified.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:

(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.

(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.

(c) The first outlet box in the branch circuit shall be identified.

(4) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit in combination with a listed branch circuit overcurrent protective device where all of the following conditions are met:

(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.

(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.

(c) The first outlet box in the branch circuit shall be identified.

(d) The combination of the branch circuit overcurrent device and the outlet branch circuit AFCI is identified and the combination meets the requirements for a “System Combination” type AFCI and is listed as such.

(NOTE: It is understood that the Correlating Committee has directed the CMP to correlate the added text and its location in Proposals 2-102, 2-103, and 2-109 with the panel action on Proposal 2-92. There are no comments on those items.)

Informational Note No. 1: For information on ~~types of~~ combination type and branch/ feeder type arc-fault circuit interrupters, see UL 1699-~~2011~~, Standard for Arc-Fault Circuit Interrupters. For information on outlet branch circuit type arc-fault circuit interrupters see UL 1699A Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters. For information on system combination arc fault circuit interrupters see UL 1699C Outline of Investigation for System Combination Arc-Fault Circuit Interrupters.

Informational Note No. 2: See 29.6(5) of NFPA 72- 2010, National Fire Alarm and Signaling Code, for information related to secondary power supply requirements for smoke alarms installed in dwelling units.

Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.

Substantiation: In the panel statement to Proposal 2-92 the panel agreed with the principle of a systems approach for providing arc fault protection to the branch circuit. The protection system accepted by the Panel consisted of an

installation including a branch circuit breaker having a specific instantaneous trip current and a branch circuit where the length of the wiring from the overcurrent protection to the first outlet is limited and the installation of a listed outlet branch circuit AFCI at the first outlet on the circuit.

The specific instantaneous trip current for the branch circuit breaker in the ROP specifies a level of 300A or less based on work done by UL but further work by UL has shown that number to be in error and notes that the instantaneous trip level must be 195A or less.

In the latest UL work UL notes there are variations in the instantaneous trip levels in different lots and styles of circuit breakers. UL notes that only one style of breaker from the samples they have looked at appears to have an instantaneous trip level close to the 195 number. It has further been pointed out by circuit breaker manufacturers that while that number was in the breakers UL purchased that is not a maximum level in existing breaker production as this is not a controlled parameter in a standard circuit breaker.

Manufacturers have pointed out that instantaneous trip levels are not verified in submittals or follow up and that these numbers can and do vary tremendously on existing product styles and could vary on circuit breakers that have not been designed to meet the arc mitigation requirements of UL 1699. Circuit breakers are intended and Listed to protect the conductors from a short circuit or overload condition and the qualification of the circuit breaker includes testing to verify that. The necessary instantaneous trip level required to protect the conductor from a short circuit or overload conditions is very different than the level required for arc mitigation however and the circuit breaker is not tested for that. Standard circuit breakers are not Listed, nor are the parameters controlled, to provide any type of arc-fault protection. Without such Listing the standard circuit breaker is being driven to provide protection outside the parameters for which it has been listed and outside the claims of the manufacturer. This drives a Listed product to be used in an unintended manner for which it is designed and Listed. The continued UL testing has demonstrated that without appropriate control of operational parameters of the circuit breake
in conjunction with the outlet device, the circuit can be at risk from arc-fault protection which may not be provided.

It is agreed that a systems approach could be used to add additional ways to provide AFCI protection but any change to the NEC for AFCI protection needs to provide protection equal to the current requirements in UL 1699 and must be verified in the product or system certification.

This comment is to address the latest UL work and to identify all the known possible solutions to provide AFCI protection. The comment modifies the final wording from the ROP and is summarized as follows:

(1) The first solution is the existing combination AFCI and there is no change to this item.

(2) The second solution identifies the combination of a branch/feeder AFCI along with an outlet branch circuit AFCI. This solution allows an outlet branch circuit AFCI to be used with no restrictions on wiring methods or available current or conductor length.

(3) The third solution is similar to the additional requirements accepted in Proposal 2-92. The issue of the instantaneous trip level is addressed by a supplemental arc protection circuit breaker (SAPCB) instead of a standard thermal magnetic circuit breaker. This solution will allow an outlet branch circuit AFCI to be used with a SAPCB with the same restrictions currently in the ROP – i.e. b) that the conductor be continuous between the circuit breaker and the first outlet; c) that the length of the conductor be no more than
50 feet for a 15A 14 AWG conductor circuit or 70 feet for a 20A 12 AWG conductor circuit; and d) that the first outlet be identified. The supplemental arc protection circuit breaker supplements the protection provided by the outlet branch circuit AFCI by providing the protection from UL 1699 that the outlet devices do not provide in a circuit breaker that has been tested and certified to the requirements in a new Outline of Investigation.

(4) The fourth solution is a modification of the CMP action on 2-92 and allows the combination of the overcurrent protective device and the outlet branch circuit AFCI to be tested as a system and certified as providing equivalent protection to a combination AFCI. This modification will address the issue of instantaneous trip levels of the circuit breaker and the verification of these levels. Informational Note 1 is corrected to delete dates for editions and to show the correct reference of UL 1699A for the outlet branch circuit type arc-fault circuit interrupter and add UL 1699C for the system combination AFCI.

2-41 Log #1226 NEC-P02 Final Action:
(210.12)

Submitter: Tom Packard, Arc Fault Circuit Interrupter Joint Research and Development Consortium
Comment on Proposal No: 2-68
Recommendation: Proposal 2-68 should be ACCEPTED IN PRINCIPLE IN PART in place of the action taken on Proposal 2-92. Section 210.12(A) should be revised to read as follows:
210.12 Arc-Fault Circuit-Interrupter Protection.
(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreational rooms, closets, hallways, or similar or areas shall be protected by a listed arc-fault circuit interrupter, combination-type, installed to provide protection of the branch circuit. It shall be permitted to install a listed outlet branch-circuit-type arc-fault circuit interrupter to provide protection of the branch circuit where the length of branch-circuit wiring from the branch-circuit overcurrent device to the first outlet does not exceed 15.2 m (50 ft) for 14 AWG conductors and 21.3 m (70 ft) for 12 AWG conductors.
Informational Note No. 1: For information on types of arc-fault circuit interrupters, see ANSI/UL 1699-1999 2011, Standard for Arc-Fault Circuit Interrupters.
Informational Note No. 2: See 11.6.3(5) 29.6.3(5) of NFPA 72-2010, National Fire Alarm and Signaling Code, for information related to secondary power supply requirements for smoke alarms installed in dwelling units.
Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.
Exception No. 1: If RMC, IMC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118 and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.
Exception No. 2: Where a listed metal or nonmetallic conduit or tubing is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.
Exception No. 3: Where an individual branch circuit to a fire alarm system installed in accordance with 760.41(B) or 760.121(B) is installed in RMC, IMC, EMT, or steel-sheathed cable, Type AC or Type MC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.

Substantiation: This comment is made on behalf of the Arc Fault Circuit Interrupter Wiring Device Joint Research and Development Consortium, the original submitter of Proposal 2-153 (Log #3485), Held along with associated Comment 2-68 (Log #1755) in the 2010 Annual Meeting National Electrical Code Committee Report. This Code Cycle's Proposal 2-68 (Log #22) was previously that Held Comment 2-68. The Consortium members are: Cooper Wiring Devices, Hubbell Incorporated (Delaware), Leviton Manufacturing Inc., Legrand/Pass & Seymour.
Accepting this comment here will promote increased installation of AFCI devices across the country thus increasing overall safety, as indicated in the original Parks study. The majority of CMP2 has indicated in previous votes that they are in favor of acceptance of an AFCI Receptacle without the home run metal conduit limitation. This new data from the Parks Associate Short Circuit Fault Current survey reinforces this majority opinion and specifically mitigates UL's concern about SCC availability. Some CMP2 members have asked for AFCI installation options. Acceptance of an OBC AFCI Receptacle will provide that option. As stated in proposal 2-68, "The Panel action on this Proposal allows for a more practical means of meeting the requirements of 210.12 and will extend this life saving technology to more branch circuit wiring than what is being protected by the present code text". Please consider all of the far reaching benefits of an AFCI Receptacle and accept this comment.
Comment 2-68 from the 2011 Code Cycle (now Proposal 2-68 in the 2014 Code Cycle) is very effective in explaining the benefits of an AFCI Receptacle. Arguments on upstream and downstream protection are also covered very well. Parallel arc faults upstream of the AFCI Receptacle on the home run from the panel has been the primary focus of concern, ignoring all of the other protection upstream and downstream provided by the AFCI receptacle. Proposal 2-68 again goes into all of this protection and added benefit. A primary argument has been the panel circuit breaker ability to trip in the presence of a parallel arc fault on the home run and the Short Circuit Current available at the panel. A recent UL report demonstrated that the higher the available short circuit current at the panel, the more effective the circuit breaker will be in clearing parallel arc faults. This relationship is reinforced by the equation that relates conductor length, available short circuit current and circuit breaker magnetic trip current found on page 3 of the UL report

"Evaluation of Run Length and Available Current on Breaker Ability to Mitigate Parallel Arcing Faults". It has been argued in front of CMP2 that, in new construction, 500 amp SCC availability at the panel is prevalent. Attached is a Parks Associates Nationwide survey of SCC availability at the panel. This survey indicates there is a high probability that the current will be sufficient to trip a circuit breaker when a parallel arc fault occurs. This is a determining factor in accepting this comment on Proposal 2-68 and this comment provides the data that the panel requested during the proposal stage..

The equation in the UL report determines that the protection against parallel arcs in the home run provided by a circuit breaker is affected by a number of variables. However, the two most significant factors in establishing the level of parallel arc protection in the home run are the instantaneous trip of the circuit breaker and the available short circuit current at the panel. The information available in the UL report and the Parks study provide a basis for the distribution of these values. A statistical simulation of the equation in the UL report using the distribution of the circuit breaker instantaneous trip values and the available short circuit current values reveals that a high level of protection can be expected for a 50 ft (14 AWG), 70 ft (12AWG) length of home run. In fact, the statistical analysis indicates that under the least favorable conditions the confidence level for protection of a 50 ft/70 ft home run exceeds 97%. The conclusion of this statistical analysis closely correlates with the conclusion in the UL report for protection of the home run.

Consequently the additional requirements introduced in Proposal 2-92 are unwarranted, and the Panel should ACCEPT IN PRINCIPLE IN PART Proposal 2-68 with the modification shown, in place of the action taken on Proposal 2-92.

The following items should be considered:

1. Available SCC is significantly greater than originally believed.
2. The UL report demonstrates a direct relationship of SCC availability to the ability of a circuit breaker to trip under a parallel arc fault condition.
3. The Parks study data supports parallel arc fault protection of a 50 ft home run as originally calculated by UL.

The revisions to the Informational Notes from what was presented in Proposal 2-68 are to reflect the 2011 NEC® changes from FPNs to Informational Notes and to reflect Panel action to ACCEPT Proposals 2-93, 2-94 and 2-95.

Background:

The Parts of this Code Cycle's Proposal 2-68 that are NOT carried forward for Acceptance In Principle are:

- The portion providing a definition for Arc-Fault Circuit Interrupter (AFCI) incorporated in Article 100 of the 2011 Code in accordance with panel action on Proposal 2-3 (Log #705) during the last Code Cycle
- The partial deletion of Exception No. 1, resulting from wording incorporated into the main portion of 210.12(A) above based upon new data explained below.

Proposal 2-68 appeared as Comment 2-68 (Log #1755) on Proposal 2-153 in the 2010 Annual Meeting National Electrical Code Committee Report on Proposals. This comment was held for further study during the processing of the 2011 NATIONAL ELECTRICAL CODE.

This present Comment on Proposal 2-68 from the 2014 Code Cycle Report on Proposals is to support this proposal as written and to support Proposal 2-153 from the 2011 Code Cycle as written.

Code Proposal 2-153 from the 2011 Code Cycle was written to remove the metal conduit restriction and allow for an Outlet Branch Circuit AFCI Receptacle in the first outlet. The Parks Associate Study demonstrated the increased safety benefits that would result in the widespread acceptance of an AFCI Receptacle. Code Making Panel 2 Accepted this proposal in Principle during the 2011 Code Cycle ROP meeting. CMP 2 put several Comments to this proposal on Hold during the 2011 Code Cycle ROC meeting.

Note: Supporting material is available for review at NFPA Headquarters.

2-42 Log #1227 NEC-P02 Final Action:
(210.12)

Submitter: Tom Packard, Arc Fault Circuit Interrupter Joint Research and Development Consortium
Comment on Proposal No: 2-92
Recommendation: Proposal 2-92 should be ACCEPTED IN PRINCIPLE IN PART. The wording of 210.12(A) should be revised to read as follows:

210.12 Arc-Fault Circuit-Interrupter Protection.

(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreational rooms, closets, hallways, or similar or areas shall be protected as described by (1), (2), (3) or (4):

(1) ~~a~~ A listed combination-type arc-fault circuit interrupter~~, combination-type,~~ installed to provide protection of the entire branch circuit.

(2) A listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet on the branch circuit if all of the following conditions are met:

(a) The ungrounded and grounded conductors of branch-circuit wiring shall be installed in continuous lengths without a splice or joint from the branch-circuit overcurrent device to the outlet branch-circuit arc-fault circuit interrupter.

(b) The length of branch-circuit wiring from the branch-circuit overcurrent device to the first outlet does not exceed 15.2 m (50 ft) for 14 AWG conductors and 21.3 m (70 ft) for 12 AWG conductors.

(c) The first outlet box in the branch circuit shall be identified.

(3) A listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet on the branch circuit where the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet is installed using RMC, IMC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118 and using metal outlet and junction boxes.

(4) A listed outlet branch-circuit-type arc-fault circuit interrupter installed at the first outlet on the branch circuit where the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet is installed using listed metal or nonmetallic conduit or tubing encased in not less than 50 mm (2 in.) of concrete.

Informational Note No. 1: For information on types of arc-fault circuit interrupters, see ANSI/UL 1699-~~1999~~ 2011, *Standard for Arc-Fault Circuit Interrupters*.

Informational Note No. 2: See ~~11.6.3(5)~~ 29.6.3(5) of NFPA 72-2010, *National Fire Alarm and Signaling Code*, for information related to secondary power supply requirements for smoke alarms installed in dwelling units.

Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.

~~*Exception No. 1: If RMC, IMC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118 and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.*~~

~~*Exception No. 2: Where a listed metal or nonmetallic conduit or tubing is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit-type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.*~~

Exception ~~No. 3~~: Where an individual branch circuit to a fire alarm system installed in accordance with 760.41(B) or 760.121(B) is installed in RMC, IMC, EMT, or steel-sheathed cable, Type AC or Type MC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.

Substantiation: This comment is made on behalf of the Arc Fault Circuit Interrupter Wiring Device Joint Research and Development Consortium. The Consortium members are: Cooper Wiring Devices, Hubbell Incorporated (Delaware), Leviton Manufacturing Inc., Legrand/Pass & Seymour.

Accepting this comment here will promote increased installation of AFCI devices across the country thus increasing overall safety, as indicated in the original Parks study. The majority of CMP2 has indicated in previous votes that they are in favor of acceptance of an AFCI Receptacle without the home run metal conduit limitation. This new data from the Parks Associate Short Circuit Fault Current survey reinforces this majority opinion and specifically mitigates UL's concern about SCC availability. Some CMP2 members have asked for AFCI installation options. Acceptance of an OBC AFCI Receptacle will provide that option. As stated in proposal 2-68, "The Panel action on this Proposal allows for a more practical means of meeting the requirements of 210.12 and will extend this life saving technology to more branch circuit wiring than what is being protected by the present code text". Please consider all of the far reaching benefits of

an AFCI Receptacle and accept this comment.
Comment 2-68 from the 2011 Code Cycle (now Proposal 2-68 in the 2014 Code Cycle) is very effective in explaining the benefits of an AFCI Receptacle. Arguments on upstream and downstream protection are also covered very well. Parallel arc faults upstream of the AFCI Receptacle on the home run from the panel has been the primary focus of concern, ignoring all of the other protection upstream and downstream provided by the AFCI receptacle. Proposal 2-68 again goes into all of this protection and added benefit. A primary argument has been the panel circuit breaker ability to trip in the presence of a parallel arc fault on the home run and the Short Circuit Current available at the panel. A recent UL report demonstrated that the higher the available short circuit current at the panel, the more effective the circuit breaker will be in clearing parallel arc faults. This relationship is reinforced by the equation that relates conductor length, available short circuit current and circuit breaker magnetic trip current found on page 3 of the UL report "Evaluation of Run Length and Available Current on Breaker Ability to Mitigate Parallel Arcing Faults". It has been argued in front of CMP2 that, in new construction, 500 amp SCC availability at the panel is prevalent. The Parks Associates Nationwide survey of SCC availability at the panel, shows this number to be incorrect. This information was requested by the panel. This survey indicates there is a high probability that the current will be significantly higher and sufficient to trip a circuit breaker when a parallel arc fault occurs. This is a determining factor in accepting this comment on Proposal 2-92.
The equation in the UL report determines that the protection against parallel arcs in the home run provided by a circuit breaker is affected by a number of variables. However, the two most significant factors in establishing the level of parallel arc protection in the home run are the instantaneous trip of the circuit breaker and the available short circuit current at the panel. The information available in the UL report and the Parks study provide a basis for the distribution of these values. A statistical simulation of the equation in the UL report using the distribution of the circuit breaker instantaneous trip values and the available short circuit current values reveals that a high level of protection can be expected for a 50 ft (14 AWG), 70 ft (12AWG) length of home run. In fact, the statistical analysis indicates that under the least favorable conditions the confidence level for protection of a 50 ft/70 ft home run exceeds 97%. The conclusion of this statistical analysis closely correlates with the conclusion in the UL report for protection of the home run. Consequently the additional instantaneous trip current requirements introduced in Proposal 2-92 are unwarranted, and the Panel should ACCEPT IN PRINCIPLE IN PART Proposal 2-92 with the modifications shown.
The following items should be considered:
1. Available SCC is significantly greater than originally believed.
2. The UL report demonstrates a direct relationship of SCC availability to the ability of a circuit breaker to trip under a parallel arc fault condition.
3. The Parks study data supports parallel arc fault protection of a 50 ft home run as originally calculated by UL.
The revisions to the Informational Notes from what was presented in Proposal 2-92 are to reflect the 2011 NEC® changes from FPNs to Informational Notes and to reflect Panel action to ACCEPT Proposals 2-93, 2-94 and 2-95.
Note: Supporting material is available for review at NFPA Headquarters.

2-43 Log #1244 NEC-P02 **Final Action:**
(210.12)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 2-82a
Recommendation: I ask the panel to reject this proposal.

Substantiation: IEC believes the AFCI is a very important product and has the potential to save lives and property; however, in a recent survey of installers, approximately 50% of responders reported having some sort of difficulty with nuisance tripping during installation of AFCI's. One in seven reported replacing the AFCI with a standard circuit breaker because the installation problems could not be resolved. A taskforce has been formed consisting of manufacturers and distributors to gather more information and to better understand the reasons for the installation problems. At the present time, IEC believes there is a need for more training, better test equipment and possibly the AFCI needs more testing. Until more information can be gathered the panel is encouraged not to expand the use of AFCI's in the industry. While IEC continues to believe the AFCI is an important product, more information needs to be gathered.

2-44 Log #1363 NEC-P02 Final Action:
(210.12)

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 2-92
Recommendation: Revise text to read as follows:

210.12 Arc-Fault Circuit-Interrupter Protection. Arc-fault circuit-interrupter protection shall be provided as required in 210.12(A) and (B). The arc-fault circuit interrupter shall be installed in a readily accessible location.

(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling unit kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas shall be protected by any of the means described in (1) through (6). ~~as described by (1), (2), (3), or (4).~~

(1) A listed combination type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.

~~(2) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where all of the following conditions are met:~~

~~a.The branch circuit over current protection device shall be a listed circuit breaker having an instantaneous trip not exceeding 300 amperes.~~

~~b.The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.~~

~~c. The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.~~

~~d.The first outlet box in the branch circuit shall be identified.~~

(2) A listed branch/feeder type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be identified.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:

(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.

(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.

(c) The first outlet box in the branch circuit shall be identified.

(4) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit in combination with a listed branch circuit overcurrent protective device where all of the following conditions are met:

(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.

(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.

(c) The first outlet box in the branch circuit shall be identified.

(d) The combination of the branch circuit overcurrent device and the outlet branch circuit AFCI is identified and the combination meets the requirements for a “System Combination” type AFCI and is listed as such.

It is understood that the Correlating Committee has directed the CMP to correlate the added text and its location in Proposals 2-102, 2-103, and 2-109 with the panel action on Proposal 2-92. There are no comments on those items.

Informational Note No. 1: For information on types of combination type and branch/ feeder type arc-fault circuit interrupters, see UL 1699-2011, Standard for Arc-Fault Circuit Interrupters. For information on outlet branch circuit type arc-fault circuit interrupters see UL 1699A Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters. For information on system combination arc fault circuit interrupters see UL 1699C Outline of Investigation for System Combination Arc-Fault Circuit Interrupters.

Informational Note No. 2: See 29.6(5) of NFPA 72- 2010, *National Fire Alarm and Signaling Code*, for information related to secondary power supply requirements for smoke alarms installed in dwelling units.

Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.

Substantiation: In the panel statement to Proposal 2-92 the panel agreed with the principle of a systems approach for providing arc fault protection to the branch circuit. The protection system accepted by the Panel consisted of an installation including a branch circuit breaker having a specific instantaneous trip current and a branch circuit where the length of the wiring from the overcurrent protection to the first outlet is limited and the installation of a listed outlet branch circuit AFCI at the first outlet on the circuit.

The specific instantaneous trip current for the branch circuit breaker in the ROP specifies a level of 300A or less based on work done by UL but further work by UL has shown that number to be in error and notes that the instantaneous trip level must be 195A or less.

In the latest UL work UL notes there are variations in the instantaneous trip levels in different lots and styles of circuit breakers. UL notes that only one style of breaker from the samples they have looked at appears to have an instantaneous trip level close to the 195 number. It has further been pointed out by circuit breaker manufacturers that while that number was in the breakers UL purchased that is not a maximum level in existing breaker production as this is not a controlled parameter in a standard circuit breaker.

Manufacturers have pointed out that instantaneous trip levels are not verified in submittals or follow up and that these numbers can and do vary tremendously on existing product styles and could vary on circuit breakers that have not been designed to meet the arc mitigation requirements of UL 1699. Circuit breakers are intended and Listed to protect the conductors from a short circuit or overload condition and the qualification of the circuit breaker includes testing to verify that. The necessary instantaneous trip level required to protect the conductor from a short circuit or overload conditions is very different than the level required for arc mitigation however and the circuit breaker is not tested for that.

Standard circuit breakers are not Listed, nor are the parameters controlled, to provide any type of arc-fault protection. Without such Listing the standard circuit breaker is being driven to provide protection outside the parameters for which it has been listed and outside the claims of the manufacturer. This drives a Listed product to be used in an unintended manner for which it is designed and Listed. The continued UL testing has demonstrated that without appropriate control of operational parameters of the circuit breaker in conjunction with the outlet device, the circuit can be at risk from arc-fault protection which may not be provided.

It is agreed that a systems approach could be used to add additional ways to provide AFCI protection but any change to the NEC for AFCI protection needs to provide protection equal to the current requirements in UL 1699 and must be verified in the product or system certification.

This comment is to address the latest UL work and to identify all the known possible solutions to provide AFCI protection. The comment modifies the final wording from the ROP and is summarized as follows:

(1) The first solution is the existing combination AFCI and there is no change to this item.

(2) The second solution identifies the combination of a branch/feeder AFCI along with an outlet branch circuit AFCI. This solution allows an outlet branch circuit AFCI to be used with no restrictions on wiring methods or available current or conductor length.

(3) The third solution is similar to the additional requirements accepted in Proposal 2-92. The issue of the instantaneous trip level is addressed by a supplemental arc protection circuit breaker (SAPCB) instead of a standard thermal magnetic circuit breaker. This solution will allow an outlet branch circuit AFCI to be used with a SAPCB with the same restrictions currently in the ROP – i.e. b) that the conductor be continuous between the circuit breaker and the fist outlet; c) that the length of the conductor be no more than 50 feet for a 15A 14 AWG conductor circuit or 70 feet for a 20A 12 AWG conductor circuit; and d) that the first outlet be identified.

The supplemental arc protection circuit breaker supplements the protection provided by the outlet branch circuit AFCI by providing the protection from UL 1699 that the outlet devices do not provide in a circuit breaker that has been tested and certified to the requirements in a new Outline of Investigation.

(4) The fourth solution is a modification of the CMP action on 2-92 and allows the combination of the overcurrent protective device and the outlet branch circuit AFCI to be tested as a system and certified as providing equivalent protection to a combination AFCI. This modification will address the issue of instantaneous trip levels of the circuit breaker and the verification of these levels.

Informational Note 1 is corrected to delete dates for editions and to show the correct reference of UL 1699A for the outlet branch circuit type arc-fault circuit interrupter and add UL 1699C for the system combination AFCI.

2-45 Log #1389 NEC-P02 Final Action:
(210.12.Arc-Fault Circuit-Interrupter Protection)

Submitter: Joseph C. Engel, Monroeville, PA
Comment on Proposal No: 2-88
Recommendation: Revise text to read as follows:
210.12 Are-Fault Circuit-Interrupter Protection.
(A) Dwelling Units: All 125-volt, single-phase, 15- and 20- ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by a listed arc fault circuit interrupter combination-type, installed to provide protection of the branch circuit.
Substantiation: I believe the Panel MUST vote to Accept my proposal to remove the words “combination-type” from 210.12. A vote to Reject would force a consumer to purchase a more expensive product whose key performance claims the Panel argues are false. People could thus consider a vote to Reject to be unethical or worse (fraudulent?).
My reasoning is as follows.
The Panel now seems to agree that the claims made concerning the Combination AFCI are FALSE. Namely that 1) series arcing across a break in a cord’s conductor is a fire hazard and 2) a Combination AFCI will respond to such an event and trip. The Panel apparently conducted a test that proved claims false. From the Panel’s own Rejection Statement of my proposal:
“Replication of the experiments shown in the video shows that there is minimal actual arcing occurring. When arcing does occur, causing the sparking seen in the video, its duration is very short and the energy is three orders of magnitude below what is required to ignite the NM cable or surrounding materials. The waveform looks the same as when a wall switch is switched on and off. If the AFCI responded to this waveform it would increase the incidence of unwanted tripping while not contributing significantly to mitigating fire hazards.”

2-46 Log #29 NEC-P02 Final Action:
(210.12(A))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-92
Recommendation: The Correlating Committee understands that the term "over current" should be the term "overcurrent" in 210.12(A)(2)(a).
The Correlating Committee directs that the panel correlate the actions on Proposals 2-96, 2-102, 2-103, 2-109, and 2-116, and clarify the use of the Exceptions.
In addition, the Correlating Committee understands that the panel actions on Proposals 2-79, 2-80, 2-82a, 2-85, 2-93, 2-94 and 2-95 modify the accepted text in Proposal 2-92, per their respective panel statements.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-47 Log #452 NEC-P02 Final Action:
(210.12(A))

Submitter: Robert G. Fahey, City of Janesville
Comment on Proposal No: 2-80, 2-82a, 2-85
Recommendation: Revise text to read:
210.12(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in dwelling units, with the exception of unfinished basements, garages and bathrooms ~~kitchens, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, laundry areas, or similar rooms or areas~~ shall be protected as described by (1), (2), (3), or (4).
Substantiation: The proposed language eliminates the laundry list provided in this Code section, therefore providing more clarity. This comment is not intended to change or eliminate the present or proposed locations where AFCI protection is required; this comment is meant only to make the Code language more concise.

2-48 Log #867 NEC-P02 Final Action:
(210.12(A))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 2-80
Recommendation: Reject proposal 2-80.
Substantiation: No substantiation has been provided to indicate that arcing faults within the wiring of laundry areas have caused the fires noted in the proposal. NFPA statistics provided in the report discussed in the substantiation are not specific to the segment of the wiring within a dwelling unit responsible for the fire.

2-49 Log #868 NEC-P02 Final Action:
(210.12(A))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 2-85
Recommendation: Reject proposal 2-85.
Substantiation: The addition of “or devices” following “outlets” in the list found in 210.12(A) has greatly expanded the requirements for AFCI protection to all areas of a dwelling unit, but the substantiation only refers to bedroom areas. The substantiation supporting the proposed change is lacking technical merit and is anecdotal. It does not present any data indicating a problem exists with hard wired devices.

2-50 Log #869 NEC-P02 Final Action:
(210.12(A))

Submitter: C. Douglas White, Center Point Energy / Rep. Edison Electric Institute/Electric Light & Power Group
Comment on Proposal No: 2-90
Recommendation: Reject proposal 2-90.
Substantiation: The substantiation for this proposal does not cite any reference that validates an issue exists for dishwashers or the dishwasher circuit. A subsequent NFPA document [Hall, John R. Jr., Home Electrical Fires, National Fire Protection Association, January 2012] to the one cited in the substantiation does not list dishwashers as a cause of home electrical fires and there is no data listed that indicates the wiring of the dishwasher circuit is a cause of home fires.

2-51 Log #1245 NEC-P02 Final Action:
(210.12(A))

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 2-89
Recommendation: This comment recommends the panel approve proposal 2-89 with the change shown below. The requested change would allow any listed AFCI to be used at the origin of the branch circuit and for the outlet AFCI.
(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms. living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by a listed arcfault circuit interrupter, combination-type, installed to provide protection of the branch circuit.
Informational Note No. I: For information on types of arc-fault circuit interrupters, see UL 1699-1999, Standard for Arc-Fault Circuit Interrupters.
Informational Note No.2: See 11.6.3(5) of NFPA 72-2010, National Fire Alarm and Signaling Code, for information related to secondary power supply requirements for smoke alarms installed in dwelling units.
Informational Note No.3: Sec 760.41 (8) and 760.121 (8) for power-supply requirements for lire alarm systems.
Exception No. I: If RMC, [MC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118 and metal outlet and junction boxes are installed for the portion of the branch circuit between the branchcircuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit. Home run circuits shall be clearly identified at all points of termination, connection, and splices. The means of
identification shall be permitted by separate color coding. marking: tape, tagging, or other approved means.
Exception No.2: Where a listed metal or nonmetallic conduit or tubing is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to be installed an outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit. Home run circuits shall be clearly identified at all points of termination. connection. and splices. The means of identification shall be permitted by
separate color coding:. marking tape. tagging. or other approved means.
Exception No. 3: Where an individual branch circuit to a fire alarm system installed in accordance with 760.41 (B) or 760.121 (B) is installed in RMC, IMC, EMT, or steel-sheathed cable, Type AC or Type MC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.
(B) Branch Circuit Extensions or Modifications - Dwelling Units. In any of the areas specified in 21 0.12(A), where branch-circuit wiring is modified, replaced, or extended the branch circuit shall be protected by one of the following:
(I) A listed ~~combination type~~ AFCI located at the origin of the branch circuit
(2) A listed outlet branch-circuit type AFC[located at the first receptacle
Substantiation: IEC believes the AFCI is a very important product and has the potential to save lives and property; however, in a recent survey of installers, approximately 50% of responders reported having some sort of difficulty with nuisance tripping after installing AFCI's. One in seven reported replacing the AFCI with a standard circuit breaker because the installation problems could not be resolved. A taskforce has been formed consisting of manufacturers and distributors to gather more information and to better understand the reasons for the installation problems. At the present time, IEC believes there is a need for more training, better test equipment and possibly the AFCI needs more testing. Until more information can be gathered the panel is encouraged to allow the non combination type AFCI to be installed because it gives the contractor more flexibility to eliminate nuisance tripping during installation.
While IEC continues to believe the AFCI is an important product, more information needs to be gathered.

2-52 Log #1411 NEC-P02 Final Action:
(210.12(A))

Submitter: Robert L. LaRocca, UL LLC
Comment on Proposal No: 2-92
Recommendation: Continue to accept 2-92 in principle but revise the CMP 2's action as follows:

210.12 Arc-Fault Circuit-Interrupter Protection.
(A) Dwelling Units. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected ~~as described by (1), (2), (3) or (4)~~ by any of the means described in (1) through (6):

(1) A listed combination type arc-fault circuit interrupter, installed to provide protection of the entire branch circuit.

~~(2) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where all of the following conditions are met:~~
~~(a) The branch circuit over current protection device shall be a listed circuit breaker having an instantaneous trip not exceeding 300 amperes.~~
~~(b) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.~~
~~(c) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.~~
~~(d) The first outlet box in the branch circuit shall be identified.~~

(2) A listed branch/feeder type AFCI installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit. The first outlet box in the branch circuit shall be identified.

(3) A listed supplemental arc protection circuit breaker installed at the origin of the branch circuit in combination with a listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet box on the branch circuit where all of the following conditions are met:
(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.
(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.
(c) The first outlet box in the branch circuit shall be identified.

(4) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit in combination with a listed branch circuit over current protective device where all of the following conditions are met:
(a) The branch circuit wiring shall be continuous from the branch circuit overcurrent device to the outlet branch circuit arc-fault circuit interrupter.
(b) The maximum length of the branch circuit wiring from the branch circuit overcurrent device to the first outlet shall not exceed 15.2 m (50 ft) for a 14 AWG or 21.3 m (70 ft) for a 12 AWG conductor.
(c) The first outlet box in the branch circuit shall be identified.
(d) The combination of the branch circuit overcurrent device and outlet branch circuit AFCI is identified as meeting the requirements for a "System Combination" type AFCI and is listed as such.

(3)(5) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet is installed using RMC, IMC, EMT, Type MC, or steel armored Type AC cables meeting the requirements of 250.118 and using metal outlet and junction boxes.

(4)(6) A listed outlet branch circuit type arc-fault circuit interrupter installed at the first outlet on the branch circuit where the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet is installed using a

listed metal or nonmetallic conduit or tubing encased in not less than 50 mm (2 in.) of concrete.

Delete Exceptions 1 and 2 of the existing text

~~Exception 3~~ Exception: Where an individual branch circuit to a fire alarm system installed in accordance with 760.41(B) or 760.121(B) is installed in RMC, IMC, EMT, or steel-sheathed cable, Type AC or Type MC, meeting the requirements of 250.118, with metal outlet and junction boxes, AFCI protection shall be permitted to be omitted.

Informational Note No. 1: For information on ~~types of~~ combination type and branch/feeder type arc-fault circuit interrupters, see UL 1699~~-1999~~, Standard for Arc-Fault Circuit-Interrupters. For information on outlet branch circuit type arc-fault circuit interrupters see UL Subject 1699A Outline of Investigation for Outlet Branch Circuit Arc-Fault Circuit-Interrupters. For information on System Combination AFCIs see UL Subject 1699C Outline of Investigation for System Combination Arc Fault Circuit Interrupters.
Informational Note No. 2: See 11.6.3(5) of NFPA 72- 2010, National Fire Alarm and Signaling Code, for information related to secondary power supply requirements for smoke alarms installed in dwelling units.
Informational Note No. 3: See 760.41(B) and 760.121(B) for power-supply requirements for fire alarm systems.

Substantiation: This comment was developed in conjunction with the manufacturers of circuit breakers and outlet branch circuit AFCIs.
The level of protection of the branch circuit against the effects of arcing faults needs to be equivalent to that currently defined for Combination Type AFCIs meeting the requirements of UL 1699. Both the proposal 2-92 and CMP 2's action on it at the ROP were based on information in the UL Report - *Effectiveness of Circuit Breakers in Mitigating Parallel Faults in the Home Run*. This report was issued on September 30, 2011 and revised on January 11, 2012. Since that time, UL has continued with additional research testing.
Continued testing conducted by UL shows that the effectiveness of the protection of the home run afforded by a branch circuit breaker is affected by the current available at the panel, the instantaneous trip setting of the branch circuit breaker, and the length and size of the branch circuit conductors. The current available at the panel can vary from installation to installation based on the local distribution system, distance from the supply transformer and size of the service entrance conductors. The branch circuit lengths cited in the original report and accepted by CMP 2 are valid only if the current available at the panel is relatively high and the circuit breaker instantaneous trip rating is controlled to a known value. UL 1699, however, assumes that the current at the panel can be as low as 500A based on previous research work. Discussions with some utilities confirm that a value this low is a possibility for some installations. The instantaneous trip performance of the circuit breaker is not defined by UL requirements and recent testing shows that there can be variations of this parameter from batch to batch.
The results of testing reported in a new UL report - *Evaluation of Run Length and Available Current on Breaker Ability to Mitigate Parallel Arcing Faults*, Part 1 dated July, 2012, and Part 2 dated October, 2012, show that for an installation with 500 A available at the panel, the lengths of home run conductors cited in the panel action require a branch circuit breaker having an instantaneous trip current of less than 200A rather than the 300 A accepted in the panel action. Only some residential breakers currently available in the market place have demonstrated instantaneous trip levels this low and variations from batch to batch have been noted in testing by UL. Additionally, the instantaneous trip response may vary with the ambient temperature of the installation.

The Report mentioned above is available from the UL.Com website using this link to the appropriate page:
http://lms.ulknowledgeservices.com/common/ncsresponse.aspx?rendertext=randdthoughtleadership
The revisions to the CMP's action on 2-92 in the comment above are intended to give the installer choices among systems of protection devices that provide protection of the branch circuit that is equivalent to the protection currently provide by a combination type AFCI meeting the requirements of UL 1699. A number of viable options for systems providing this protection have been suggested by the testing conducted by UL and collaborative work with the involved industries.
Option 1 is the current requirement for a listed combination type AFCI installed at the origin of the branch circuit and is unchanged.
Option 2 combines a listed branch feeder type AFCI installed at the origin of the branch circuit with a listed outlet branch circuit AFCI installed at the first outlet. The branch feeder type device provides protection against faults in parallel with the supply for the home run up to the terminals of the outlet branch circuit device. The outlet branch circuit device provides protection against arcing faults in series with the load for the upstream and downstream circuit conductors. Both devices can mitigate the effects arcing faults in parallel with the supply on the load side of the outlet branch circuit device. Since both devices are listed and in compliance with UL 1699, they have been tested assuming

only 500 A available short circuit current at the panel, and there is no restriction on the length or size of the branch circuit conductors in the home run.
Option 3 introduces a special supplemental arc protection circuit breaker to be used in combination with an outlet branch circuit AFCI. The supplemental arc protection circuit breaker concept is being developed by the circuit breaker industry specifically for this application. An outline containing certification requirements is being developed jointly by the industry and UL. This type of circuit breaker will be investigated to provide the required arc fault protection of the home run when installed in a systems with an outlet branch circuit device and a home run of the specified length and AWG. Investigation of the circuit breaker will be based on selected requirements from UL 1699 and will assume a 500A current capability at the panel. UL's certification of this breaker will include specific surveillance components to verify the effectiveness of the arc mitigation of production samples.
Option 4 modifies option 2 of the CMP's action based on the additional research testing performed by UL. It introduces the concept of certifying a branch circuit overcurrent device and outlet branch circuit AFCI in specific system combinations that have been tested and certified to comply with the requirements of UL 1699 using a new outline of investigation. This outline will be published as UL Subject 1699C after being developed jointly by UL and the circuit breaker and wiring device industries. UL's certification of the combination will include specific surveillance components to verify the effectiveness of the arc mitigation of production samples in combination.
Options 5 and 6 are options 3 and 4 from the panel's action, renumbered.
Exceptions 1 and 2 of the existing code text should have been deleted by the CMP since the exceptions were turned into positive language in options 3 and 4 of the panel's action.
Informational Note 1 is revised to delete references to specific issue dates for the referenced documents and also adds references to the outlines of investigation for the outlet branch circuit device and for the system combination.
Each of the options above provides protection of the entire branch circuit in a manner that is equivalent to the current UL 1699 protection levels and controls the important parameters of the arc fault protection. Since testing is conducted in accordance with UL 1699 or requirements derived from UL 1699, the effect of temperature variations on performance is addressed as well.

2-53 Log #1502 NEC-P02 **Final Action:**
(210.12(A))

Submitter: Alan Manche, Schneider Electric
Comment on Proposal No: 2-92
Recommendation: Revise the proposed language in 210.12(A)(2) to include a minimum available fault current value.
(e)The available fault current at the branch circuit overcurrent device shall not be less than 500A.

Substantiation: The available fault current at the branch circuit overcurrent device plays a significant role in the operation parameters for protection. We often think of single family residence and concerns in rural areas where the fault current is known to be below this value. Even more significant concerns are found in multi-family dwellings where the Transformer sits in a central location of a multi-building complex, the Multi-meter equipment serves as the service disconnect on the end of each building may be 100ft of conductor from the transformer to the meter main and then the feeder conductor from the service meter main may be 200 ft long in a three or four story complex and those conductors are feeding a panel in the far end of the multi-family building.

A quick point-to-point calculation will demonstrate that you easily drop below 500A at the panel where the branch circuit devices are located, creating an issue for this protection system of standard breaker and AFCI receptacle. This comment seeks to ensure we have the appropriate parameters in place to ensure the configuration is providing protection.

2-54 Log #944 NEC-P02 Final Action:
(210.12(A), Informational Note 4)

Submitter: Ed Larsen, Schneider Electric USA
Comment on Proposal No: 2-96
Recommendation: Accept the revised proposal to add text to read as follows:
Informational Note No. 4: See 410.9, 411.8 and 422.5 for FCC Part 15 Class B Digital Device ~~or~~ and FCC Part 18 ~~limits for~~ Consumer ISM Equipment ~~compliance~~ marking requirements for fluorescent and high intensity discharge luminaires, LED and low voltage lighting power supplies, self ballasted lamps and appliances installed in dwelling units.
Substantiation: CMP2 accepted this proposal, but it was rejected by the TCC because the proposals to add sections 410.9, 411.8 and 422.5 were rejected by CMP17 and CMP18. Comments have been submitted regarding ROP 17-20, 18-62 and 18-88 to revise the proposed text in response to the panel statements. The text for Informational Note No. 4 has been revised to correlate with the revised text for 410.9, 411.8 and 422.5. This comment should be accepted contingent on acceptance of the submitter's comments on 17-20, 18-62 and 18-88.

2-55 Log #30 NEC-P02 Final Action:
(210.12(A) Exception No. 1)

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-102
Recommendation: The Correlating Committee directs that the panel correlate the added text and its location in Proposals 2-102, 2-103, and 2-109 with the panel action on Proposal 2-92.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-56 Log #431 NEC-P02 Final Action:
(210.12(A) Exception No. 1)

Submitter: Robert G. Wilkinson, IEC Texas Gulf Coast
Comment on Proposal No: 2-101
Recommendation: Accept proposal 2-101.
Substantiation: CMP2 rejected my proposal 2-101 with the panel statement "Section 90.4 permits new products that may not be available at the time the Code is adopted". This provision was added to the 90.4 in the 1984 NEC and it was never intended to be applied to products that don't exist. The first electronic GFCI was developed in 1961 and the first requirement for GFCI protection in the NEC was in the 1968 edition and it was limited to protection of underwater lighting in swimming pools. Imagine what would have happened if the 1959 NEC required GFCI protection in light of the fact that the first circuit breaker type GFCI was not introduced until 1968 and the first receptacle type GFCI was not introduced until 1972. It is a disservice to the public to require a product that is not available to fulfill a requirement in the NEC. To continue to go down this path is to put the NEC in jeopardy of not being adopted. The credibility of the NEC is compromised by requiring products that do now exist. To take this matter to be ridiculous, I propose for the NEC to require a receptacle that I plan to develop that will provide AFCI, GFCI, ALCI, ELCI, IDCI, and LCDI protection. This receptacle will also be tamper resistant, weather resistant, and have the ability to change color to match the wall color. Since 90.4 permits requiring new products that may not be available at the time the Code is adopted, I'm sure my proposed magic receptacle will be accepted.

2-57 Log #430 NEC-P02 Final Action:
(210.12(A) Exception No. 2)

Submitter: Robert G. Wilkinson, IEC Texas Gulf Coast
Comment on Proposal No: 2-104
Recommendation: Accept proposal 2-104.
Substantiation: CMP2 rejected my proposal 2-104 with the panel statement "Section 90.4 permits requiring new products that may not be available at the time the Code is adopted". This provision was added to 90.4 in the 1984 NEC and it was never intended to be applied to products that don't exist. The first GFCI was developed in 1961 and the first requirement for GFCI protection in the NEC was in the 1968 edition and it was limited to protection of underwater lighting in swimming pools. Imagine what would have happened if the 1959 NEC required GFCI protection in light of the fact that the first circuit breaker type GFCI was not introduced until 1968 and the first receptacle type GFCI was not introduced until 1972. It is a disservice to the public to require a product that not available to fulfill a requirement in the NEC. To continue to go down this path is to put the NEC in jeopardy of not being adopted. The credibility of the NEC is compromised by requiring products that do not exist. To take this matter to the ridiculous, I propose for the 2017 NEC to require a receptacle that I plan to develop that will provide AFCI, GFCI, ALCI, ELCI, IDCI, and LCDI protection. This receptacle will also be tamper resistant, weather resistant, and have the ability to change color to match the wall color. Since 90.4 permits requiring new products that may not be available at the time the Code is adopted, I'm sure my proposed magic receptacle will be accepted.

2-58 Log #1521 NEC-P02 Final Action:
(210.12(A) Exception No. 2)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 2-105
Recommendation: Revise text to read as follows:
210.12 Arc-Fault Circuit-Interrupter Protection. (A) Dwelling Units.
Exception No. 2: Where a listed ~~metal or~~ nonmetallic conduit (PVC or RTRC) or tubing (ENT) ~~or Type MC Cable~~ is encased in not less than 50 mm (2 in.) of concrete for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install an outlet branch-circuit type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.
Substantiation: Exception No 1. allows listed metallic conduit and tubing to be used. It is not necessary to list it again “encased in concrete”.
Exception No 1. allows MC cable. . It is not necessary to list it again “encased in concrete”.
The objection to limiting the non-metallic conduits to PVC is addressed by the changes.
HDPE and NUCC were omitted from the list since they are not to be used in a building. I understand that encased in concrete places them “outside” the building.

2-59 Log #1010 NEC-P02 Final Action:
(210.12(A)(2)(d))

Submitter: Mike Holt, Mike Hold Enterprises
Comment on Proposal No: 2-92
Recommendation: Revise Section 210.12(A)(2)(d) of the proposal as follows (or with similar, better language):
(d) The first outlet box in the branch circuit shall be marked to indicate that it is the first outlet of the circuit ~~identified~~.
Substantiation: The term “identified” is defined in Article 100. It seems that the definition is not what the submitter intended.

2-60 Log #31 NEC-P02 Final Action:
(210.12(B) (New))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-116
Recommendation: The Correlating Committee directs the panel to reconsider and correlate the action on this proposal with the action taken on Proposal 1-131.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-61 Log #980 NEC-P02 Final Action:
(210.12(B))

Submitter: Charles J. Palmieri, Town of Norwell
Comment on Proposal No: 2-116
Recommendation: Revise text to read as follows:
Arc-fault circuit-interrupter protection shall be provided as required in 210.12(A) and (B). The arc-fault circuit interrupter shall be installed in ~~a readily accessible location~~ accordance with 110.25.
Substantiation: I am providing suggested text for the panel to consider on this proposal if Code Panel 1 continues to accept P 1-131 70-A2013-ROP and create a new section 110.25. The recommended modification to panel action on P-2-116 should be considered. The TCC has directed the panel to coordinate its actions on P 2-3. The same consideration should be afforded to the panel action on P 2-116.

2-62 Log #429 NEC-P02 Final Action:
(210.12(B)(2))

Submitter: Robert G. Wilkinson, IEC Texas Gulf Coast
Comment on Proposal No: 2-123
Recommendation: Accept proposal 2- 123.
Substantiation: CMP2 rejected my proposal 2-123 with the panel statement "Section 90.4 permits requiring new products that may not be available at the time the code is adopted". This provision was added to the 90.4 in the 1984 NEC and it was never intended to be applied to products that don't exist. The first electronic GFCI was developed in 1961 and the first requirement for GFCI protection in the NEC was in the 1968 edition and it was limited to protection of underwater lighting in swimming pools. Imagine what would have happened if the 1959 NEC required GFCI protection in light of the fact that the first circuit breaker type GFCI was not introduced until 1968 and the first receptacle type GFCI was not introduced until 1972. It is a disservice to the public to require a product that is not available to fulfill a requirement in the NEC. To continue to go down this path is to put the NEC in jeopardy of not being adopted. The credibility of the NEC is compromised by requiring products that do not exist. To take this matter to the ridiculous, I propose for the 2017 NEC to require a receptacle that I plan to develop that will provide AFCI, GFC I, ALCI, ELCI, IDCI, and LCDI protection. This receptacle will also be tamper resistant, weather resistant, and have the ability to change color to match the wall color. Since 90.4 permits requiring new products that may not be available at the time the Code is adopted, I'm sure my proposed magic receptacle will be accepted.

2-63 Log #1246 NEC-P02 Final Action:
(210.12(B)(2))

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 2-123
Recommendation: I recommend the panel accept proposal 2-123.
Substantiation: CMP 2 rejected proposal 2-123 with the panel statement "Section 90.4 permits requiring new products that may not be available at the time the Code is adopted". This provision was added to 90.4 in the 1984 NEC and it was never intended to be applied to products that don't exist. The first electronic GFCI was developed in 1961 and the first requirement for GFCI protection in the NEC was in the 1968 edition and it was limited to protection of underwater lighting in swimming pools. Imagine what would have happened if the 1959 NEC required GFCI protection in light of the fact that the first circuit breaker type GFCI was not introduced until 1968 and the first receptacle type GFCI was not introduced until 1972. It is a disservice to the public to require a product that is not available to fulfill a requirement in the NEC. To continue to go down this path is to put the NEC in jeopardy of not being adopted. The credibility of the NEC is compromised by requiring products that do not exist.

2-64 Log #1547 NEC-P02 Final Action:
(210.13 (New))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 2-125
Recommendation: Reject the proposal.
Substantiation: It is unlikely that the circuit described in the substantiation would actually have the status of a branch circuit. The secondary conductors from the transformer would be classified as a tap in Section 240.21(C) and require overcurrent protection at some point on the supply side of the transformer. If of sufficient size the GFPE rules in Section 215.10 would apply. The Code does not require a change to address this.

2-65 Log #1011 NEC-P02 Final Action:
(210.17)

Submitter: Ryan Jackson, West Valley City, UT
Comment on Proposal No: 2-128a
Recommendation: Please substantiate the change.
Substantiation: The "substantiation" proved by the panel wasn't substantiation at all. Perhaps the substantiation was supposed to be the panel statement? I don't mind this change, but those of us who teach and/or write books about the Code need to know why this change occurred. Is it based on the typical load of this type of equipment? Was there a task group involved? Thank you.

2-66 Log #1049 NEC-P02 Final Action:
(210.17)

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 2-128a
Recommendation: Reject the proposal.
Substantiation: Panel 2 is once again venturing into design considerations without minding the impositions of vague and unenforceable language on both installers and inspectors trying to comply with the Code, and without evidence of a problem relating to safety or fire hazard. The panel is creating a problem where the installer may claim a receptacle is for a blender and the inspector claims it looks like an EV-charging location. This is a design consideration based on equipment that may not have even been invented yet. See the panel's more appropriate responses to proposals 2-63 and 2-64. There may be instances where the designer finds it beneficial to group an EV receptacle with other loads for other purposes. Barring a fire or a death to prohibit that, it should remain in the hands of the designer.

2-67 Log #6 NEC-P02 Final Action:
(210.19, Informational Note 5)

Submitter: Peter Skweres, Minnesota Department of Transportation
Comment on Proposal No: 2-132
Recommendation: Add text as follows:
Informational Note 5. On dedicated lighting circuits that only employ LED luminaires the acceptable maximum voltage drop on both feeders and branch circuits shall not exceed 10 percent.
Substantiation: Voltage drop requirements for exclusive lighting circuits that employ LED luminaires are too stringent. New LED luminaires have power supplies that operate on an input voltage range from 277 - 105 V AC (nns). RehL'(ing the voltage drop requirement when LED luminaires are used will not reduce the efficiency of this type of luminaire. LED luminaires are specifically designed to operate over this very wide input voltage range. There is a linear relationship between the stated power consumed and the current required and the voltage applied.

2-68 Log #32 NEC-P02 Final Action:
(210.19(A)(1))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-131
Recommendation: It was the action of the Correlating Committee that this proposal be reconsidered and correlated with the actions taken on Proposals 2-201 and 2-202.
The Correlating Committee directs that the panel clarify whether the 125 percent is applied before or after the correction factors for consistency.
The Correlating Committee also directs that this proposal be submitted to Code-Making Panel 6 for comment.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-69 Log #257 NEC-P02 Final Action:
(210.19(A)(1))

Submitter: Code-Making Panel 6,
Comment on Proposal No: 2-131
Recommendation: Edit the wording of 210.19(A)(1), 2011 Code version, as follows:
(1) General. After the application of any ampacity adjustment or correction factors, branch-circuit conductors shall have an ampacity not less than the maximum combined load to be served. Within 1.22 m (4 ft) of termination equipment, the combined load of each connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating. ~~Where a branch-circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum branch-circuit conductor size, before the application of any adjustment or correction factors, shall have an allowable ampacity not less than the noncontinuous load plus 125 percent of the continuous load.~~
Delete the Exception and add new Informational Note:
Informational Note No. 5: Not all conductors of a circuit are necessarily connected tot he same termination equipment (circuit breaker, bus-bar lug, device, etc.). For instance, grounded conductors might not need the extra 25 percent of the continuous load added tot he combined load, where ungrounded conductors connected to a circuit breaker might.
Substantiation: The submitter is correctly concerned that the needed information to size the conductors is not clear. The part which is certain is that the ampacity must be at least the size of the load. However, the conductors within the 4 foot test length for equipment must have continuous loads considered (also noted in 2014 Proposal 2-202). If the equipment is 100% rated, then there is no adjustment needed, but if it is not 100% rated, then an additional 25% of the continuous load must be added.
Further Discussion:
The determination of conductor ampacity already includes any required adjustment or correction factors, but the added opening phrase reminding users that ampacity adjustment or correction factors may change the ampacity of a conductor might be worthwhile.
Phrasing the requirement in positive language allows the Exception to be deleted, as per Style Manual preference. The added Info Note clarifies that there might be different requirements for each end of each conductor of a circuit due the equipment it is terminated to.
The first sentence establishes the basic rule, including a reminder regarding ampacity factors. A second sentence to establish that at least four feet of each individual conductor connected to a standard non-100% rated equipment must have the possibility of an extra 25 percent continuous load considered. An information note to help clarify the concept of evaluating each conductor separately based on the equipment's listed rating. This then establishes the minimum load ampacity for the conductors. The conductor ampacity is then determined by 110.14(C) and any other applicable ampacity sections, usually those in Article 310.
The term "equipment" is a Code defined term which covers all the various types of termination methods.
We do not consider that the language inclusive of the 4 foot limitation is a new subject since it correlates to the necessary considerations for the conductor ampacity for non-!00% rated equipment situations. Should your panel consider it new, then you could consider this alternate for the second sentence:
"The combined load of each connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating." This wording still separates one conductor from another.
It appears to be true that the current 2011 wording of 210.19(A)(1) is a problem due to the syntax of the word "before." It appears that a #12 THHN copper could be allowed a rating of 20 for its 210.19(A)(1) based ("before the application of any adjustment or correction factors,") load ampacity, even though it might have correction factors which then limit it to an inadequate level.
Similar general logic will apply to Proposal 2-201 and 2-202 regarding feeders.
This Comment was developed before the results of the ROP were published, and therefore, could not reflect or consider any changes approved during the ROP process.

This comment was developed by a CMP-6 Task Group and balloted through the entire panel with the following ballot results:
10 Eligible to Vote
7 Affirmative (See voting comments below)
3 Negative (See voting comments below)

The following Comments on Vote were received:

AFFIRMATIVE:

S. CLINE: For the Informational Notes only, of 210.19(A)(1) [P2-131], and 215.2(A)(1) [P2-201 and P2-202], the words "a circuit breaker" might better be "an overcurrent device" for equal treatment.

P.R. PICARD: The use of a 4 foot length requires more substantiation than Mr. Hartwell's statement in ROP 2-202 that "the four-foot limit is based on prior conversations with UL personnel relative to how much conductor length is actually effective in performing that function."

NEGATIVE:

S. B. FRIEDMAN: The proposed language changes do not add clarity, and in fact adds confusion to the requirements when trying to incorporate the 4 ft. exception into existing text in proposal 2-131 and 2-201. Additionally, adding the 4 foot rule in the manner proposed for Proposal 2-202 goes beyond that indicated and substantiated in proposal and accepted by CMP-2.

NEMA should support the actions taken by CMP-2 with no further changes.

NEMA recommends an affirmative vote on panel 6 comments 6-4 and 6-5 on code proposals 8-191 and 8-192 respectively.

R.L. HUDDLESTON, Jr.: The comment as submitted by Panel 6 as written on the "Form for Comment" contains language that would leave the reader with the impression that the installation described is "typical", does not add clarity to the Code, but rather adds confusion, and is also technically unsubstantiated. The 4 ft. length of conductors came from Mr. Hartwell's proposal (2-202) and apparently was something that was based on some undocumented conversation with UL personnel.

Code requirements should never be based on hearsay, but on technical substantiation. The comments suggests that typically within 4' of terminations that are not listed for 100% rating, a cable will be sized one way, and then outside of the 4' length it will be sized another way. I contend that this will be very much the exception to the way branch circuit installations will normally take place. I, for one, would much prefer to run a longer length of copper conductor of a certain size than to splice on both ends and run a smaller size in the middle, as splices are an obvious and proven weak point in the conductive path. If it can be technically demonstrated that 4' is the proper length to use, then this wording should appear as an exception rather than the rule. Also, Mr. Hartwell proposed the 4' rule for feeders in Article 215, and this comment from Panel 6 has merged that thinking into branch circuits in Article 210, where it was never intended to be utilized.

The substantiation (further discussion) page of Comment 6-1 gives alternate text for the 2nd sentence: "The combined load of each connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating." If this wording was used instead of that shown on the "Form for Comment", I would support it.

M. XERRI: The proposed language changes do not add clarity to the proposals. By adding the 4 ft. exception into the proposals it is actually making the statement confusing. Additionally, adding the 4 foot rule in the manner proposed for proposal 2-202 goes beyond that indicated and substantiated in proposal and accepted by CMP-2.

2-70 Log #1477 NEC-P02 **Final Action:**
(210.19(A)(1))

Submitter: Charles R. Miller, Charles R. Miller Electrical Education and Training
Comment on Proposal No: 2-131
Recommendation: Accept the following text as revised by Code-Making Panel 2:

(1) General. Branch-circuit conductors shall have an ampacity not less than the maximum load to be served. Conductors shall be sized to carry not less than the larger of (a) or (b).

(a) Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum branch-circuit conductor size shall have an allowable ampacity not less than the noncontinuous load plus 125 percent of the continuous load.

(b) The minimum branch-circuit conductor size shall have an allowable ampacity not less than the maximum load to be served after the application of any adjustment or correction factors.

Substantiation: Because of the new wording, this section is now easy to understand.

2-71 Log #852 NEC-P02 Final Action:
(210.19(A)(2))

Submitter: Travis Lindsey, Travis Lindsey Consulting Services
Comment on Proposal No: 2-133
Recommendation: Add new text to read as follows:
Conductors for branch circuits as defined in Article 100 shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent. Voltage drop for a branch circuit is to be calculated or measured by utilizing a resistive load that represents 80% of the ampacity rating of the branch circuit.
Informational Note: See 215.2(A)(5) for voltage drop on feeder conductors.
Substantiation: The code panel has chosen not accept this proposal citing prior consensus. Prior surveys of inspectors, contractors and electricians have shown an overwhelming majority of these professionals consider excessive voltage drop to be a safety issue as well as an economic issue. Failures of fire alarm systems and smoke evacuation systems can be attributed to failure to adjust for circuit losses yet these circuits are not required to be adjusted for voltage drop. Circuit operating voltages have been responsible for many equipment losses. A number of these equipment losses have in the past caused large monetary losses especially in process systems such as factories. Cost should not be a factor when this conflicts with increasing safety.

2-72 Log #974 NEC-P02 Final Action:
(210.19(A)(2) (New))

Submitter: David Brender, Copper Development Assn. Inc.
Comment on Proposal No: 2-133
Recommendation: Add text to read as follows:
(2) Voltage Drop. Conductors for branch circuits as defined in Article 100, shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent. Voltage drop for a branch circuit is to be calculated or measured by utilizing a resistive load that represents 80% of the ampacity rating of the branch circuit.
Informational Note: See 215.2(A)(5) for voltage drop on feeder conductors.
Substantiation: Voltage drop on critical circuits (such as fire stairwell pressurization) has been identified as a safety concern, not just a convenience concern, or "reasonable efficiency of operation" concern 210.19(A) Informational Note 4 is not enforceable, and the above change would move the voltage drop requirement to enforceable language.

2-73 Log #1548 NEC-P02 Final Action:
(210.21(B)(1))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 2-121
Recommendation: Accept the proposal in principle. Reformat the recommended text as a separate numbered paragraph as follows:
(5) Receptacles on Individual Branch Circuits. A receptacle outlet installed to comply with a requirement for an individual branch circuit shall contain a single receptacle, or a multiple receptacle if, and then only to the extent that, the supplied equipment includes multiple supply cord connections.
Substantiation: CMP 2 objected to this proposal on the grounds that it was placed in a paragraph now reserved to the rating of the receptacle. Fair enough. This comment addresses that problem. The substantiation regarding field controversies and the IAEI Section Meeting discussions remain valid.

2-74 Log #243 NEC-P02 Final Action:
(210.23)

Submitter: Jim Lally, Detailed Inspection Service, Inc.
Comment on Proposal No: N/A
Recommendation: Add new text to read as follows:
New 210.23(E) In other than dwellings there should be no more than a maximum of (13) duplex receptacles installed on a 20 amp. branch circuit.
Substantiation: This would compliment and clarify the reasoning in 220.14(I) and 220.14(L).
180va X 13= 2340va so since 120volts X 20 amps = 2400va
This would be the maximum allowed on a 20 amp. branch circuit.

2-75 Log #1549 NEC-P02 Final Action:
(210.52(A))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 2-148
Recommendation: Accept the proposal.
Substantiation: The panel statement is not responsive. What the panel intends should never have been intended. Kitchen counter receptacles are not now, never have been, and can never be reserved for appliance use. In a space adjacent to a counter, the NEC now allows a receptacle 5½ ft above the floor to count as a perimeter receptacle in that space; it is frankly absurd to disallow a receptacle at the end of the counter some 4 ft above the floor to count for the same purpose. It is absurd to begin requiring 210.52(A) receptacle placements in stove and refrigerator cutouts because the adjacent countertop receptacles no longer count. And it greatly diminishes safety to reduce, in some cases to the vanishing point, receptacles in other rooms designed with built-in cabinetry. It also diminishes safety to, however inadvertently, effectively allow peninsular countertops of indefinite length with only a single receptacle outlet placement. The proposal that started us down this road to unintended consequences was never adequately substantiated. CMP 2 should revisit the exhaustive substantiation provided with the proposal, which need not be repeated here, and step on this before it gets any worse.

2-76 Log #560 NEC-P02 Final Action:
(210.52(A)(1))

Note: When the ballot result does not confirm the TC action on a Proposal by a two-thirds affirmative vote, the Report on Proposals shall be published with a specific request for public comment on that Proposal. The Proposal is now being reconsidered by the TC as a public comment.

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)

Comment on Proposal No: 2-149

Recommendation: Revise text to read as follows:

210.52(A)(1)

(1) Spacing. Receptacles shall be installed such that no point measured horizontally along the floor line in any wall space is more than ~~1.8 m (6 ft)~~ 1.2m (4 ft) from a receptacle outlet.

Substantiation: **Current Requirement:** In previous editions of the NEC Handbook (e.g. 1981) it has been stated, "Receptacles are to be located so that no point in any wall space is more than 6 ft from a receptacle. This rule intends that an appliance or lamp with a flexible cord attached may be placed anywhere in the room and be within 6 ft of a receptacle, thus eliminating the need for extension cords."

Problem: Since **most cord connected equipment will have cords that are less than 6 ft long** , based on the UL standards requirements for these products, it is unlikely that the receptacle spacing requirement now in the NEC will allow the cord on any single product to reach a receptacle from any point on the wall without the use of an extension cord, even if the cord attached product is sitting at the same height as the receptacle. **Should the cord connected equipment (a Lamp for instance) be elevated beyond the height of the receptacle, even a cord length of 6 ft would no longer accommodate the need**. Generally, receptacles are mounted at approximately 18" above floor height. The average height of a bedside table is approximately 28". By triangulating the cord requirement based on the difference in heights and the distance travel, the lamp cord would now have to be greater than 6 ft **,** if the cord remains flush to the wall. If the cord is angled away from the wall by 8 inches, e.g., a lamp on a table, a cord of more than 6 ft in length would be stretched taught to reach the receptacle. Often location of furniture precludes the relocation of the appliance closer to the outlet.

Need for More Receptacles: Additionally, this requirement did not anticipate the **extraordinary increase in the availability and use of cord connected equipment** in the home, ie, Televisions, DVD Players, Stereo Systems, Lamps, Cordless Phones, Cell Phone Chargers, Video Gaming Systems, Computers, Printers, Fax Machines, Cameras, Cell Phone Chargers, I-Pods, I-Pads, Electronic Readers (Kindle, Nook), Electric Toys, Chargers for Battery Powered Tools, etc. All of which are generally available in multiples throughout the average home, and few of which were available when this code was originally developed. Due to this ever expanding list of cord connected products that may be used in any room of a home, all available receptacles within reach of a cord can easily be in use. This results in increased usage of extension cords to reach available receptacles, remotely located in other areas of the household. The increased use of cord connected equipment results in the same condition that the 6 ft spacing rule was intended to prevent, and it is evident that **the number of receptacles required 50 years ago is no longer adequate for today's home**. Reducing the required spacing will have the effect of making more receptacles available for the increased number of cord connected products now in the home.

Should the spacing requirement between receptacles not be reduced to accommodate the aforementioned increase in demand, improper use of **extension cord**s ~~use~~ **will continue to proliferate** ~~and the~~ with **hazardous results** ~~of their use will multiply~~. Electrical cord fires are one of the **leading causes of the total number of residential fires in the United States**. The U.S. Consumer Product Safety Commission (CPSC) estimates that 3300 residential fires originate in extension cords each year, killing 50 persons.

Additionally, recent CPSC statistics (CPSC Document # 16 - http://www.cpsc.gov/cpscpub/pubs/16.html) also indicate that there are over 4,000 injuries associated with electrical extension cords that result in treatment in hospital emergency rooms annually. Half of these injuries involve fractures, lacerations, contusions or strains from people tripping over extension cords. Thirteen percent of the injuries involve children under the age of 5.

Increasing the number of available receptacles will reduced the improper use of extension cords that lead to the incidents described in the CPSC reports. When more receptacles are available, the improper use of extension cords installed under carpets and rugs, run though doorways and in walkways will be reduced.

Summary: As the number of cord connected household electrical / electronic products continues to grow, the lack of a sufficient number of available receptacle outlets leads the homeowner to the use of extension cords. The NEC has long recognized the hazards presented by the use of extension cords, ~~especially~~ where they are used in place of permanent wiring. Reducing the spacing between receptacles as recommended in this proposal will help to ensure that there are

an adequate number of receptacles available for connection of the growing number of cord connected appliances being used in the typical dwelling. Since 1956, the receptacle spacing requirements in 210.52 (A) (1), and the resulting number of receptacles installed has remained unchanged.

2-77 Log #805 NEC-P02 **Final Action:**
(210.52(A)(1))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 2-149
Recommendation: Proposal 2-149 should be accepted.
Substantiation: The panel did not have the required 2/3 votes to reject this proposal during the ROP. In addition, the Panel Statement for rejection did not address the NEMA substantiation supplied with the proposal.

2-78 Log #1550 NEC-P02 **Final Action:**
(210.52(A)(1))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 2-149
Recommendation: Continue to reject the proposal.
Substantiation: The most disturbing thing about the panel action on this proposal is that it actually received more than one or two affirmative votes. The proposal is extremely disturbing in that it would overturn NEC provisions that have served us well for many decades in order to ratify multiple product standards that somehow allow listed cord- and plug-connected appliances in 210.52(A) (residential) environments to be equipped with cords that are too short. This submitter has now decided to submit a proposal (public input? – new procedures) to CMP 17 (Article 422) in the 2017 cycle to require a minimum cord length of 6 ft for such equipment. If the NEC Committee doesn't get a handle on this soon, the tail will surely wag the dog. Where will this trend end? If the rule drops to four feet, will we see appliance cords drop to 4 feet? Perhaps one meter? An important reason NEMA and UL have representatives on all code making panels is supposed to be to assure that the equipment they manufacture and list will perform properly in locations governed by NEC provisions. It was never supposed to be the case that the installation code would instead do the reverse, and bow to the product standard.

CMP 2 members might be interested to know that they are not the only panel subjected to this sort of proposal. CMP 9 just overwhelmingly rejected a proposal (9-97, vote 10-2) to unravel settled NEC provisions in 402.8(C) going back two cycles because the NEC is inconsistent with the product standard. And so it is; it was put in the NEC expressly to compel a change in the product standard because of field installation issues. Now it seems that in order to avoid a file review the manufacturers involved are attempting to undo the prior change. Enough is enough. Proposals such as these must be resoundingly rejected. At best, the proposal substantiation provides some arguments for making changes in product standards that increase the length of cords supplied with appliances, floor lamps, etc. This electrician, when installing new cords on such equipment, always makes them even a little longer than 6 ft for the same reasons.

2-79 Log #408 NEC-P02 **Final Action:**
(210.52(A)(3))

Submitter: Russel LeBlanc, The Peterson School of Engineering
Comment on Proposal No: 2-154
Recommendation: This proposal should have been accepted.
Substantiation: The panel's statement is incorrect. The present "literal" wording does not address a receptacle outlet mounted ON the floor. While the INTENT of the present wording may be to include it, the LITERAL wording does not. There is a difference between an outlet box installed IN a floor and one installed ON a floor. The proposed wording makes it clear that either location is acceptable. If this difference is not clear then let us use this funny analogy. The next time you need to use the toilet, will you be sitting ON the bowl or IN the bowl? You'll probably notice that there is quite a difference!

2-80 Log #33 NEC-P02 Final Action:
(210.52(E))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-169
Recommendation: The Correlating Committee understands that the first sentence of 210.52(E) is revised by the panel action taken on Proposal 2-168.
The Correlating Committee directs that the panel clarify the action on this proposal with respect to the text that was accepted in the panel action on Proposal 2-176.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-81 Log #34 NEC-P02 Final Action:
(210.52(E)(3))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-176
Recommendation: The Correlating Committee directs that the panel correlate the action on Proposal 2-169 with this proposal.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-82 Log #1480 NEC-P02 Final Action:
(210.52(G))

Submitter: Donald R. Offerdahl, Bismarck, ND
Comment on Proposal No: 2-179
Recommendation: Revise text to read as follows:
(G) Basements, Garages, and Accessory Buildings. For a one-family dwelling, the following provisions shall apply:
(1) At least one receptacle outlet, in addition to those for specific equipment, shall be installed in each basement.
(2) At least one receptacle outlet shall be installed for each car space in each attached garage and in each detached garage.
(3) At least one receptacle outlet shall be installed in each accessory building with electric power.
Substantiation: The panel statement states “The submitter has not substantiated requiring that the number of receptacles.” The substantiation that the panel wants has been witnessed by myself and if the panel asks any electrical inspectors if there is a misuse of extension cords when inspecting the residential homes, the panel will have the substantiation they are asking for by the information obtained from electrical inspectors throughout the United States.

2-83 Log #806 NEC-P02 Final Action:
(210.52(G)(1))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 2-181
Recommendation: Proposal 2-181 should be accepted.
Substantiation: Builders do not always locate the receptacle in a "convenient" location in the garage. Many larger garages have extra bays for lawn equipment and other supplies. These extra bays are in placed because detached barns are not always allowed in all housing developments. In addition, it is not always "convenient" to move a car with a dead battery to receptacle so that a battery charger can be connected. Garage floors can have standing water on the floor from rain and melted snow. This could become a safety hazard when extension cords used.

2-84 Log #1000 NEC-P02 Final Action:
(210.52(G)(1))

Submitter: David Clements, International Association of Electrical Inspectors
Comment on Proposal No: 2-180
Recommendation: Reject the proposal and restore to the 2011 NEC language.
(G) ~~Outlets in~~ Basements, Garages, and Accessory Buildings. For a one-family dwelling, the following provisions shall apply:
(1) At least one receptacle outlet, in addition to those for specific equipment, shall be installed in each basement, in each attached garage, and in each detached garage or accessory building with electric power. ~~For receptacles outlets inside of attached and detached garages, branch circuits(s) supplying receptacle outlets not installed for specific equipment shall have no other outlets.~~
Substantiation: The correct substantiation to reject proposal 2-180 should be NEC 90.1 Purpose. (B) Adequacy. "but not necessarily efficient, convenient, or adequate for good service or future expansion of electrical use." This proposal is in conflict with NEC 90.1(B).

2-85 Log #1050 NEC-P02 Final Action:
(210.64)

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 2-191
Recommendation: Reject the proposal.
Substantiation: Considering that possibly 1% of all services installed on the planet have data recording equipment attached to them once in their lives for a temporary period of time, this proposal is woefully under-substantiated. There are cord-set GFCI protection devices to protect against half of the submitter's concern. Many services can even be temporarily modified to service a 120V receptacle for the task at hand as well.

2-86 Log #1247 NEC-P02 Final Action:
(210.64)

Submitter: John Masarick, Independent Electrical Contractors, Inc.
Comment on Proposal No: 2-191
Recommendation: I recommend the panel continue to accept in Principal proposal 2-191 as stated in the panel's statement below.
"210.64 Electrical Service Areas. At least one 125 volt single phase 15 or 20 ampere rated receptacle outlet shall be installed within 15 m (50 ft) of the electrical service equipment.
Exception: The receptacle outlet shall not be required to be installed in one and two family dwellings.

Substantiation: Test equipment is frequently needed for monitoring and servicing electrical equipment in service areas. If a receptacle is not available near the service equipment, an extension cord is often used. The extension cord often must travel down hallways and across rooms. The extension cord will present a slip, trip, or fall hazard.

2-87 Log #352 NEC-P02 Final Action:
(210.71 (New))

Submitter: Vince Baclawski, National Electrical Manufacturers Association (NEMA)
Comment on Proposal No: 2-198a
Recommendation: Add text to read as follows:
210.71 Meeting Rooms.
In other than dwelling units, portions of buildings or structures of up to 70 m2 (760 ft2) that are designed or intended for the gathering of seated occupants for such purposes as conferences, deliberations, or similar purposes, where electronic equipment such as computers, projectors, or similar equipment is likely to be used, shall have 125-volt, 15- and 20-ampere receptacle outlets installed as specified in 210.71(A) and (B).
(A) Receptacles in Walls. In meeting rooms having a floor area of 70 m2 (760 ft2) or less, receptacles shall be installed such that no point measured horizontally along the floor line of any fixed wall is more than 1.2m (4 ft) from a receptacle.
(B) Floor Receptacles. A meeting room that is at least 3.6 m (12 ft) wide and has a floor area of at least 21 m2 (225 ft2) and not more than 70 m2 (760 ft2) shall have at least one duplex receptacle located in the floor at a distance not less than 1.8 m (6 ft) from any fixed wall.
Informational Note 1: See Section 314.27 for floor boxes used for receptacles located in the floor.
Informational note 2: See Article 518 for Assembly Occupancies designed for 100 or more persons.
Substantiation: NEMA respectfully requests the code panel reconsider its action on the subject proposal.
The panel considers the installation of receptacles in meeting rooms to be a design consideration. It is readily apparent by observation of the receptacle installation in meetings rooms that the current design practice for providing receptacles in these rooms results in a shortage of available receptacles. A typical meeting room is significantly underserved by the limited number of receptacles available for cord and plug connected products. This leads to the conditions described in the proposal substantiation of daisy chained temporary power strips and the potentially hazardous use of extension cords.
The panel statement that the proposal would require receptacle outlets in moveable walls is incorrect. The proposal requires wall receptacle outlets only in fixed walls.
The panel also expressed concern with the varying configurations of meeting rooms. The proposal clearly defines the function and dimensions of the meeting rooms that will be affected. The size of the meeting room described in the proposal is very unlikely to be of a configuration that would make compliance with the requirement difficult. Meetings rooms of this size are typically rectangular in shape.

2-88 Log #807 NEC-P02 Final Action:
(210.71 (New))

Submitter: David H. Kendall, Thomas & Betts Corporation
Comment on Proposal No: 2-198a
Recommendation: Proposal 2-198a should be accepted.
Substantiation: There is not an adequate number of receptacles in meeting rooms for powering computers, projectors and other devices. The proposal defines and identifies requirements for the meeting room.

2-89 Log #255 NEC-P02 Final Action:
(210.85(A)(5))

Submitter: Code-Making Panel 17,
Comment on Proposal No: 2-10
Recommendation: Continue to reject this proposal.
Substantiation: Relocating this definition to Article 100 will grant it global authority over unfinished areas of all occupancies. Currently it is limited to dwellings as defined in article 100 (see title to 210.8 (A). The impact of such a move has not been considered nor justified in the proposal. The existing definition is specifically framed to the installation of GFCI protected receptacles in basement areas of dwellings that are not intended as habitable rooms. The use of the term “unfinished basement” in articles 334.15 (C) and 382.12 (1) apply to the installation and protection of the physical wiring methods. The definition as used in article 210.8 (A) (5) applies to protecting occupants via use of Ground Fault Circuit Interrupters in those areas of dwellings which present an elevated risk of shock. This is not true in all occupancies. The submitter has not provided historical evidence indicating a conflict in the application of the term “unfinished basement” as used in article 334.15 (C) nor 382.12 (1). The current location of this definition in 210.8 (A) (5) has a reasonable history of success and lacking empirical evidence of a problem it should not be relocated. It is important to note that in the application of the language in 334 and 382 the term unfinished and basement is easily defined by use of standard dictionaries whereas the definition located in article 210 is specific for the application of GFCIs.

This comment was developed by a CMP-7 Task Group and balloted through the entire panel with the following ballot results:
14 Eligible to vote
11 Affirmative
2 Negative (See voting Comments below)
1 Ballot Not Returned (C.J. Fahrenhold)
The following Comments on Vote were received:
NEGATIVE:

C.K. HUNTER: We disagree with the stated CMP-7 reasoning. In reviewing the uses of the term in 334.15(C) and 382.12(1), the definition fits with the language and requirements in both of these sections. The proposal submitter was correct in pointing out that when a term is used multiple times in the NEC that the definition should appear in Article 100. Leaving it in Article 210 begs the question- what differentiates an unfinished basement in Article 210 from the use in Articles 334 and 382?

S.R. LaDART: Relocating this definition to Article 100 will grant it global authority over unfinished areas of all occupancies. Currently, it is limited to dwellings as defined in Article 100. The importance of such a move has not been considered nor justified in the proposal. Continue to Reject.

2-90 Log #772 NEC-P02 Final Action:
(210.529(C)(2))

Submitter: Eric Bunce, Rmh Group Inc.
Comment on Proposal No: 2-161
Recommendation: Revise text to read as follows:

Island Counter Spaces. At least one receptacle shall be installed at each island countertop space with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater. Island counter tops that exceed 1200 mm (48 in.) in length shall have one additional receptacle outlet installed for each 1200 mm (48 in.) of counter top or fraction thereof. ~~Additional receptacle outlets required by this section shall be equally spaced along the length of the counter top measured in the long dimension.~~

Substantiation: The submitter of this idea has presented a valid solution for a real problem in the NEC. Insufficient receptacles on counter top islands result in the dangerous use of extension cords. This problem would be avoided if the panel would accept the proposed solution with the exception of removing the restrictive requirement for equally spacing receptacles. The code making panel's response that "...it is likely that additional receptacles a installed by the installer for the convenience of the owner." is very presumptive by the code making panel. Everyone's naturally inclined to do as little work as possible and home builders and owners do not want to incur additional costs if they can avoid it. I recommend that the code making panel add the proposed text above which mirrors the intent of article 210.62 for showroom windows and gives the installer a clear direction instead of assuming good will or common sense will prevail. Alternatively 210.62 could be modified to require one receptacle to mirror 210.52(C)(2) and we could depend on the contractor to just do the right thing.

2-91 Log #258 NEC-P02 Final Action:
(215.2(A)(1))

Submitter: Code-Making Panel 6,
Comment on Proposal No: 2-201
Recommendation: The wording proposed in the action needs to be changed. Edit the wording of 210.19(A)(1), 2011 Code version, as follows:
(1) General. After the application of any ampacity adjustment or correction factors, feeder conductors shall have an ampacity not less than required to supply the combined load as calculated in Parts III, IV, and V of Article 220. Within 1.22 m (4 ft) of termination equipment, the combined load of each connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating. ~~The minimum feeder-circuit conductor size, before the application of any adjustment or correction factors, shall have an allowable ampacity not less than the noncontinuous load plus 125 percent of the continuous load.~~
(Delete Exceptions #1 and #2, add new Info note.)

Informational Note: Not all conductors of a circuit are necessarily connected to the same termination equipment (circuit breaker, bus-bar lug, device, etc). For instance, grounded conductors might not need the extra 25 percent of the continuous load added to the combined load, where ungrounded conductors connected to a circuit breaker might.

215.2(A)(1) 2014 NEC Proposal 2-201
Further discussion:
The determination of conductor ampacity already includes any required adjustment or correction factors, but the added opening phrase reminding users that ampacity adjustment or correction factors may change the ampacity of a conductor might be worthwhile.

The two exceptions are deleted. The sub-section would then read:
(1) General. After the application of any ampacity adjustment or correction factors, feeder conductors shall have an ampacity not less than required to supply the combined load as calculated in Parts III, IV, and V of Article 220. Within 1.22 m (4 ft) of termination equipment, the combined load of each connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating.

Informational Note: Not all conductors of a circuit are necessarily connected to the same termination equipment (circuit breaker, bus-bar lug, device, etc). For instance, grounded conductors might not need the extra 25 percent of the continuous load added to the combined load, where ungrounded conductors connected to a circuit breaker might.
*****
Phrasing the requirements in positive language allows the Exceptions to be deleted, as per Style Manual preference. The added Info Note clarifies that there might be different requirements for the different conductors of a circuit due to the equipment they are terminated to.

The first sentence establishes the basic rule, including a reminder regarding ampacity factors. A second sentence to establish that at least four feet of each individual conductor connected to a standard non-100% rated equipment must have the possibility of an extra 25 percent continuous load considered. An information note to help clarify the concept of evaluating each conductor separately based on the equipment's listed rating. This then establishes the minimum load ampacity for the conductors. The conductor ampacity is then determined by 110.14(C) and any other applicable ampacity sections, usually those in Article 310.

The term "equipment" is a Code defined term which covers all the various types of termination methods.

It appears to be true that the current 2011 wording of 215.2(A)(1) is a problem. It appears that a #3/0 THHN copper could be allowed a rating of 225 for its 215.2(A)(1) based ("before the application of any adjustment or correction factors,") load ampacity, even though it might have correction factors which then limit it to an inadequate level.

As an example, if the load consists of 100 amps of non-continuous, and 70 amps of continuous load, the "before the

application" of any adjustment or correction factors allowable ampacity must be 187.5. By 215.2(A)(1), a typical #3/0 THHN copper is satisfactory. However, if that #3/0 is required by conditions of installation to be derated by 50% (for any of a variety of reasons), its Section 310 ampacity is only 113. The suggested wording of this comment would simply require the circuit conductors to have an installed minimum ampacity of 187.5.

The addition of the words " Within 1.22 m (4 ft) of equipment, . . . " addresses the concerns of Mr. Hartwell's Proposal 2-202.

The suggested wording is identical to the Comment for Proposal 202.
This Comment was developed before the results of the ROP were published, and therefore could not reflect or consider any changes approved during the ROP process.

Substantiation: The submitter is correctly concerned that the needed information to size the conductors is not clear. The fact that any required adjustment or correction factors for the conductor ampacity must result in a conductor ampacity at least as large as the load is not clear. However, the conductors within the 4 foot conductor test length for equipment must have continuous loads considered. If the equipment is 100% rated, then there is no load adjustment needed, but if it is not 100% rated, then an additional 25% of the continuous load must be added. Please see further discussion on page 2.

This comment was developed by a CMP-6 Task Group and balloted through the entire panel with the following ballot results:

10 Eligible to Vote

7 Affirmative (See voting comments below)

3 Negative (See voting comments below)

The following Comments on Vote were received:

AFFIRMATIVE:

S. CLINE: For the Informational Notes only, of 210.19(A)(1) [P2-131], and 215.2(A)(1) [P2-201 and P2-202], the words “a circuit breaker” might better be “an overcurrent device” for equal treatment.

P.R. PICARD: The use of a 4 foot length requires more substantiation than Mr. Hartwell’s statement in ROP 2-202 that “the four-foot limit is based on prior conversations with UL personnel relative to how much conductor length is actually effective in performing that function.”

NEGATIVE:

S. B. FRIEDMAN: The proposed language changes do not add clarity, and in fact adds confusion to the requirements when trying to incorporate the 4 ft. exception into existing text in proposal 2-131 and 2-201. Additionally, adding the 4 foot rule in the manner proposed for Proposal 2-202 goes beyond that indicated and substantiated in proposal and accepted by CMP-2.

NEMA should support the actions taken by CMP-2 with no further changes.

NEMA recommends an affirmative vote on panel 6 comments 6-4 and 6-5 on code proposals 8-191 and 8-192 respectively.

R.L. HUDDLESTON, Jr.: The comment as submitted by Panel 6 as written on the “Form for comment” contains language that would leave the reader with the impression that the installation described is “typical”, does not add clarity to the Code but rather adds confusion, and is also technically unsubstantiated. The 4 ft. length of conductors came from Mr. Hartwell’s proposal (2-202) and apparently was something that was based on some undocumented conversation with UL personnel. Code requirements should never be based on hearsay, but on technical substantiation. The Comment suggests that typically within 4’ of terminations that are not listed for 100% rating, a cable will be sized one way, and then outside of the 4’ length it will be sized another way. I contend that this will be very much the exception to the way feeder installations will normally take place. I, for one, would much prefer to run a longer length of copper conductor of a certain size than to splice on both ends and run a smaller size in the middle, as splices are an obvious and proven weak point in the conductive path. If it can be technically demonstrated that 4’ is the proper length to use, then this wording should appear as an exception rather than the rule.

M. XERRI: The proposed language changes do not add clarity to the proposals. By adding the 4 ft. exception into the proposals it is actually making the statement confusing. Additionally, adding the 4 foot rule in the manner proposed for proposal 2-202 goes beyond that indicated and substantiated in proposal and accepted by CMP-2.

2-92 Log #259 NEC-P02 Final Action:
(215.2(A)(1))

Submitter: Code-Making Panel 6,
Comment on Proposal No: 2-202
Recommendation: The effective action on proposal 2-202 needs to be: Accept in Principle in Part. The wording proposed in the action needs to be changed. Edit the wording of 210.19(A)(1), 2011 Code version, as follows:

(1) General. After the application of any ampacity adjustment or correction factors, feeder conductors shall have an ampacity not less than required to supply the combined load as calculated in Parts III, IV, and V of Article 220. Within 1.22 m (4 ft) of termination equipment, the combined load of each connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating. ~~The minimum feeder-circuit conductor size, before the application of any adjustment or correction factors, shall have an allowable ampacity not less than the noncontinuous load plus 125 percent of the continuous load.~~

(Delete Ex #1 and 2, and add new Info note.)

Informational Note: Not all conductors of a circuit are necessarily connected to the same termination equipment (circuit breaker, bus-bar lug, device, etc). For instance, grounded conductors might not need the extra 25 percent of the continuous load added to the combined load, where ungrounded conductors connected to a circuit breaker might.

Substantiation: Proposal 2-202 correctly points out that the conductor within 4 feet of a non-100% rated piece of equipment might need to be a larger size than one further away in order to achieve its tested heat-sink effect. The provisions of ampacity evaluation allow for different sections of a circuit to be arrived at independently, with the lowest ampacity being the final determinate. This wording would allow the conductor within 4 feet to be one size, and the rest of the circuit to be another size.

Further discussion:

However, it is critical that conductors connected to terminals which are not 100 percent rated must have the 25% added to their load value. Hartwell's wording seems to bypass this requirement (this is the Part not Accepted), this suggested wording would not. The balance of the wording changes are to correlate with the Comment on Proposal 2-201.

The two exceptions are deleted. The sub-section would then read:

(1) General. After the application of any ampacity adjustment or correction factors, feeder conductors shall have an ampacity not less than required to supply the combined load as calculated in Parts III, IV, and V of Article 220. Within 1.22 m (4 ft) of termination equipment, the combined load of each connected conductor shall be 100 percent of the noncontinuous load plus 125 percent of the continuous load, unless the termination equipment is listed for operation at 100 percent of its rating.

Informational Note: Not all conductors of a circuit are necessarily connected to the same termination equipment (circuit breaker, bus-bar lug, device, etc). For instance, grounded conductors might not need the extra 25 percent of the continuous load added to the combined load, where ungrounded conductors connected to a circuit breaker might.

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This portion of the edited wording addresses the concerns of this Proposal: "Within 1.22 m (4 ft) of termination equipment, . . ."

The term "equipment" is a Code defined term which covers all the various types of termination methods.

The balance of the wording changes are to correlate with the Comment on Proposal 2-201.

The suggested wording is identical to the Comment for Proposal 201.

This Comment was developed before the results of the ROP were published, and therefore could not reflect or consider any changes approved during the ROP process.

This comment was developed by a CMP-6 Task Group and balloted through the entire panel with the following ballot results:

10 Eligible to Vote
7 Affirmative (See voting comments below)
3 Negative (See voting comments below)
The following Comments on Vote were received:

AFFIRMATIVE:

S. CLINE: For the Informational Notes only, of 210.19(A)(1) [P2-131], and 215.2(A)(1) [P2-201 and P2-202], the words "a circuit breaker" might better be "an overcurrent device" for equal treatment.

P.R. PICARD: The use of a 4 foot length requires more substantiation than Mr. Hartwell's statement in ROP 2-202 that "the four-foot limit is based on prior conversations with UL personnel relative to how much conductor length is actually effective in performing that function."

NEGATIVE:

S. B. FRIEDMAN: The proposed language changes do not add clarity, and in fact adds confusion to the requirements when trying to incorporate the 4 ft. exception into existing text in proposal 2-131 and 2-201. Additionally, adding the 4 foot rule in the manner proposed for Proposal 2-202 goes beyond that indicated and substantiated in proposal and accepted by CMP-2.

NEMA should support the actions taken by CMP-2 with no further changes.

NEMA recommends an affirmative vote on panel 6 comments 6-4 and 6-5 on code proposals 8-191 and 8-192 respectively.

R.L. HUDDLESTON, Jr.: The comment as submitted by Panel 6 as written on the "Form for comment" contains language that would leave the reader with the impression that the installation described is "typical", does not add clarity to the Code but rather adds confusion, and is also technically unsubstantiated. The 4 ft. length of conductors came from Mr. Hartwell's proposal (2-202) and apparently was something that was based on some undocumented conversation with UL personnel. Code requirements should never be based on hearsay, but on technical substantiation. The Comment suggests that typically within 4' of terminations that are not listed for 100% rating, a cable will be sized one way, and then outside of the 4' length it will be sized another way. I contend that this will be very much the exception to the way feeder installations will normally take place. I, for one, would much prefer to run a longer length of copper conductor of a certain size than to splice on both ends and run a smaller size in the middle, as splices are an obvious and proven weak point in the conductive path. If it can be technically demonstrated that 4' is the proper length to use, then this wording should appear as an exception rather than the rule.

M. XERRI: The proposed language changes do not add clarity to the proposals. By adding the 4 ft. exception into the proposals it is actually making the statement confusing. Additionally, adding the 4 foot rule in the manner proposed for proposal 2-202 goes beyond that indicated and substantiated in proposal and accepted by CMP-2.

2-93 Log #35 NEC-P02 **Final Action:**

(215.2(A)(1) Exception No. 2 (New))

Submitter: Technical Correlating Committee on National Electrical Code®,

Comment on Proposal No: 2-202

Recommendation: The Correlating Committee requests that this proposal be reconsidered.

The phrase "that are not terminated at either end" and its use in the sentence are unclear.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-94 Log #1431 NEC-P02 Final Action:
(215.2(A)(1) Exception No. 2 (New))

Submitter: Christel K. Hunter, Alcan Cable, a General Cable Company
Comment on Proposal No: 2-202
Recommendation: Reject this proposed new Exception
Substantiation: The first part of this exception is already allowed by code. The installation of smaller conductors that are then spliced to larger conductors in order to comply with the
temperature limitations of equipment is certainly allowed by code as long as each section of the circuit complies with the applicable ampacity and connection requirements. There is no need to give further specific allowance for this installation method.
Additionally, there was no technical substantiation submitted for the four foot length. Although the submitter states that he has had conversations with UL, there was no submission of testing or research that would support that four feet is required or that even four feet is enough. Until valid technical substantiation is submitted, this
proposal should be rejected.

2-95 Log #1551 NEC-P02 Final Action:
(215.2(A)(1) Exception No. 2 (New))

Submitter: Frederic P. Hartwell, Hartwell Electrical Services, Inc.
Comment on Proposal No: 2-202
Recommendation: Accept the proposal in principle. Revise text to read as follows:
Exception No. 2: Feeder conductors that are connected at both their supply and load ends to separately installed pressure connectors as covered in 110.14(C)(2) shall be permitted to have an allowable ampacity, after the application of any required adjustment or correction factors, not less than the sum of the continuous load plus the noncontinuous load. This exception shall not apply within 1.2 m (4 ft), as measured along the length of the conductors, of an overcurrent device.
Substantiation: This editorial revision of the accepted proposal recasts the exception in affirmative text and addresses the concerns of the Correlating Committee. It also clarifies how the 4-ft distance is to be measured. The point is to assure adequate heat sinking capabilities of the portion of the feeder that actually lands on an overcurrent device.

2-96 Log #853 NEC-P02 Final Action:
(215.2(A)(5))

Submitter: Travis Lindsey, Travis Lindsey Consulting Services
Comment on Proposal No: 2-213
Recommendation: Add new text to read as follows:
Conductors for branch circuits as defined in Article 100 shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent. Voltage drop for a branch circuit is to be calculated or measured by utilizing a resistive load that represents 80% of the ampacity rating of the branch circuit.
Informational Note: See 215.2(A)(5) for voltage drop on feeder conductors.
Substantiation: The code panel has chosen not accept this proposal citing prior consensus. Prior surveys of inspectors, contractors and electricians have shown an overwhelming majority of these professionals consider excessive voltage drop to be a safety issue as well as an economic issue. Failures of fire alarm systems and smoke evacuation systems can be attributed to failure to adjust for circuit losses yet these circuits are not required to be adjusted for voltage drop. Circuit operating voltages have been responsible for many equipment losses. A number of these equipment losses have in the past caused large monetary losses especially in process systems such as factories. Cost should not be a factor when this conflicts with increasing safety.

2-97 Log #975 NEC-P02 Final Action:
(215.2(A)(5))

Submitter: David Brender, Copper Development Assn. Inc.
Comment on Proposal No: 2-213
Recommendation: Add text to read as follows:
(5) Voltage Drop. Conductors for feeder circuits as defined in Article 100, shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent. Voltage drop for a feeder circuit is to be calculated or measured by utilizing a resistive load that represents 80% of the ampacity rating of the branch circuit.
Informational Note: See 215.2(A)(5) for voltage drop on feeder conductors.
Substantiation: Voltage drop on critical circuits (such as fire stairwell pressurization) has been identified as a safety concern, not just a convenience concern, or "reasonable efficiency of operation" concern. 215.(A)(4) Informational Note 2 is not enforceable, and under a section that applies to dwelling units. The above change would move the voltage drop requirement to enforceable language for all occupancies.

2-98 Log #1578 NEC-P02 Final Action:
(215.3 Exception)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 10-16
Recommendation: Revise text to read as follows:
215.3 Overcurrent Protection.
Exception No. 2: Overcurrent protection for feeders between 600 to 1000 volts shall comply with Parts I through VII of Article 240, Feeders over ~~600~~ 1000 volts, nominal, shall comply with Part IX of Article 240.

Substantiation: The voltage boundary in 215 is 60 volts. The voltage boundary in 240 (changed by ROP 10-16) is 1000 volts. 215.3 Exception 2 is now split.

2-99 Log #527 NEC-P02 Final Action:
(215.12)

Submitter: James F. Williams, Fairmont, WV
Comment on Proposal No: 2-127
Recommendation: 215.12 Identification for Feeders.
(C) Ungrounded Conductors.
(2) Feeders Supplied From Direct Current Systems. Where a feeder is supplied from a dc system operating at more than 60 volts, each ungrounded conductor of 4 AWG or larger shall be identified by polarity at all termination, connection, and splice points by marking tape, tagging, or other approved means; each ungrounded conductor of 6 AWG or smaller shall be identified by polarity at all termination, connection, and splice points in compliance with ~~215.12~~210.5(C)(2)(a) and (b). The identification methods utilized for conductors originating within each feeder panelboard or similar feeder distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each feeder panelboard or similar feeder distribution equipment
~~(a) *Positive Polarity, Sizes 6 AWG or smaller.* Where the positive polarity of a dc system does not serve as the connection for the grounded conductor, each positive ungrounded conductor shall be identified by one of the following means:~~
~~(1) A continuous red outer finish.~~
~~(2) A continuous red stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or black.~~
~~(3) Imprinted plus signs "+" or the word "POSITIVE" or "POS" durably marked on insulation of a color other than green, white, gray, or black, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B).~~
~~(b) *Negative Polarity, Sizes 6 AWG or smaller.* Where the negative polarity of a dc system does not serve as the connection for the grounded conductor, each negative ungrounded conductor shall be identified by one of the following means:~~
~~(1) A continuous black outer finish.~~
~~(2) A continuous black stripe durably marked along the conductor's entire length on insulation of a color other than green, white, gray, or red.~~
~~(3) Imprinted minus signs "–" or the word "NEGATIVE" or "NEG" durably marked on insulation of a color other than green, white, gray, or red, and repeated at intervals not exceeding 610 mm (24 in.) in accordance with 310.120(B).~~
Substantiation: Define the marking requirements for ungrounded DC conductors in a single place just as the marking for grounded and grounding conductors is handled. There is no reason to replicate that complex text.

2-100 Log #36 NEC-P02 Final Action:
(215.12(C))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-217
Recommendation: The Correlating Committee directs that this proposal be reconsidered and correlated with the actions taken on Proposals 2-23, 4-234, 4-262, 4-375, 5-220, 5-221 and 13-33 with regard to the 50 volt/60 volt nominal level.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-101 Log #844 NEC-P02 Final Action:
(220.6)

Submitter: Joe Goodwater, University of Nebraska Lincoln
Comment on Proposal No: 2-220
Recommendation: Modify the original proposal as shown below:
220.6 Expert agencies. Information about the historical electrical demand of an occupancy class that is provided by an ANSI-accredited standards developer and approved by the Authority Having Jurisdiction, shall be permitted to be used as a basis for all load calculation methods in this Article.
Informational Note: An example of an ANSI accredited standards developer is the Institute of Electrical and Electronic Engineers whose recommended practices such as ANSI/IEEE Std. 241, *Recommended Practice for Electric Power Systems in Commercial Buildings,*
Substantiation: For the convenience of the committee, the substantiation for the original rejection of our proposal is reproduced below:
"Panel Statement: The proposal does not define the requirements of the "third party agency" in any detail. 90.4 allows the AHJ to waive specific requirements by establishing and maintaining effective safety."
Our response:
Rather than use the term, "third party" or "expert agency" it might be better to simply identify the IEEE since electrical engineers are more likely to be closer to load data than fire protection professionals. There is precedent for this already in Section 430.26: It is unlikely that most AHJs will approve any reduction of the requirements. Referring to the IEEE would make the AHJ job easier as they would not have to make the final decision on whether to allow the reduced requirements.
430.26 Feeder Demand Factor. Where reduced heating of the conductors results from motors operating on duty-cycle, intermittently, or from all motors not operating at one time, the authority having jurisdiction may grant permission for feeder conductors to have an ampacity less than specified in 430.24, provided the conductors have sufficient ampacity for the maximum load determined in accordance with the sizes and number of motors supplied and the character of their loads and duties.
Informational Note: Demand factors determined in the design of new facilities can often be validated against actual historical experience from similar installations. Refer to ANSI/IEEE Std. 141, *IEEE Recommended Practice for Electric Power Distribution for Industrial Plants,* and ANSI/IEEE Std. 241, *Recommended Practice for Electric Power Systems in Commercial Buildings,* for information on the calculation of loads and demand factor.
The energy conservation space continues to move quickly and NEC committees do not need to be perceived as being too slow to adapt to rapidly falling load densities. Moving too slowly is also unsafe as we have argued that over-sized transformers pose more of a flash hazard risk than overload fire risk. It is best to start reaching out to solid organizations such as the IEEE to revisit the prescriptive requirements of this article.
As for Section 90.4: that is "general purpose" language that is unhelpful for Authorities Having Jurisdiction who fear becoming a large target for lawsuits when they take exception to any part of the NEC. Clear, bright-line language preferred – especially when the changes we seek are relatively easy and backed up by convincing data.
This is not original material; its reference/source is as follows:
Michael A. Anthony, PE - University of Michigan.

2-102 Log #838 NEC-P02 Final Action:
(Table 220.12)

Submitter: Brent Baumer, Ball State University
Comment on Proposal No: 2-228
Recommendation: Ball State University supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to continue its acceptance in principle.
Substantiation: In my experience at Ball State University calculating lighting load per the tables in Art. 220 contributes to greatly over sizing services, feeders and transformers. This unnecessarily adds costs increasing the financial burden on the student and the taxpayer and increases the amount of available fault current and arc flash energy thereby decreasing safety. Many states adopt ASHRAE 90.1 which requires lighting load be much less than is required by Art. 220. In our buildings constructed under the rules of 90.1 I have not seen a great increase in the use of task lighting, desk lamps, table lamps, under cabinet lighting etc. to supplement the general room lighting. In fact, very few persons request or utilize supplemental lighting. With LED lighting rapidly replacing traditional fluorescent lighting, I see this gap between Art. 220 and reality only widening and the use of supplemental lighting becoming closer to negligible than it already is.

2-103 Log #842 NEC-P02 Final Action:
(220.12 and Table 220.12)

Submitter: Jared Friesen, Morrissey Engineering
Comment on Proposal No: 2-228
Recommendation: Reword the exception to 220.12 approved in Proposal 2-228 and revise to provide three separate positive language paths for lighting load calculation as shown below:

220.12 Lighting Load ~~for Specified Occupancies~~. A unit load of not less than that calculated in 220.12 (A), (B) or (C) ~~specified in Table 220.12 for occupancies specified therein~~ shall constitute the minimum lighting load. The floor area for each floor, where used in the minimum lighting load calculation, shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. For dwelling units, the calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use of dwelling units.

(A) For Specified Occupancies. A unit load of not less than that specified in Table 220.12 for occupancies specified therein shall constitute the minimum lighting load.

Informational Note: The unit values herein are based on minimum load conditions and 100 percent power factor and may not provide sufficient capacity for the installation contemplated.

(B) Energy Restricted Occupancies. Where the building is required to comply with the prescriptive lighting power requirements of an energy code adopted by the local authority, the maximum lighting power density values specified in that energy code may be used.

(C) Monitored Lighting Loads In Non-Dwelling Units. Where monitoring of the volt-amp or amp load dedicated to and including all permanently connected lighting is available to personnel who are qualified to maintain or modify the lighting system, the load may be calculated based on the maximum volt-ampere rating of the equipment and lamps for which the luminaire(s) is rated.

Substantiation: The modification to the accepted Proposal 2-228 incorporates the concerns of Morrissey Engineering and the specifying-engineer community at large who will be tasked with interpreting and applying the accepted proposal. Morrissey Engineering is involved in all phases of design, construction, and remodel/modification of each type of occupancy who's lighting density, and therefore load, is to be calculated by use of section 220.12 and table 220.12.

First, the re-formatted text repeats the same intent of accepted Proposal 2-228 but phrases with positive language over exceptions as the NFPA Manual of Style encourages.

Second, the new text clarifies that the calculation using the adopted energy code should be based on the more conservative maximum lighting power density, and not the connected (as defined by the applicable energy code) lighting power. The maximum lighting power density represents the maximum lighting power that is allowed to be used, not the lighting power that is designed for. Furthermore, the text now allows use of this energy code maximum lighting power density to stand alone from use of a power monitoring system. This change should be approved because it recognizes the legally mandated limits placed on the lighting system by other code writing panels when an energy code is adopted. Note that application of the energy code maximum power density calculation is essentially the same as application of table 220.12, but with values that are legal limits and are provided by other code writing panels who are engaged in the collection and interpretation of lighting power data by recognized authorities in the lighting industry.

Finally, the revised text provides for a third lighting load calculation method with the same intent of accepted Proposal 2-228. This method has been revised to 1) use the volt-ampere rating of the connected luminaire(s) that is to be monitored and 2) Be restricted to branch circuits serving only lighting in non-dwelling units and 3) ensure that data needed to monitor the system is available to those who are expected to need it and not be inaccessible. Based on the experience of many professional engineers in the consulting-specify industry, these revisions are expected to be sufficiently restrictive to be safe. They both require circuits to be sufficiently sized for a load with a definable demand when the branch circuit is dedicated to lighting, and allow for future expansion based on operational peak demand information accessible to the personnel who would need it.

2-104 Log #843 NEC-P02 Final Action:
(Table 220.12)

Submitter: Joe Goodwater, University of Nebraska Lincoln
Comment on Proposal No: 2-228
Recommendation: The University of Nebraska supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to approve it for inclusion into the 2014 National Electrical Code
Substantiation: Over the last 33 years UNL has tracked the demand on our building transformers. Our average demand is less than 40% of transformer rating and average load is well below that. I can only think of two instances in those 33 years that a transformer was fully loaded. In both of those cases, energy management systems have reduced the load to well under the original demand. On Love Library demand went from over 1000 kw to less than 500 Kw.

2-105 Log #845 NEC-P02 Final Action:
(Table 220.12)

Submitter: Jerry Jimenez, University of California Berkeley
Comment on Proposal No: 2-228
Recommendation: The University of California Berkeley supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to approve it for inclusion into the 2014 National Electrical Code but with the following modifications:
Exception: In other than residential single-family and multifamily dwelling units , where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated at the values specified in the energy code where the following conditions are met
a. A power monitoring system is installed that will provide ~~continuous~~ historical information regarding the total ~~general lighting~~ load of the building.
b. The power monitoring system will be set with alarm values to alert the building owner or manager if the ~~lighting~~ total load exceeds the capacity of the service equipment ~~values set by the energy code.~~
c. The demand factors specified in 220.42 are not applied to the general lighting load.
Substantiation: This is how we would like the new language to appear in the 2014 NEC:
Exception: In other than residential single-family and multi-family dwelling units, where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated at the values specified in the energy code where the following conditions are met
a. A power monitoring system is installed that will provide historical information regarding the total load of the building.
b. The power monitoring system will be set with alarm values to alert the building owner or manager if the total load exceeds the capacity of the service equipment
c. The demand factors specified in 220.42 are not applied to the general lighting load.
This modification will permit the “power monitoring system” to be more basic in function and it will eliminate the need to install such equipment in single-family and multi-family dwelling units.
In the spirit of producing evidence that most distribution transformers are over-sized, we present the following:
At UC Berkeley, twelve transformers representative of typical building use (labs, classrooms, offices) were monitored with permanently installed real time meters for one year. The transformers are all 12 kV primary and either 480/277 v or 208/120 v secondary. They range in size from 500 kVA to 3,000 kVA. The average load over a period of one year was in the range of 7.5% to 38.7%. The peak load over that same period ranged from 17.8 % to 58.1 %. This means that in all cases, the transformers are too large by at least 50%. This causes several problems:
1) The no load losses over time are much higher than needed. This wastes energy and money.
2) The downstream switchgear is of higher ampacity than it needs to be. This wastes money.
3) The downstream switchgear is of higher short circuit rating than it needs to be. This wastes money.
4) The upstream infrastructure, which is based on connected kVA, is not loaded as heavily as it could be. This causes additional circuits to be constructed when perhaps they are not really required. This wastes money.
5) The fault currents downstream from these transformers is larger than it would be if the transformers were properly sized. This poses risk to electricians and others who might be in the vicinity of switchgear when a fault occurs. This presents a larger hazard than what would exist if the transformers were properly sized.

2-106 Log #846 NEC-P02 Final Action:
(Table 220.12)

Submitter: Glenn T. Keates, Dymax Engineering
Comment on Proposal No: 2-228
Recommendation: Dymax Engineering supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to approve it for inclusion into the 2014 National Electrical Code.
Substantiation: With lighting becoming more efficient and moving toward high efficiency ballasts, LED's, etc., it is time to recognize the importance of intelligently engineering a lighting system. This provision would allow that to occur, lowering the wasted "kVA" that exists in our present day electrical systems. It has been our experience and I'm sure others, as consulting engineers for a variety of campuses, to typically find that these facilities are, for lack of a better term, "over-transformered" to the extent that power factors are adversely affected, the units are underutilized and that the capital dollars are not be wisely used, as these more efficient systems come into reality.
This is not original material; its reference/source is as follows:
Michael A. Anthony, PE - University of Michigan.

2-107 Log #847 NEC-P02 Final Action:
(Table 220.12)

Submitter: Paul A. Kempf, University of Notre Dame
Comment on Proposal No: 2-228
Recommendation: The University of Notre Dame supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urges the technical committee to approve it for inclusion into the 2014 National Electrical Code.
Substantiation: The University of Notre Dame has vast experience with the design and operation of campus facilities as well as its own electrical distribution network system. Our experience includes the loading of service transformers across a wide array of building types including residential, research, office, large assembly and food service to name a few.
Our considerable historical data of service demands indicates that under-loaded transformers are the norm for our facilities. We attribute this under loading to the service load calculations which overestimate the true load demands. We support this proposal as we seek to reduce incident energy levels, gain sustainability through the conservation of energy and natural resources and lower the capital expense of purchasing equipment through more appropriately sized transformers. As safety and sustainability are key drivers for our industry and we believe this proposal supports these efforts in a responsible manner.

2-108 Log #848 NEC-P02 Final Action:
(Table 220.12)

Submitter: Jose Meijer, Peter Basso Associates, Inc.
Comment on Proposal No: 2-228
Recommendation: We support the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to continue its acceptance but with the following modification:
Exception: In other than dwelling units, where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated at the values specified in the energy code ~~where the following conditions are met~~
~~a. A power monitoring system is installed that will provide continuous information regarding the total general lighting load of the building.~~
~~b. A power monitoring system will be set with alarm values to alert the building owner or manager if the lighting load exceeds values set by the energy code.~~
~~c. The demand factors specified in 220.42 are not applied to the general lighting load.~~
Substantiation: There is a widening gap between the unit load requirements of Table 220.12 and energy codes (such as ASHRAE 90.1 and the International Energy Conservation Code) both of which reference *Illuminating Engineering Society* lighting power densities.
A power monitoring system is not necessary because if there are overloads – even in continuously energized mixed outlet and lighting supply circuits – overcurrent devices will safely de-energize the circuit.
We recommend removal of dwelling from the scope of this exception because such circuits are covered under local residential building and energy codes which are also driving down permissible lighting power densities.

2-109 Log #850 NEC-P02 Final Action:
(Table 220.12)

Submitter: Kathy Richards, Northern Michigan University
Comment on Proposal No: 2-228
Recommendation: Continue to accept this proposal but revise the description of the “power monitoring system” so that the system is more generic and does not necessarily require a new capital expenditure but can use an existing building control system.:
Exception: Where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated at the values specified in the energy code where the following conditions are met:
a. A ~~power monitoring~~ system is installed that will provide ~~continuous~~ information regarding the ~~total~~ general lighting load of the building.
b. The ~~power monitoring~~ system will be set with alarm values to alert the building owner or manager if the lighting load exceeds the values set by the energy code.
~~c. The demand factors specified in 220.42 are not applied to the general lighting load.~~
Substantiation: The lighting load for alteration and new buildings is being driven downward so aggressively by energy codes that it may not even be necessary to require a power monitoring system; an existing facility management system may be sufficient. The majority of the buildings on Northern Michigan University's campus are fed from a main switchboard in the central steam plant through an underground power distribution system. Each building has a dedicated electric meter that is connected to the building's facility management system which is centrally monitored by Facilities Department staff. The facility management system has trending and alarm capabilities that could be utilized for monitoring the building electrical load.
Lighting load is usually only about 25% of a building’s electrical load. Overloads due to lighting are extremely unlikely and when they are present they will be taken out by overcurrent devices therefore Condition (c) may be deleted.

2-110 Log #910 NEC-P02 Final Action:
(Table 220.12)

Submitter: Brooks H. Baker, III, University of Alabama at Birmingham
Comment on Proposal No: 2-228
Recommendation: The University of Alabama at Birmingham supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to approve it for inclusion into the 2014 National Electrical Code.
Substantiation: When undertaking a design of a project and the load data is submitted to the utility company for transformer sizing, they typically undersize the transformer based on their historical data. Oversizing a transformer as currently required has a downstream affect on the overall design of a project in that it could increase the size requirement of the room, which then impacts the overall project budget and can impact the sizing of program space.

2-111 Log #911 NEC-P02 Final Action:
(Table 220.12)

Submitter: Kevin Folsom, Dallas Theological Seminary
Comment on Proposal No: 2-228
Recommendation: Dallas Theological Seminary supports the acceptance of Proposal 2-228 that permits an exception to the prescriptive unit load lighting requirements of Table 220.12 and urge the technical committee to approve it for inclusion into the 2014 National Electrical Code.
Substantiation: For the past 50 years we have had a utility-owned oil-filled transformer that is installed in the basement of one building with feeders running out to 5 other other adjacent buildings at 480 volts. When it was installed in 1972 it was 70% underloaded. Today, it is 30% underloaded based upon their ambient ratings. (They could be driven up to 150% of rated kVA for very short periods of time). There are several problems with this:1. Even though the utility owns this transformer a large amount of un-used and unnecessary electrical energy has been present in the building that typically presents a proportional unnecessary flash risk to any electrician
2. This transformer has dumped unnecessary waste heat into the building for a half century and has raised our cooling costs
3. Now the aging transformers are failing and there is no way to get them out safely and quickly.
While utilities are not bound to NEC rules for calculating electrical load within the building, this installation demonstrates how prospective load assumptions for the other 5 buildings that are built into Chapter 2 calculation methods are not keeping pace with changes in energy codes that are driving power densities downward. While Proposal 2-228 may well create capital expenditure in terms of power monitoring systems, it is a significant step in the right direction.

2-112 Log #37 NEC-P02 Final Action:
(220.14(B))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 2-232
Recommendation: The Correlating Committee directs the panel to (1) clarify the action on Proposal 2-232 in regard to the appropriateness of the new heading for 220.55, (2) clarify and correlate with the action taken on Proposal 2-245, and (3) clarify the Heading of 220.14(B).
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-113 Log #851 NEC-P02 Final Action:
(220.42)

Submitter: Kathy Richards, Northern Michigan University
Comment on Proposal No: 2-254
Recommendation: Relocate language originally proposed in Proposal 2-254 as a new exception after existing Section 220.42

220.42 General Lighting. The demand factors specified in Table 220.42 shall apply to that portion of the total branch-circuit load calculated for general illumination. They shall not be applied in determining the number of branch circuits for general illumination.

Exception: As an alternative to the lighting load demand factors of Table 220.42 general lighting demand factors for new or existing loads shall be permitted to be based upon lighting power densities specified in an energy code provided the lighting load demand factor is determined by a registered professional engineer.

Substantiation: Table 220.42 needs a significant update – or needs to be removed entirely -- because the occupancy classes it contains is not granular enough for all the occupancy classes now identified in lighting energy codes. The attachment to this comment (filed with NFPA Staff) is a listing of the various occupancy classes that have been modeled by the Illumination Engineering Society (IES) and ASHRAE 90.1 Addendum BH. Table 220.42 has four occupancy classes PLUS "everything else". The lighting power densities of the 10th Edition of the IES has about 40 different occupancy types. This proposal is a broadening of the applicability of Section 645.25 that was written into the 2011 NEC. It closes the gap between what this section requires for fire safety and what the actual lighting load will be as LED lighting technology.

The oversizing of transformers that results from the design-prescriptive requirements of Article 220 causes us to bring in far more energy into a building than is necessary. Across 40 medium voltage services that supply over 3 million square feet of a variety of occupancy classes typical in a campus setting in the upper peninsula of Michigan, the average demand on a typical service at Northern Michigan University is 21.2 percent of the ambient rating of the transformer. The average watt per square foot load across the Northern Michigan University campus is 1.53 watts per square foot. This loading data is typical for facilities in our industry. Technological innovation has driven down the power requirements of end-use equipment for many years now. An explicit exception to the Article 220 requirement will help our industry and others reduce flash hazard as well as contribute significantly our industry's sustainability objectives.

In light of this, Northern Michigan University supports the effort by the APPA.ORG Standards Council to bring the 2014 NEC in step with rapidly evolving energy codes and to reduce flash hazard by reducing the size of building services. We urge the NEC Technical Correlating Committee to assign a Task Force to discover ways of accomplishing this goal. We urge the NFPA Fire Protection Research Foundation to develop a research project to support the Task Force. In both cases, we would be happy to turn over our electrical demand information for further study.

Note: Supporting material is available for review at NFPA Headquarters.

2-114 Log #1051 NEC-P02 Final Action:
(220.58)

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 2-247
Recommendation: Accept the proposal in part: substitute 83% where this proposal calls for a 88% reduction, per the action taken on Proposal 6-49a, and force the deletion of 310.15(B)(7).
Substantiation: CMP-2 appears to be unaware that CMP-6 has been effectively reducing the "calculated load" for 30 years with 2011's 310.15(B)(7). Since the reasoning behind 310.15(B)(7) is that dwelling units have a decreased LOAD due to the use of the occupancy, this concept should be moved to Article 220 and be a part of the actual LOAD CALCULATION. The substantiation for this proposal is the presence of 310.15(B)(7) in the 2011 NEC. And the acceptance of Proposal 6-49a in the 2014 cycle. 310.15(B)(7) should be deleted, and normal wire sizing rules should govern over the diverse LOAD.

If Article 220 takes this concept over, then Article 310 can focus on what to do with the load once it's been calculated.

2-115 Log #1052 NEC-P02 Final Action:
(220.82(A))

Submitter: George M. Stolz, II, Quicksilver Electrical Training
Comment on Proposal No: 2-248
Recommendation: Accept the proposal as coordinated with the original.
Substantiation: See substantiation of comment regarding Proposal 2-247.

2-116 Log #849 NEC-P02 Final Action:
(220.86 (New))

Submitter: Jose Meijer, Peter Basso Associates, Inc.
Comment on Proposal No: 2-252
Recommendation: Accept Proposal 2-252 as written:
220.86+(NEW) Engineering Supervision. As an alternative to the feeder and service load calculations required by Parts III and IV of Article 220, feeder and service load calculations for new or existing loads shall be permitted to be used if performed by qualified persons under engineering supervision.
Substantiation: We would like to respond to the panel's statement point by point:
Claim 1: **"** *The submitter's substantiation does not justify how a qualified person under engineering supervision could improve upon the rules for calculations in Article 220."*
Response: We believe that a great deal of improvement is possible. From the standpoint of safety, the reduction in transformer kVA that will likely result from the application of informed professional judgment will – in all but a few cases – result in greater electrician safety. Four other committees were presented with significant data that spanned a range of occupancy classes to prove, overwhelmingly, that the prescriptive requirements in Article 220 results in power delivery apparatus that is at least 50 percent over-sized. As consulting engineers we see this every day.
Claim 2: *"The panel does not agree with allowing historical demand as the singular basis for determination of load under the NEC. Historical demand is an indicator of how a particular building is performing, but it is not necessarily providing all of the necessary information for another building in the future."*
Response: If the panel does not agree with allowing historical demand as the singular basis then how did the rules in Article 220 come to be in the first place? Where did the demand values originate from? We believe they were formulated from rules of thumb the better part of 50 years ago when the characteristics of end-use equipment was very different and when the US economy grew at a rate when "building extra capacity" was more likely to be cost-effective. In the economy in which we now live, however, it is more cost effective to wait until an expansion covers the cost of adding to supply service equipment rather than build the service with 50 percent more capacity assuming that the load will grow. The loads are not growing to justify the overcapacity built into the prescriptive requirements of this chapter.
Claim 3: *" The panel takes the position that if the Article 220 calculations are incorrect and arriving at oversized feeders and services (at peaks and not just averages), then proponents should complete a credible study noting how the current calculations are inaccurate and how they should be changed (e.g. lower lighting loading va/sq.ft. etc.)."*
Response: We did provide data in our original proposal. There are over 15 proposals submitted to this committee with similar data that tells the same story. Perhaps not everyone saw the data that accompanied these proposals since the data was contained in the accompanying "reference material" to committee members on a CD.
Finally, the committee should recognize precedent set in other parts of the Code where an engineer's judgment is permitted – Section 430.26 and Section 645.25. For the convenience of the committee those passages are reproduced below:
430.26 Feeder Demand Factor. Where reduced heating of the conductors results from motors operating on duty-cycle, intermittently, or from all motors not operating at one time, the authority having jurisdiction may grant permission for feeder conductors to have an ampacity less than specified in 430.24, provided the conductors have sufficient ampacity for the maximum load determined in accordance with the sizes and number of motors supplied and the character of their loads and duties.
Informational Note: *Demand factors determined in the design of new facilities can often be validated against actual historical experience from similar installations. Refer to ANSI/IEEE Std. 141, IEEE Recommended Practice for Electric Power Distribution for Industrial Plants, and ANSI/IEEE Std. 241, Recommended Practice for Electric Power Systems in Commercial Buildings, for information on the calculation of loads and demand factor.*
Another example:
645.25 Engineering Supervision. As an alternative to the feeder and service load calculations required by Parts III and IV of Article 220, feeder and service load calculations for new or existing loads shall be permitted to be used if performed by qualified persons under engineering supervision.

2-117 Log #1342 NEC-P02 Final Action:
(220.87)

Submitter: James E. Degnan, Sparling
Comment on Proposal No: 2-257
Recommendation: Revise text to read as follows:
~~220.87 Determining Existing Loads. The calculation of a feeder or service load for existing installations shall be permitted to be determined use the actual maximum demand to determine the existing load under all of the following conditions.~~
~~(1) The maximum demand data is available for a 1 year period.~~
~~Exception: … *If the maximum demand data for a 1 year period is not available, the calculated load shall be permitted to be based on the maximum demand (measure of average power demand over a 15 minute period) continuously recorded over a minimum 30 day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or equipment load and other loads that may be periodic in nature due to seasonal or similar conditions.*~~
~~(2) The maximum demand at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.~~
~~(3) The feeder has overcurrent protection in accordance with 240.4 and the service has overload protection in accordance with 230.90.~~

220.87 Existing Loads. The existing load shall be permitted to be calculated in accordance with 220.87(A) under all of the conditions of either 220.87(B) or 220.87(C).

(A) Calculation. The feeder or service load shall be measured as the average power or current demand over a 15 minute periods, and continuously recorded. The calculated existing load shall be determined from the maximum demand load after adjustment for :
(1) Variations in occupancy
(2) The larger of the seasonal space heating or cooling load
(3) Variations in process or production
(4) Similar factors affecting the measured load
Adjustments shall be based on previous or projected: occupancy, process demand, or seasonal environment.

(B) General Metering
(1) The calculated existing load at 125 percent, plus the feeder calculations for any new load does not exceed the ampacity of the feeder or rating of the service.
(2) The service has overload protection in accordance with 230.90
(3) The metering is in place for a minimum of 30 days.
(4) The metered load is measured on the highest loaded phase after an initial measurement at the start of the recording.

(C) Permanent Metering on Feeders or Services Rated Over 1000 Amperes
(1)The maximum demand at 115 percent plus the feeder calculations for any new load does not exceed the ampacity of the feeder or rating of the service.
(2) The service has overload protection in accordance with 230.90
(3) The overcurrent protective device assembly for the feeder or service is larger than 1000 amperes and is listed for operation at 100% of its rating.
(4) The metering is permanent, has been in place for a minimum of one year and will remain in place, measures the current on each phase, and complies with one of the following:
a. The meter is the utility service meter and the service is being measured.
b. The metering is an integral part of the feeder or service overcurrent protective device. Metering data is displayed or exported to a data base that can be read at the facility.
c. The metering transducer is secured to the interior of the panelboard or switchboard, is mounted in a dedicated space, and labeled according to the associated feeder or service. Metering data is displayed or exported to a data base that

can be read at the facility.
(5) The distribution system loading is regularly monitored and controlled by a Qualified Person.
(6) At the point where the load is measured the circuit conductors exceed 250 volts to ground.

Substantiation: The panel is encouraged to take another look at proposal 2-257. The above text is the nearly the same as the original text, except:
1. The amount of 110% has been increased to 115%.
2. (C)(6) has been added
3. "accessible" has been edited out for compatibility with the NEC definition of the word, and other minor editing.

In rejecting the proposal the panel seeks substantiation for reducing the safety margin from 125 to 110%. Many provisions of the NEC are written based on judgment and experience without a specific link to analysis that clarifies why one number was chosen as opposed to another number that might be different by a moderate amount. The new proposal of 115% is a reasonable choice, especially with the addition of provision (C)(6). We have to start somewhere! Substantiation is as follows:
The present version of 220.87 has a safety margin that includes allowances for:
1. Power factor, if only kw is measured,
2. Phase unbalance, if the unbalance is not indicated at the initial measurement.
3. The extent that a load may actually have a substantial component that exists for more than three hours, requiring derating as a continuous load, but is not revealed by 15 minute windows.

Requiring permanently fixed in place, 3 phase metering will eliminate the portion of the existing safety factor that exists for items 1 & 2. Requiring 100% rated circuit breakers will eliminate the portion of the safety factor that exists for item 3. The submitter maintains that this combined portion of the safety factor should justify the original reduction from 125% to 110%. However recognizing the NEC need for safety, this comment changes the reduction to 115% and adds an additional safety directive that it apply only to loads with a voltage to ground above 250 volts.
At 208 volts, a 100 amp feeder requires a 25% safety margin, yielding about (1.73*208*100*.25=) 9kVA. Applying the same safety margin to a 1000 amp, 208 volt feeder yields (1.73*208*1000*.25=) 90 kVA. It is much more likely for a 9 kVA load to appear after detailed load monitoring and exceed the capacity of a 100 amp system than it is for a 90 kVA load to appear and exceed the capacity of a 1000amp system (or even ten 9kVA loads to appear). Hence the justification for only allowing the reduced safety margin to apply to systems over 1000 amps. Still, the need for caution with a new code development is understood. With the addition of the requirement for the feeder to exceed 250 volts to ground the kVA safety margin will improve substantially over what the code would accept for 208 volt systems. In the preceding example, if the 1000 amp feeder is 480 volts instead of 208, the kVA safety margin increases to over 200kVA. . Reducing this to a 15% margin constitutes a load of 120kVA. Clearly in a facility that has permanently fixed in place metering, with Qualified Personnel, a load of this magnitude will not appear on the system without due consideration. The logic and benefits increase with even higher voltages.
This provision of the code will help to encourage permanent metering which will support more efficient use and safer electrical systems.

2-118 Log #56 NEC-P02 **Final Action:**
(230.2(F) (New))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 4-101
Recommendation: The Correlating Committee directs that this proposal be referred to Code-Making Panel 2 for action in 220.87.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
This is not original material; its reference/source is as follows:
Michael A. Anthony, P.E. - University of Michigan & APPA.ORG - Leadership in Education Code Advocacy Task Force (Issue 11-6 Proposal 52).

2-119 Log #57 NEC-P02 Final Action:
(230.2(F) (New))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 4-102
Recommendation: The Correlating Committee directs that this proposal be referred to Code-Making Panel 2 for action in 220.87.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.
This is not original material; its reference/source is as follows:
Paul Kempf (University of Notre Dame), Tim Croushore (First Energy), Fred Hartwell

2-120 Log #148 NEC-P02 Final Action:
(404.14(E) Exception (New))

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 9-101
Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 2 for action in Article 210.

Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-121 Log #236 NEC-P02 Final Action:
(410.9)

Submitter: Technical Correlating Committee on National Electrical Code®,
Comment on Proposal No: 18-61
Recommendation: It was the action of the Correlating Committee that this proposal be referred to Code-Making Panel 2 for action.
Substantiation: This is a direction from the National Electrical Code Technical Correlating Committee in accordance with 3.4.2 and 3.4.3 of the Regulations Governing Committee Projects.

2-122 Log #1479 NEC-P02 Final Action:
(Example D.4(b))

Submitter: Charles R. Miller, Charles R. Miller Electrical Education and Training
Comment on Proposal No: 2-265
Recommendation: Revise text to read as follows:
Each dwelling unit is equipped with an electric range of 8-kW nameplate rating, four 1.5-kW separately controlled 240-V electric space heaters, and a 2.5-kW, 240-V electric water heater. Assume range, space heater, and water heater kW ratings equivalent to kVA. Calculate the load for the individual dwelling unit by the standard calculation (Part III of Article 220). A common laundry facility is available to all tenants *[see 210.52(F), Exception No. 1].* Area of each dwelling unit is 840 ft^2.
Calculated Load for Each Dwelling Unit *(see Part II and Part III of Article 220)*
Substantiation: This example is confusing because the title of this example references the optional calculation but the calculation for the individual dwelling units is by the standard calculation (Part III of Article 220). Text is needed to clarify that the individual dwelling units are not calculated by the optional calculation, but by the standard calculation.